INTRODUCTION

The Massachusetts Watershed Initiative 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 basin's natural resources can be achieved. Implementation of this project is underway in a process known as the "Watershed Approach". The five-year cycle of the Watershed Approach, as illustrated in Figure 3, provides the management structure to carry out the mission. This report presents the current assessment of water quality conditions in the Blackstone River Basin. The assessment is based on information that has been researched and developed through the first three years (information gathering, monitoring, and assessment) of the five-year cycle by the Department of Environmental Protection (DEP) as part of its federal mandate under the Federal Water Pollution Control Act (commonly known as the Clean Water Act).

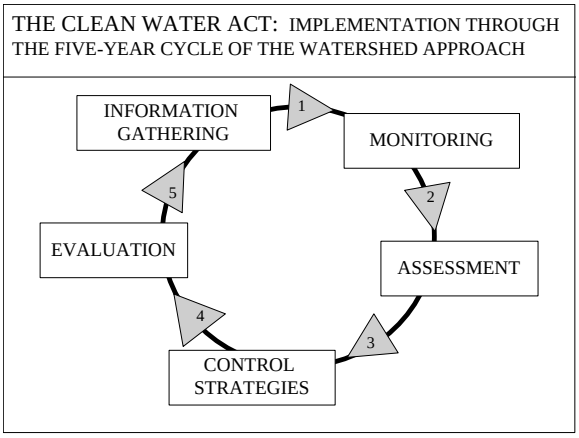

Figure 3. Clean Water Act Implementation Cycle

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this goal, the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the U.S. Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act, DEP must submit a statewide report every two years to the EPA, which describes the status of water quality in the Commonwealth. The most recent 305(b) report is the *Commonwealth of Massachusetts Summary of Water Quality 2000* (MA DEP 2000b). The 305(b) statewide report is based on the compilation of information for the Commonwealth's 27 watersheds. The 305(b) report compiles data from a variety of sources, and provides an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the statewide level. At the watershed level, instream biological, habitat, physical/chemical, toxicity data and other information is evaluated to assess the status of water quality conditions. This analysis follows a standardized process described below (Assessment Methodology).

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

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

Inland Water Classes

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

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

3. ***Class C*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife,* and *for secondary contact recreation. These waters shall be suitable for the irrigation of crops used for consumption after cooking* and *for compatible industrial cooling* and *process uses. These waters shall have good aesthetic value.*

Coastal and Marine Classes

4. ***Class SA*** *– These waters are designated as an excellent habitat for fish, other aquatic life* and *wildlife* and *for primary* and *secondary recreation. In approved areas they shall be suitable for shellfish harvesting without depuration (Open Shellfishing Areas). These waters shall have excellent aesthetic value.*

5. ***Class SB*** *– These waters are designated as a habitat for fish, other aquatic life* and *wildlife* and *for primary* and *secondary contact recreation. In approved areas they shall be suitable for shellfish harvesting with depuration (Restricted Shellfishing Areas). These waters shall have consistently good aesthetic value.*

6. ***Class SC*** *– These waters are designated as a habitat for fish, other aquatic life,* and *wildlife* and *for secondary contact recreation. They shall also be suitable for certain industrial cooling* and *process uses. These waters shall have good aesthetic value.*

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* and *Secondary Contact Recreation, Shellfishing* and *Aesthetics*. Three 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), Warm Water Fishery (waters which are not capable of sustaining a year-round population of cold water aquatic life), and Marine Fishery (suitable for sustaining marine flora and fauna).

The SWQS, summarized in Table 2, prescribes minimum water quality criteria to sustain the designated uses. Furthermore these standards describe the hydrological conditions at which water quality criteria must be met (MA DEP 1996). In rivers, the lowest flow conditions at and above which criteria must be met is the lowest mean flow for seven consecutive days to be expected once in ten years (7Q10). In artificially regulated waters, the lowest flow conditions at which criteria must be met is the flow equal or exceeded 99% of the time on a yearly basis or another equivalent flow which has been agreed upon. In coastal and marine waters and for lakes the most severe hydrological condition is determined by DEP on a case-by-case basis.

The availability of appropriate and reliable scientific data and technical information is fundamental to the 305(b) reporting process. It is EPA policy (EPA Order 5360.1 CHG 1) that any organization performing work for or on behalf of EPA establish a Quality System to support the development, review, approval, implementation, and assessment of data collection operations. To this end, 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, DEP requires the following: 1) an appropriate *Quality Assurance Project Plan* including a QA/QC plan, 2) use of a state certified lab (certified in the applicable analysis), 3) data management QA/QC be described, and 4) the information be documented in a citable report.

Table 2. Summary of Massachusetts Surface Water Quality Standards (MA DEP 1996). *Note*: *Italics are direct quotations.*

Dissolved Oxygen	Class A, BCWF*, SA : ≥ 6.0 mg/L and ≥ 75% saturation unless background conditions are lower Class BWWF**, SB: ≥ 5.0 mg/L and ≥ 60% saturation unless background conditions are lower Class C: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 3.0 mg/L anytime unless background conditions are lower; levels cannot be lowered below 50% saturation due to a discharge Class SC: Not ≤ 5.0 mg/L for more than 16 of any 24 –hour period and not ≤ 4.0 mg/L anytime unless background conditions are lower; and 50% saturation; levels cannot be lowered below 50% saturation due to a discharge
Temperature	Class A: ≤ 68°F (20°C) and Δ 1.5°F (0.8°C) for Cold Water and ≤ 83°F (28.3°C) and Δ 1.5°F (0.8°C) for Warm Water Class BCWF: ≤ 68°F (20°C) and Δ3°F (1.7°C) due to a discharge Class BWWF: ≤ 83°F (28.3°C) and Δ3°F (1.7°C) in lakes, Δ5°F (2.8°C) in rivers Class C, SC: ≤85°F (29.4°C) nor Δ5°F (2.8°C) due to a discharge Class SA: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) Class SB: ≤85°F (29.4°C) nor a maximum daily mean of 80°F (26.7°C) and Δ1.5°F (0.8°C) between July through September and Δ 4.0°F (2.2°C) between October through June
pH	Class A, BCWF, BWWF: 6.5 – 8.3 and Δ0.5 outside the background range. Class C: 6.5 – 9.0 and Δ1.0 outside the naturally occurring range. Class SA, SB: 6.5 – 8.5 and Δ0.2 outside the normally occurring range. Class SC: 6.5 – 9.0 and Δ0.5 outside the naturally occurring range.
Fecal Coliform Bacteria (Class A criteria applied to the drinking water use, Class B criteria applied to primary and secondary contact recreational uses)	Class A: an arithmetic mean of < 20 organisms /100 mL in any representative set of samples and < 10% of the samples > 100 organisms/100 mL. Class B: a geometric mean of < 200 organisms /100 mL in any representative set of samples and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class C: a geometric mean of < 1000 organisms /100ml, and < 10% of the samples > 2000 organisms/100 mL. Class SA: approved Open Shellfish Areas: a geometric mean (MPN method) of < 14 organisms/100 mL and < 10% of the samples > 43 organisms/100 mL (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SB: approved Restricted Shellfish Areas: < a fecal coliform median or geometric mean (MPN method) of 88 organisms/100 mL and < 10% of the samples > 260 organisms /100 mL (MPN method). Waters not designated for shellfishing: < a geometric mean of 200 organisms in any representative set of samples, and < 10% of the samples > 400 organisms /100 mL. (This criterion can be applied on a seasonal basis at the discretion of the DEP.) Class SC: < a geometric mean of 1000 organisms/100 mL and < 10% of the samples > 2000 organisms/100ml.
Solids	All Classes: *These waters shall be free from floating, suspended,* and *settleable solids in concentrations or combinations that would impair any use assigned to each class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.*
Color and Turbidity	All Classes: *These waters shall be free from color* and *turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use.*
Oil & Grease	Class A, SA: *Waters shall be free from oil* and *grease, petrochemicals* and *other volatile or synthetic organic pollutants.* Class SA: *Waters shall be free from oil* and *grease* and *petrochemicals.* Class B, C,SB, SC: *Waters shall be free from oil* and *grease, petrochemicals that produce a visible film on the surface of the water, impart an oily taste to the water or an oily or other undesirable taste to the edible portions of aquatic life, coat the banks or bottom of the water course or are deleterious or become toxic to aquatic life.*
Taste and Odor	Class A, SA: *None other than of natural origin.* Class B, C,SB, SC: *None in such concentrations or combinations that are aesthetically objectionable, that would impair any use assigned to each class, or that would cause tainting or undesirable flavors in the edible portions of aquatic life.*
Aesthetics	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.*
Toxic Pollutants ~	All Classes: *All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife… The division shall use the recommended limit published by EPA pursuant to 33 USC 1251, 304(a) as the allowable receiving water concentrations for the affected waters unless a site-specific limit is established*.
Nutrients	*Shall not exceed the site-specific limits necessary to control accelerated or cultural eutrophication.*

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

EPA provides guidelines to the States for making their use support determinations (US EPA 1997). The determination of whether or not a waterbody supports each of its designated uses is a function of the type(s), quality and quantity of available current information. Although data/information older than five years are usually considered "historical" and used for descriptive purposes, they can be utilized in the use support determination providing they are known to reflect the current conditions. While the water quality standards (Table 2) 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). Water quality conditions that do not meet criteria but are "naturally occurring" (e.g., low pH in some areas) do not constitute violations of the standards.

Each designated use within a given segment is individually assessed as 1*)* ***support***, 2) ***partial support***, or 3) ***non-support***. The term ***threatened*** is used when the use is fully supported but may not support the use within two years because of adverse pollution trends or anticipated sources of pollution. When too little current data/information exists or no reliable data are available the use is ***not assessed.*** In this report, however, if there is some indication that water quality impairment may exist which is not "naturally occurring", the use is identified with an "Alert Status". Detailed guidance for assessing the status of each use follows in the Designated Uses Section of this report. It is important to note, however, that not all waters are assessed. Many small and/or unnamed lakes, rivers, and estuaries are currently ***unassessed***; the status of their designated uses has never been reported to EPA in the state's 305(b) Report nor is information on these waters maintained in the Water Body System (WBS) database.

DESIGNATED USES

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

- AQUATIC LIFE - suitable habitat for sustaining a native, naturally diverse, community of aquatic flora and fauna. Three subclasses of aquatic life are also designated in the standards for freshwater bodies; *Cold Water Fishery* - capable of sustaining a year-round population of cold water aquatic life such as trout, *Warm Water Fishery* - waters which are not capable of sustaining a year-round population of cold water aquatic life, and *Marine Fishery* - suitable for sustaining marine flora and fauna.

- FISH CONSUMPTION - pollutants shall not result in unacceptable concentrations in edible portions of marketable fish or shellfish or for the recreational use of fish, shellfish, other aquatic life or wildlife for human consumption.

- DRINKING WATER - used to denote those waters used as a source of public drinking water. They may be subject to more stringent regulation in accordance with the Massachusetts Drinking Water Regulations (310 CMR 22.00). These waters are designated for protection as Outstanding Resource Waters under 314 CMR 4.04(3).

- PRIMARY CONTACT RECREATION - suitable for any recreation or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water. These include, but are not limited to, wading, swimming, diving, surfing and water skiing.

- SECONDARY CONTACT RECREATION - suitable for any recreation or other water use in which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

- AESTHETICS - all surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

- AGRICULTURAL AND INDUSTRIAL - suitable for irrigation or other agricultural process water and for compatible industrial cooling and process water.

Other restrictions which denote specific subcategories of use assigned to the segment that may affect the application of criteria or specific antidegradation provision of 314 CMR 4.00 which are specified along segments in the Chicopee River Basin:

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

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

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, 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 DEP's data collection techniques dictate that a weight of evidence be used to make the assessment, with biosurvey results used as the final arbiter of borderline cases. The following chart provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Aquatic Life Use*:

Variable (# indicates reference provided at the end of the designated use section)	***Support*** – Data available clearly indicates support. Minor excursions from chemical criteria (Table 2) may be tolerated if the biosurvey results demonstrate support.	***Partial Support*** – Uncertainty about support in the chemical or toxicity testing data, or there is some minor modification of the biological community. Excursions not frequent or prolonged.	***Non-Support*** – There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY			
Rapid Bioassessment Protocol (RBP) II or III (4)	Non-Impaired	Slightly Impaired	Moderately or Severely Impaired
Fish Community (4)	Best Professional Judgement (BPJ)	BPJ	BPJ
Habitat and Flow (4)	BPJ	BPJ	Dewatered Streambed due to artificial regulation or channel alteration
Macrophytes (4)	BPJ	Non-native plant species present, but not dominant, BPJ	Non-native plant species dominant, BPJ
Plankton/ Periphyton (4)	No algal blooms	Occasional algal blooms	Persistent algal blooms
TOXICITY TESTS			
Water Column/Ambient (4)	>75% survival either 48 hr or 7-day exposure	>50 - ≤75% survival either 48 hr or 7-day exposure	≤50% survival either 48 hr or 7-day exposure
Effluent (4)	Meets permit limits	(NOTE: if limit is not met, the stream is listed as threatened for 1.0 river mile downstream from the discharge.)	
Sediment (4)	>75% survival	>50 - ≤75% survival	≤50% survival
CHEMISTRY- WATER			
DO (3, 6)	Criteria (Table 2)	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
pH (3, 6)	Criteria (Table 2)	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Temperature (3, 6) [1]	Criteria (Table 2), [1]	Criteria exceed in 11-25% of measurements.	Criteria exceeded >25% of measurements.
Turbidity (4)	Δ 5 NTU due to a discharge	BPJ	BPJ
Suspended Solids (4)	25 mg/L max., Δ10 mg/L due to a discharge	BPJ	BPJ
Nutrients (3) Phosphate-P (4)	Table 2, (Site-Specific Criteria; Maintain Balanced Biocommunity, no pH/DO violations)	BPJ	BPJ
Toxic Pollutants (3, 6) Ammonia-N (3, 4) [2] Chlorine (3, 6) [3]	Criteria (Table 2) 0.254 mg/L NH_3-N [2] 0.011 mg/L TRC[3]	BPJ	Criterion is exceed in > 10% of samples.
CHEMISTRY – SEDIMENT			
Toxic Pollutants (5) [4]	≤ L-EL[4], Low Effect Level	One pollutant between L-EL and S-EL	One pollutant ≥ S-EL (severe)
Nutrients (5)	≤ L-EL	between L-EL and S-EL	≥ S-EL
Metal Normalization to Al or Fe (4)	Enrichment Ratio ≤ 1	Enrichment Ratio >1 but ≤10	Enrichment Ratio ≥10
CHEMISTRY- EFFLUENT			
Compliance with permit limits (4)	In-compliance with all limits	NOTE: If the facility does not meet their permit limits, the information is used to threaten one river mile downstream from the discharge.	
CHEMISTRY-TISSUE			
PCB – whole fish (1)	≤500 µg/kg wet weight	BPJ	BPJ
DDT (2)	≤14.0 µg/kg wet weight	BPJ	BPJ
PCB in aquatic tissue (2)	≤0.79 ng TEQ/kg wet weight	BPJ	BPJ

[1]maximum daily mean T in a month (min 6 measurements evenly distributed over 24-hours) <criterion, [2]Ammonia levels for pH of 9.0, actual "criterion" varies with pH and is evaluated case-by-case. During DWM's Chicopee 1998 survey the max pH was 7.9 SU resulting in an ambient criterion for ammonia-N of 1.46mg/L. [3]The minimum quantification level for TRC is 0.05 mg/L. [4]For the purpose of this report, the S-EL for total PCB in sediment (which varies with TOC content) with 1% TOC is 5.3 PPM while a sediment sample with 10% TOC is 53ppm.

Note: The 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 shellfish or for the recreational use of fish, shellfish, 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 (DPH), Bureau of Environmental Health Assessment (MA DPH 1999). The DPH list identifies waterbodies where elevated levels of a specified contaminant in edible portions of freshwater species poses a health risk for human consumption; hence the *Fish Consumption Use* is assessed as non-support in these waters. In 1994, DPH also issued a statewide "Interim Freshwater Fish Consumption Advisory" for mercury (MA DPH 1994). This precautionary measure was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption. DPH's interim advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially. Because of the statewide interim advisory, however, no fresh waters can be assessed as support or partial support for the *Fish Consumption Use*. The following is an overview of the guidance used to assess the status (support, partial support, non-support) of the *Fish Consumption Use*.

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

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). 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 on a statewide basis to EPA in the 305(b) report. Below is EPA's guidance to assess the status (support, partial support, non-support) of the drinking water use.

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

*MCLs = maximum contaminant levels

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 Blackstone River Basin's public water suppliers.

PRIMARY CONTACT RECREATIONAL USE

This use is suitable for any recreational or other water use in which there is prolonged and intimate contact with the water with a significant risk of ingestion of water (1 April to 15 October). These include, but are not limited to, wading, swimming, diving, surfing and water skiing. The chart below provides an overview of the guidance used to assess the status (support, partial support, non-support) of the *Primary Contact Use*.

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

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are represent dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.

**Any portion of a lake exhibiting impairment of the *Primary Contact Recreation Use* (swimmable) because of macrophyte cover and/or transparency (Secchi disk depth) is assessed as either partial or non-support. If no fecal coliform bacteria data are available and the lake (entirely or in part) met the transparency (Secchi disk depth) and aesthetics guidance this use is not assessed.

SECONDARY CONTACT RECREATIONAL USE

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

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

Note: Excursions from criteria due to natural conditions are not considered impairment of use.

* Fecal coliform bacteria interpretations require additional information in order to apply this use assessment guidance. Small/limited datasets require an evaluation of survey conditions (i.e., interpretation of the amount of precipitation received in the subject region immediately prior to sampling and streamflow conditions) to determine whether the fecal coliform bacteria results are represent dry or wet weather/storm water runoff conditions. When larger data sets are available, the frequency of standards/guidance exceedances is calculated.

** In lakes if no fecal coliform data are available, macrophyte cover is the only criterion used to assess the *Secondary Contact Recreational Use*.

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

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

AESTHETICS USE

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

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

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

References

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

BLACKSTONE RIVER BASIN DESCRIPTION AND CLASSIFICATION

DESCRIPTION

The Blackstone River (Figure 4) is formed in the City of Worcester by the confluence of the Middle River and Mill Brook. The mainstem flows generally southeast through Worcester, Millbury, Sutton, and Grafton to Fisherville Pond, where it converges with the Quinsigamond River. Below Fisherville Pond, the Blackstone River flows in a southerly direction through Northbridge, Uxbridge, Millville, and Blackstone and crosses for the first time into Rhode Island. Just south of the RI border, it is joined by the Branch River, turns north and re-enters Massachusetts for a short distance, then turns south again and enters Woonsocket RI. The Blackstone River Basin is bordered by the Chicopee River Basin to the northwest, the French River Basin to the southwest, the Concord River Basin to the northeast and by the Charles River Basin to the southeast. The north and south portions of the basin are bordered the Nashua River Basin and the state of Rhode Island, respectively. Major tributaries that discharge to the Blackstone River in Massachusetts include the Quinsigamond, West, and Mumford rivers. The Mill and Peters rivers join the Blackstone River in Rhode Island. There are 188 lakes in the Massachusetts portion of the basin which cover approximately 7,087 acres.

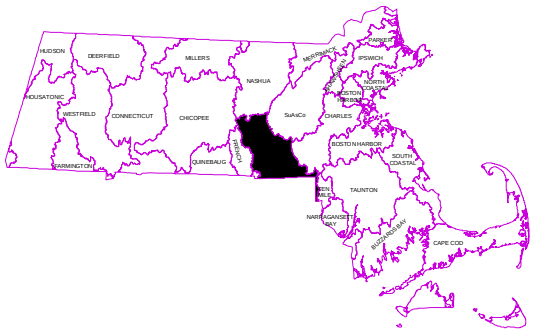

Figure 4. Location of Blackstone River Basin.

The mainstem Blackstone River is characterized by numerous impoundments formed by the remains of old mill-dams used historically for water power. In Massachusetts, two of these are still used at varying levels to generate power: Riverdale and Synergics (Tupperware). Water levels in the river fluctuate rapidly over short periods of time due to a combination of storm impacts and water flow regulations. The flow impacts during storm events are compounded by the predominance of impervious surfaces and the scarcity of wetlands. A decrease in impervious surfaces and an increase in wetlands would moderate flows through absorbing and releasing the water over larger time events.

The drainage area of the Blackstone River Basin encompasses a total of 540 square miles of which approximately 335 square miles lie in Massachusetts including portions of Bristol, Middlesex, Norfolk, and Worcester counties. The communities of Attleboro, Auburn, Bellingham, Blackstone, Boylston, Douglas, Franklin, Grafton, Holden, Hopedale, Hopkinton, Leicester, Milford, Millbury, Millville, Northbridge, Mendon, North Attleborough, Oxford, Paxton, Plainville, Shrewsbury, Sutton, Upton, Uxbridge, Webster, Westborough, West Boylston, Worcester, and Wrentham lie wholly or in part within the watershed boundaries.

The Blackstone River has a long history of pollution. The Blackstone Valley was the birthplace of the American textile industry. The construction of the Blackstone Canal, which extended from Narragansett Bay to Worcester, was finished in 1828. It was used through 1848, when the railroad became a quicker and cheaper method of transporting goods. A detailed description of the canal and its history can be found in the Blackstone River Valley Cultural Heritage and Land Management Plan (BRVNHCC 1989). The Blackstone River and its tributaries were the first to be polluted by waste discharges from textile mills. The river has been described as “the world’s busiest river“ and “industrial stream” during the nineteenth and twentieth centuries (Tennant *et al*. 1975). Gross sediment contamination also resulted from the discharges of heavy metals from plating operations, oil and grease from machine shops, dyes and prints from textile plants, organics and metals from tanneries, and other sources (McGinn 1981). Resuspension of contaminated sediments located behind many of the dams along the Blackstone River, however, remains a major concern (US EPA and MA DWPC undated).

The industrial pollution has declined but domestic wastes being discharged into the river have increased with the growing population of the valley. According to Tennant *et al.,* the city of Worcester is the single

most important factor in the pollution of the Blackstone River (1975). Not only is the flow of the Blackstone River adversely affected by extensive impervious surfaces (altered natural hydrology resulting in higher high flows and lower low flows) which contribute pollutants from nonpoint sources, the river also provides limited dilution for municipal and industrial wastewater discharges. Since 1963, thirty-six National Pollutant Discharge Elimination System (NPDES) discharges, representing both municipal and industrial operations in 11 towns, have ceased to discharge to the Blackstone River Basin (Hogan 2000).

Today, major municipal wastewater treatment plants are located in Worcester (Upper Blackstone Water Pollution Abatement District - UBWPAD), Northbridge, Upton, Douglas, Hopedale, Grafton and Uxbridge. The Millbury wastewater treatment plant will be decommissioned within the next few years and the wastewater will be sent to the UBWPAD for treatment. Nonpoint source pollution associated with urban and agricultural runoff, contaminated sediments, runoff and/or leachate from dumps, junkyards, gravel pits, and automobile graveyards also contributes to the basin's water quality problems.

With the exception of Worcester, all communities in the Blackstone River Basin rely on groundwater as their primary source of public supply (Izbicki 2000). By the year 2020, demand for water in the basin is expected to be 52 MGD, one-third greater than the demand in 1980. Most of this increase is expected to be supplied by increased groundwater withdrawals from aquifers in the eastern and northern parts of the basin.

CLASSIFICATION

Consistent with the National Goal Uses of "fishable and swimmable waters," the classification of waters in the Blackstone River Basin according to the SWQS (314 CMR 4.0), include Class A and Class B waters, as described below.

Class A Public Water Supplies in the Blackstone River Basin

As stated previously, Class A waters are designated for protection as Outstanding Resource Waters (ORWs). These include public drinking water supplies, vernal pools, and all surface waters within an Area of Critical Environmental Concern (ACEC). In the Blackstone watershed, registered and/or permitted Class A Public Water Supplies include (MA DEP 1996):

- Kettle Brook, source to dam at Reservoir #1,
- Kettle Brook Reservoir Nos. 1-4, source to outlets in Leicester and Paxton and those tributaries thereto,
- Lynde Brook Reservoir, source to outlet in Leicester and those tributaries thereto,
- Holden Reservoirs Nos. 1 and 2, source to outlet in Holden and those tributaries thereto, and
- All interstate surface waters that are public water supplies in Rhode Island from 1000 feet upstream of the state line.

At this time, there are 38 certified vernal pools (CVP) in the Blackstone River Basin (according to the CVP database with the Division of Fisheries and Wildlife, January 2001). These vernal pools are found in Bellingham, Douglas, Grafton, Millbury, North Attleborough, Northbridge, Shrewsbury, Sutton, Upton, Uxbridge, and Worcester. Species of special concern observed in these pools include the marbled salamander (*Ambystoma opacum*) and the spotted turtle (*Clemmys guttata*). Other obligate vernal pool species include the spotted salamander (*A. maculatum*), wood frog (*Rana sylvatica*), and fairy shrimp (Order Anostraca). Numerous facultative vernal pool species were also identified (Maher 2001).

Currently, there is one designated ACEC in the Blackstone River Basin: the Miscoe-Warren-Whitehall ACEC in Grafton, Upton and Hopkinton was officially accepted on 17July 2000. The ACEC encompasses approximately 8,700 acres, and drains to both the Blackstone and Concord watersheds. Approximately 89% of the ACEC consists of forest, non-forested wetlands, and open lands and farmland. Resources of these headwater streams include: high quality surface and groundwater; reproducing populations of native brook trout; unfragmented and diverse wildlife habitat, which are known to be home to five rare species; agriculture; forestry; and unique and highly significant archaeological and historical resources. (For more information see http://www.state.ma.us/dem/programs/acec/l-miscoe.htm).

Class B Cold Water Fisheries in the Blackstone River Basin:

- West River, source to the Upton STP (WWTP)

Class B Warm Water Fisheries in the Blackstone River Basin:

- Kettle Brook, from Dam at Reservoir # 1 to outlet of Curtis Pond
- Middle River, entire length
- Blackstone River, source to outlet of Fisherville Pond (CSO), and to the Rhode Island State Line
- Mill Brook, entire length (CSO)
- Quinsigamond River, entire length
- Mumford River, source to the confluence with the Blackstone River
- West River, from the Upton STP to the Blackstone River
- Mill River, entire length
- Beaver Brook, entire length
- Weasel Brook, entire length

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

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

[Adapted from: *The Blackstone River Watershed Resource Assessment and Management Report TMDL Phase 1, (*MA DEP and US EPA 1997*)* and *Blackstone River Initiative Comprehensive Assessment Report on Dry and Wet Weather and Modeling* (Wright *et al*. 1998).

The Massachusetts Department of Environmental Protection (DEP) has conducted numerous water quality surveys in the Blackstone River watershed since 1965. Over 30 reports have been published by the DEP on the river and watershed since that time. These reports are available for review at the DEP Division of Watershed Management office in Worcester.

The most significant and comprehensive study of the river began in 1990 as an interagency interstate study of the river system during dry and wet weather conditions. The project was a cooperative effort among the USEPA, the University of Rhode Island, and the Massachusetts DEP. The project conducted extensive activities from 1991-1994 as part of an integrated monitoring (biology, chemistry, and toxicity of water and sediments), modeling, and assessment project. Dry weather sampling was conducted during July, August, and October of 1991 at 15 mainstem stations as well as the six major tributaries in the watershed. Wet weather sampling was conducted in 1992 and 1993. Biological and habitat assessment work was conducted between 1991 and 1994. Sediment quality sampling was also conducted in 1991(whole sediment toxicity and pore water toxicity tests).

A number of reports and appendices were produced which summarized the efforts involved, the data collected, and the final analyses and recommendations. Assessment of the Blackstone River Initiative (BRI) data was completed in 1997 as applied to the Massachusetts river segments and agency programs with a proposed plan of action for remediation (MA DEP and US EPA 1997). Assessment of the complete MA and RI data appears in the draft study report. (Wright *et al.* 1998)

- *Blackstone River Initiative: Phase 1: Dry Weather Assessment Interim Report of Data 1991* (US EPA and MA DWPC undated);
- *Blackstone River Initiative Phase 1 Dry Weather Assessment Report of Data 1991 Appendices* (US EPA and MA DWPC undated);
- *Blackstone River Watershed: Resource Assessment and Management Report, TMDL Phase 1 (*MA DEP and US EPA 1997*);*
- *Blackstone River Initiative Comprehensive Assessment Report on Dry and Wet Weather and Modeling (*Wright *et al.* 1998*). Data and models included on CD.*
- *Blackstone River Watershed Dissolved Oxygen Wasteload Allocation for Massachusetts and Rhode Island, (*MA DEP, EPA and RIDEM 1997*).*

The information collected under the BRI was utilized to develop a wasteload allocation computer model for the entire river in both Massachusetts and Rhode Island. This computer model, detailed in the Blackstone River Initiative Comprehensive Assessment Report (Wright *et al.* 1998) was utilized by the states to develop NPDES permit limits for municipal facilities on the mainstem. The 1998 report entitled, *Blackstone River Wasteload Allocation Report*, details the process involved in the development of the NPDES permit limits for

the municipal dischargers on the mainstem in Massachusetts and Rhode Island, and provides the options for permit limits with changes to water quality instream. This material was then incorporated into a Draft Seasonal Low Flow TMDL for nutrients and organic enrichment on the mainstem (MA DEP 2000a).

Follow-up work was conducted during 1998 and focused on the areas that the Blackstone Initiative identified as either "hot spots" or needing further monitoring, specifically in the numerous headwater tributaries and on the West River (Hartman and Fiorentino 1999). These areas for study were further refined by the information contained in the DEP and EOEA Blackstone watershed preliminary assessment and management report.

Typically during storm events with greater than 0.5 inches of rain and/or during consecutive storms, the Worcester CSO (MA0102997) facility discharges wastewater and storm water into "Mill Brook", Worcester. Additionally, the headwaters of the Blackstone River have numerous stormdrains, and other nonpoint source inputs that all contribute to water quality degradation, during wet weather. The Upper Blackstone Water Pollution Abatement District (UBWPAD) (MA0102369) discharges just downstream of the confluence of the headwater streams, and downstream of the confluence with Mill Brook and the CSO.

The Blackstone River Initiative demonstrated significant toxicity in the upper reaches of the mainstem during storm events. The largest number of toxic endpoints during storm events were measured in the upper two miles. Water quality exceedances during dry weather were found in the numerous impoundments along the mainstem. During dry weather, high levels of chlorophyll, large diurnal fluctuations in dissolved oxygen and pH, and supersaturated oxygen levels during the afternoon indicated high levels of phosphorus and other nutrients. The report also indicated the toxicity of sediments, which have been deposited historically in the impoundments and in the riverbanks. These sediments are resuspended into the water column through scouring at high flows and during times in which the river flow rises and falls rapidly.

The tributaries sampled in 1991 demonstrated high levels of some metals. Two tributaries had problems with dissolved oxygen.

The Clean Water Act section 303(d) requires states to identify those waterbodies that are not meeting Surface Water Quality Standards (SWQS). Table 3 is a list of waterbodies in the Blackstone River Basin that are on the 1998 Massachusetts Section 303(d) list of waters (MA DEP 1999).

Table 3. Waterbodies in the Blackstone River Basin included on the 1998 303(d) list.

1998 303(d) Listed Waterbody		Cause of Impairment
Blackstone River	American Steel Dam, Worcester to Fisherville Dam, Grafton	Unknown toxicity, priority organics (PCB), metals, unionized ammonia, chlorine, nutrients, organic enrichment/low DO, flow alteration, pathogens(fecal coliform bacteria), suspended solids, turbidity
	Fisherville Dam, Grafton to Rice City Pond, Uxbridge	Unknown toxicity, PCB, metals, nutrients, organic enrichment/low DO, flow alteration, fecal coliform bacteria, suspended solids, turbidity
	Rice City Pond, Uxbridge to the Water Quality Monitor, Millville	Unknown toxicity, PCB, metals, nutrients, pH, flow alteration, suspended solids, turbidity
	From the Water Quality Monitor, Millville to the Rhode Island Border	PCB, nutrients, pH, flow alteration, fecal coliform bacteria, suspended solids, turbidity
Unnamed tributary (also known as "Mill Brook")	Outlet Indian Lake to confluence with the Blackstone River, Worcester (flows through an underground conduit)	PCB, metals, unionized ammonia, nutrients, organic enrichment/low DO, fecal coliform bacteria, suspended solids, turbidity
Peters River	Outlet Curtis Pond, Bellingham to Rhode Island state line	Metals, fecal coliform bacteria
Mill River	Outlet North Pond, Milford/Upton to confluence with Blackstone River, Woonsocket, Rhode Island	PCB, metals
West River	Outlet Silver Lake, Upton to Upton WWTP	pH, organic enrichment/low DO, fecal coliform bacteria
	Upton WWTP to confluence with Blackstone River, Uxbridge	Metals, nutrients, pH, organic enrichment/low DO, salinity/TDS/chlorides
Mumford River	Douglas WWTP to confluence with Blackstone River, Uxbridge	Metals, pH, organic enrichment/low D.O., fecal coliform bacteria
Middle River	Curtis Pond to American Steel Dam, Worcester	Unknown toxicity, metals, nutrients, pH, fecal coliform bacteria, turbidity
Kettle Brook	Waite Pond, Leicester to Curtis Pond, Worcester	Nutrients, fecal coliform bacteria

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

Table 3. Continued. Waterbodies in the Blackstone River Basin included on the 1998 303(d) list.

1998 303(d) Listed Waterbody		Cause of Impairment
Tatnuck Brook	Outlet Holden Reservoir #2, Holden to confluence with Beaver Brook, Worcester	Turbidity
Aldrich Pond	Sutton	Noxious aquatic plants
Auburn Pond	Auburn	Noxious aquatic plants
Brierly Pond	Millbury	Noxious aquatic plants
Burncoat Park Pond	Worcester	Noxious aquatic plants, turbidity
Chase Pond	Douglas	Noxious aquatic plants
Cider Millpond	Grafton	Noxious aquatic plants
City Farm Pond	Shrewsbury	Siltation, noxious aquatic plants
Clark Reservoir	Sutton	Noxious aquatic plants
Crane Pond	Blackstone	Noxious aquatic plants
Crystal Lake	Douglas	Noxious aquatic plants
Curtis Pond (North Basin)	Worcester	Noxious aquatic plants
Curtis Pond (S. Basin)	Worcester	Siltation, Noxious aquatic plants
Dark Brook Pond	Sutton	Noxious aquatic plants
Dark Brook Reservoir	Auburn	Noxious aquatic plants
Dorothy Pond	Millbury	Turbidity
Dudley Pond	Douglas	Noxious aquatic plants
Eddy Pond	Auburn	Noxious aquatic plants
Fish Pond	Northbridge	Noxious aquatic plants
Fiske Millpond	Upton/Milford	Noxious aquatic plants
Flint Pond	Shrewsbury/Grafton/Worcester	Turbidity
Gilboa Pond	Douglas	Noxious aquatic plants
Green Hill Pond	Worcester	Turbidity
Harris Pond	Blackstone	Noxious aquatic plants
Hathaway Pond	Millbury/Sutton	Noxious aquatic plants
Hayes Pond	Grafton	Noxious aquatic plants
Hopedale Pond	Hopedale	Noxious aquatic plants
Hovey Pond	Grafton	Noxious aquatic plants
Howe Pond	Millbury	Noxious aquatic plants
Howe Reservoir (E Basin)	Millbury	Flow alteration, noxious aquatic plants
Howe Reservoir (West)	Millbury	Noxious aquatic plants
Indian Lake	Worcester	Organic enrichment/ low DO, noxious aquatic plants
Ironstone Reservoir	Uxbridge	Noxious aquatic plants
Jenks Reservoir	Bellingham	Noxious aquatic plants
Joes Rock Pond	Wrentham	Noxious aquatic plants
Jordan Pond	Shrewsbury	Turbidity
Lee Reservoir	Uxbridge	Noxious aquatic plants
Leesville Pond	Auburn/Worcester	Nutrients, organic enrichment/ low DO
Manchaug Pond	Douglas/Sutton	Organic enrichment/ low DO, noxious aquatic plants
Marble Pond	Sutton	Noxious aquatic plants
Martin Street Pond	Douglas	Noxious aquatic plants
Merrill Pond No. 3	Sutton	Noxious aquatic plants
Merrill Pond No. 4	Sutton	Noxious aquatic plants
Milford Street Pond	Hopedale/Milford	Noxious aquatic plants
Mill Pond	Upton	Noxious aquatic plants
Mill Pond	Shrewsbury	Turbidity
Miscoe Lake	Wrentham/Cumberland, RI	Noxious aquatic plants
Newton Pond	Shrewsbury/Boylston	Noxious aquatic plants
Number 1 Pond	Sutton	Noxious aquatic plants, turbidity
Number 2 Pond	Sutton	Noxious aquatic plants
Peabody Pond	Uxbridge	Noxious aquatic plants
Pondville Pond	Auburn	Noxious aquatic plants
Pout Pond	Boylston	Noxious aquatic plants
Pratt Pond	Upton	Noxious aquatic plants
Pratts Pond	Grafton	Noxious aquatic plants
Lake Quinsigamond	Shrewsbury/Worcester	Noxious aquatic plants
Rice City Pond	Uxbridge	PCB, turbidity
Riley Pond	Northbridge	Turbidity
Lake Ripple	Grafton	Noxious aquatic plants
Riverdale Impoundment	Northbridge	PCB, turbidity
Rivulet Pond	Uxbridge	Noxious aquatic plants
Salisbury Pond	Worcester	Noxious aquatic plants, turbidity
Schoolhouse Pond	Sutton	Noxious aquatic plants
Silver Hill Pond	Milford	Noxious aquatic plants

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

Table 3. Continued. Waterbodies in the Blackstone River Basin included on the 1998 303(d) list.

1998 303(d) Listed Waterbody		Cause of Impairment
Silver Lake	Bellingham	Noxious aquatic plants
Silver Lake	Grafton	Noxious aquatic plants
Slaughterhouse Pond	Millbury/Sutton	Noxious aquatic plants
Smiths Pond	Leicester	Turbidity
Southwick Pond	Leicester/Paxton	Noxious aquatic plants
Spindleville Pond	Hopedale	PCB, noxious aquatic plants
Stoneville Pond	Auburn	Noxious aquatic plants
Sutton Falls	Sutton	Turbidity
Swans Pond	Sutton	Noxious aquatic plants
Taft Pond	Upton	Noxious aquatic plants
Town Farm Pond	Sutton	Noxious aquatic plants
Tuckers Pond	Sutton	Noxious aquatic plants
Welsh Pond	Sutton	Noxious aquatic plants
West River Pond	Uxbridge	Noxious aquatic plants
Whitins Pond	Northbridge/Sutton	Noxious aquatic plants
Lake Wildwood	Upton/Grafton	Noxious aquatic plants
Windle Pond	Grafton/Shrewsbury	Noxious aquatic plants
Woodbury Pond	Sutton	Noxious aquatic plants
Woolshop Pond	Millbury	Noxious aquatic plants, turbidity
Sewall Pond	Boylston	Noxious aquatic plants
Meadow Pond	Northbridge/Sutton	Noxious aquatic plants
Doctors Pond	Uxbridge	Noxious aquatic plants
Brooklawn Parkway Pond	Shrewsbury	Noxious aquatic plants
Shirley Street Pond	Shrewsbury	Noxious aquatic plants
Arcade Pond*	Northbridge	Noxious aquatic plants

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

SOURCES OF INFORMATION

Multiple local, state and federal agencies provided information used in the water quality assessment of the Blackstone River Basin. Within the Department of Environmental Protection (DEP) information was obtained from three programmatic bureaus: Bureau of Resource Protection (BRP, see below), Bureau of Waste Prevention (industrial wastewater discharge information) and the Bureau of Waste Site Cleanup (hazardous waste site cleanup information). Specifically, DEP BRP Division of Watershed Management (DWM) Watershed Planning Program provided water quality, habitat assessment, biological data, and lake synoptic survey data. The DEP Central Regional Office, Blackstone River Watershed Team and the DWM Watershed Permitting Program (Water Management Act, and National Pollutant Discharge Elimination System) provided water withdrawal and wastewater discharge permit information. [Note: The BRP DWM Drinking Water Program evaluates the status of the *Drinking Water Use* and this information is therefore not provided in this assessment report.]

Projects funded through various 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 Blackstone River Basin is provided in Appendix E.

Other state agencies contributing information to this report include: the Massachusetts Department of Public Health (DPH), the Department of Fisheries, Wildlife, and Environmental Law Enforcement (DFWELE) Division of Fisheries and Wildlife and Riverways programs, the Department of Environmental Management (DEM), and the UMass Extension Service. Contributing federal agencies include EPA, United States Geological Survey (USGS), Federal Energy Regulatory Commission, and the United States Army Corps of Engineers (ACOE).

The ACOE New England Division (NAE) owns and operates numerous flood control projects throughout the nation, including the West Hill Dam project on the West River (Upton, Northbridge, and Uxbridge). The West Hill Dam project is a dry-bed reservoir, and does not maintain a conservation pool behind the dam. It operates run-of-river except during flooding events. The ACOE owns 614 acres within the project area, and has easements on an additional 838 acres. Most of the land use in the 27.9 square mile drainage area consists of rural, forested and low density residential land; however, this area is under

intense development pressure, with numerous developments under construction both up- and downstream of the ACOE property.

The goals of the ACOE reservoir water quality control management program, established in 1982, protecting public health and safety, meeting State water quality standards, maintaining the water quality necessary to meet the individual project goals, and identifying the impacts of the projects on water quality (Barker, 1998). Activities conducted under the Reservoir Water Quality Operation and Maintenance Program during fiscal year 1999 (October 1, 1998 through September 30, 1998) include potable water and bathing beach water quality monitoring, baseline monitoring of Class I projects with conservation pools, and the continuation of a study on the relationship between rainfall and elevated bacteria counts at project beaches (among other projects). Beaches are monitored biweekly from May through Labor Day. The assessment of the data collected in these programs are presented in annual reports; the reports utilized in this assessment are for Fiscal Years 1997- 1999 (Barker, 1999, 1998, 1999a). The West Hill Dam project is considered to be a Class I project i.e., it exhibits consistently high water quality, based on previous NAE water quality reports, state water quality reports, changes between inflow and discharge water quality, frequency of violation of water quality criteria, and the presence/absence of a conservation pool (Barker, 2000). Data collected at the sampling station at West Hill Dam from FY 1997-2000 showed that water quality was within the good to excellent range, indicating that the state water quality standards were met or exceeded, and that the water quality met the needs of the project (i.e., recreation, fish and wildlife habitat).

In addition to state and federal agencies, regional, local and citizen monitoring groups provided valuable data/information for the watershed management process which may be used to indicate areas of degraded water quality, as well as causes and sources of contamination. The Blackstone River Watershed Association (BRWA) is a nonprofit organization dedicated to restoring and enhancing the environmental quality of the waters and adjacent lands of the Blackstone River and its tributaries (BRWA 18 April 2001). The BRWA's objectives are:

- to restore the waters of the Blackstone and its tributaries to their highest possible quality and protect their shores and floodplains from inappropriate uses;
- to enhance the natural integrity of and protect public access to the river, canal, and tributaries for canoeing, fishing, and other recreational pursuits;
- to preserve the rural and forested character of the Blackstone Valley and protect lands with ecological, recreational, and/or scenic value.

From 1996 through 2000, shoreline surveys were conducted by volunteers in many headwater streams of the Blackstone River in Shrewsbury and Worcester (Coffin 24 January 2001). These surveys were carried out by the BRWA, the Blackstone Headwaters Coalition, the Tatnuck Brook Stream Team, Coes and Patches Watershed Association, and the Flint Pond Stream Team. Locations surveyed included Kinneywood Brook, Cooks Pond, Peter's Brook, Boynton/Cascades Brook, West Tatnuck Brook, Patch Reservoir, Country Club Tributary, Fowler Brook, Worcester State College tributary, Williamsburg Ave tributary, Coes Reservoir, Beaver Brook, Tatnuck Brook, Middle River, Poor Farm Brook, Flint Pond, and the Mumford River. Teams on shore and in boats noted conditions in the water bodies and along the banks, and recorded land uses, erosion, surface pipes, siltation/sedimentation, trash, odors, sheens, foams, aquatic vegetation, color, solid waste, and recreational resources.

Site-specific evaluations of other water quality issues in the Blackstone River Basin related to either wastewater discharges and/or water withdrawals were conducted either through field investigations (where resources could be allocated) or through the review of discharge monitoring reports (DMRs) and annual water withdrawal reports submitted by the permittees. Water withdrawal and wastewater discharge permit information was provided by the DEP Central Regional Office Blackstone River Watershed Team and the DWM Watershed Permitting Program (Water Management Act - WMA and National Pollutant Discharge Elimination System –NPDES).

The Blackstone River Basin has facilities that discharge to the mainstem of the river and to several of its tributaries (Appendix D, Table D1). The following types of NPDES discharges occur in the Blackstone River Basin (Hogan 2000):

- *Municipal wastewater treatment plants (WWTPs):* these facilities treat wastewater from domestic and industrial sources within the WWTP service area. Five discharge to the mainstem Blackstone River in Massachusetts - Upper Blackstone Water Pollution Abatement District {UBWPAD} (the largest point source discharge in the watershed); Millbury WWTP (scheduled to be connected to UBWPAD); Grafton WWTP; Northbridge WWTP (actually discharges to unnamed stream near the mainstem); Uxbridge WWTP. Three facilities discharge to tributaries of the Blackstone River; Douglas WWTP (Mumford River), Upton WWTP (West River) and the Hopedale WWTP (Mill River). These discharges range in size from the Douglas WWTP, which has a current capacity of 0.18 MGD and treats only municipal, sanitary wastewater to the regional UBWPAD facility with a treatment capacity of 56 MGD. The UBWPAD discharges into the upper reaches of the mainstem, just downstream of the confluences of the smaller tributaries forming the headwaters of the river. These headwater tributaries drain the seven hills of the City of Worcester and parts of surrounding towns, presenting a situation of urban headwaters and a large NPDES discharger with low dilution. Specifically, the UBWPAD accounts for approximately 90% of the wastewater discharged to the Blackstone River in Massachusetts. The river is therefore effluent-dominated for a number of river miles in the upper and middle reaches, especially during extended periods low-flows.

- *Combined Sewer Overflows* (Brander 2001): The city of Worcester has completed considerable work with regard to CSO abatement including the construction of a CSO treatment facility and ongoing sewer separation. At this time, there is a single CSO discharge point, and all CSO discharges receive screening and disinfection with some solids removal in detention tanks prior to discharge. As a result of an Administrative Order issued by EPA on 19 September 2000, the City of Worcester will continue to move forward with a two-phased Long-term CSO Control Plan. Phase one will involve characterizing the combined sewer system, establishing baseline conditions for CSO and non-CSO pollutant loads, and developing costs for a range of CSO control alternatives (approximately one year). Phase two will focus on the development of a final Long-term CSO Control Plan (approximately one year). If non-CSO loads are determined to be a predominant contributor to violations of SWQS, then the final strategy for CSO abatement will likely be meshed with storm water management strategies in order to maximize the cost-effectiveness of the overall program.

  The treated CSO discharges flow to Mill Brook and the Blackstone River. These segments are both presently designated Class B. A CSO-impacted segment can be reclassified to B(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 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. As the City of Worcester has not completed the planning process, a final determination on the level of CSO control to be required and the associated water quality standard have not yet been made. Until such time, the receiving waters will continue to be designated Class B (Brander 2001).

- *Industrial WWTPs and non-process discharges:* the majority of industrial process wastewaters are treated at the municipal WWTPs (particularly the UBWPAD) under conditions of their industrial pre-treatment program (IPP). The IPP is controlled by the municipality and is a condition of the municipal WWTP NPDES permit. There are three major industrial discharges (New England Plating; Guilford of Maine; Wyman-Gordon, Grafton) in the Blackstone River Basin and three minor discharges (Lewcott Corp., Norton Co., and Coz Chemical). [Note: There are also several industries which have NPDES permits for the discharge of non-contact cooling water and storm water; some of these discharges are authorized and controlled under individual permits while others are regulated under general permits issued to the facilities by USEPA.]

Two FERC licensed hydroelectric power plants effect the Blackstone River in Massachusetts:

- Riverdale Mills, Northbridge (FERC Project # 9100)
- Synergics Hydropower in the village of Waterford (FERC Project # 3023), just over the Massachusetts state line in Rhode Island

NPDES Toxicity Testing Discharge Monitoring Reports (DMRs):
All eight municipal wastewater treatment plants in the Blackstone River Basin submit toxicity testing reports to EPA and 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 January 1996 to April 2000 were reviewed and summarized (ranges) for use in the assessment of current water quality conditions in the Blackstone River Basin. These include:

- Upper Blackstone WPAD MA0102369
- Millbury WWTP(MA0100650)
- Uxbridge WWTF (MA0102440)
- Grafton WWTP (MA0101311)
- Northbridge WWTF (MA0100722)
- Douglas WWTF(MA0101095)
- West Upton WWTF (MA0100196)
- Hopedale WWTF (MA0102202)
- Worcester CSO Treatment Facility (MA0102997
- New England Plating Company, Worcester (MA0005088)
- Wyman-Gordon (MA0004341)
- Coz Plastics, Inc. (MA0032549)
- Guilford of Maine, Inc. East Douglas Division (MA0001538)
- Riverdale Mills (MAG250279)

A list of registered and permitted Water Management Act (WMA) withdrawals (both public water suppliers and other industrial users) is provided in Appendix D, Table D2 (LeVangie 2000).

TOTAL MAXIMUM DAILY LOADS (TMDL)

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

RIVERS
MADEP and USEPA are drafting a Low Flow Seasonal TMDL for nutrients and organic enrichment/low dissolved oxygen for the mainstem of the Blackstone River (segments MA51-03 through MA51-06). Although the mainstem of the river is on the 1998 303(d) list for multiple causes, the first Blackstone River TMDL focused on organic enrichment (BOD)/low dissolved oxygen, and excessive nutrients (phosphorus) to coincide with the on-going work on the NPDES municipal permits. The TMDL is based upon the extensive field and modeling work completed under the interstate/interagency Blackstone River Initiative, the five-year cycle of the Watershed Approach, the DEP/CERO strategic monitoring program, and the wasteload allocation work completed in 1998. A load-response relationship was developed between the municipal facility discharges and the dissolved oxygen levels in the river. Control measures target new storm water management through permitting, education, and grants; development of BMPs; CSO permit reissuance; concurrent issuance of TMDLs for selected lakes in the watershed; and changes to the NPDES municipal discharge effluent limits. The proposed limits are expected to improve water quality instream through meeting standards for target constituents. Once the draft TMDL is completed, the report will be made available for public comment (MA DEP 2000a).

LAKES

There are eighty-eight lakes in the Blackstone basin on the 1998 303(d) list for which the most common cause of impairment is noxious aquatic plants (Table 3). A single draft TMDL for Total Phosphorus is being developed for 16 of these lakes located in the northern section of the basin, which will include (MA DEP 2000c):

Auburn Pond (MA51004), Auburn; **Brierly Pond** (MA51010), Millbury; **Curtis Pond North** (MA51032), Worcester; **Curtis Pond South** (MA51033), Worcester; **Dorothy Pond** (MA51039), Millbury; **Eddy Pond** (MA51043), Auburn; **Green Hill Pond** (MA51056), Worcester; **Howe Reservoir** (MA51071), Millbury; **Jordan Pond** (MA51078), Shrewsbury; **Mill Pond** (MA51105), Shrewsbury; **Newton Pond** (MA51110), Shrewsbury; **Pondville Pond** (MA51120), Auburn; **Smiths Pond** (MA51156), Leicester; **Southwick Pond** (MA51157), Leicester, **Stoneville Pond** (MA51160), Auburn; **Shirley Street Pond** (MA51196), Shrewsbury.

This draft TMDL will be available for public comment in 2001, and the final revised version is scheduled to be submitted to EPA by the end of 2001 (Mattson 2001).

In addition, draft phosphorus TMDLs based on previous diagnostic/feasibility studies are being developed for Lake Quinsigamond/Flint Pond, Indian Lake, Salisbury Pond and Leesville Pond. These draft phosphorus TMDLs will also be announced for public comment in 2001.

Two additional impoundments (Rice City Pond and Riverdale Impoundment) on the Blackstone River will be included in a draft TMDL for phosphorus for the Blackstone River as described above (MA DEP 2000a).

TMDLs for the remaining Blackstone River Basin lakes are scheduled to be developed on the Five-year watershed cycle in 2004 and 2009.

OBJECTIVES

This report summarizes information generated in the Blackstone River Basin through *Year 1* (information gathering in 1997) and *Year 2* (environmental monitoring in 1998) activities established in the "Five-Year Cycle" of the Watershed Initiative. Data collected by DWM in 1998, in accordance with the preliminary Quality Assurance Project Plan (QAPP) (Hartman and Fiorentino 1999)**,** are provided in Appendices A, B, and C (QA/QC, data tables, and the technical memorandum - Blackstone River Watershed 1998 Biological Assessment). Together with other sources of information (identified in each segment assessment), the status of water quality conditions of lakes and rivers in the Blackstone River Basin was assessed in accordance with EPA's and DEP's use assessment methods. Not all waters in the Blackstone River Basin are included in the DEP/EPA Water Body System (WBS) database or this report.

The objectives of this water quality assessment report are to:

1. Evaluate whether or not surface waters in the Blackstone River Basin, 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/or major point (wastewater discharges) and nonpoint (land-use practices, storm water discharges, etc.) sources of pollution that may impair water quality conditions,
3. identify the presence or absence of any non-native macrophytes in lakes,
4. identify waters (or segments) of concern that require additional data to fully assess water quality conditions,
5. recommend additional monitoring needs and/or remediation actions in order to better determine the level of impairment or to improve/restore water quality, and
6. provide information to the Blackstone River Watershed Team for use in its annual and 5-year watershed action plans.

REPORT FORMAT

RIVERS

The rivers assessed in the Blackstone River Basin are presented in the *River Segment Assessments* section of this report (Figure 5). The order of river segments follows the Massachusetts Stream Classification Program (Halliwell *et al*. 1982) hierarchy. River segments are organized hydrologically (from most upstream to downstream) and tributary segments follow after the river segment into which they discharge. Each river segment assessment is formatted as follows:

SEGMENT IDENTIFICATION

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

Sources of information: coding system (waterbody identification number e.g., MA51-01) used by DEP to reference the stream segment in databases such as 305(b) and 303(d), the Massachusetts SWQS (MA DEP 1996), and other descriptive information.

SEGMENT DESCRIPTION

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

Sources of information: descriptive information from USGS topographical maps, base geographic data from MassGIS, land use statistics from a GIS analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1985 and 1990 (EOEA 1999a).

SEGMENT LOCATOR MAP

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

Sources of information: MassGIS (EOEA 1999b) data layers (stream segments, and quadrangle maps).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

Water withdrawal, NPDES wastewater discharge (when provided)

Sources of information: WMA Database Printout (LeVangie 2000); open permit files located in Worcester DEP Office (MA DEP 2000e and f).

USE ASSESSMENT

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

Sources of information include: DWM 1998 Survey data (Appendix B and Appendix C); USGS streamflow and water quality data (Socolow *et al.* 1996, Socolow *et al.* 1997, Socolow *et al.* 1998, Socolow *et al.* 1999 and Socolow *et al.* 2000); the Blackstone River Initiative Reports (Wright *et al.* 1996); the US ACOE Blackstone River Watershed Reconnaissance Investigation (US ACOE 1997), Rice City Pond 319 Project (Snook 1996); DEP DWM Toxicity Testing Database "TOXTD"; BRWA and Stream Team reports (Coffin 24 January 2001). The MA DPH Freshwater Fish Consumption Advisory List (MA DPH 1999) was used to assess the *Fish Consumption Use*. Where other sources of information were used to assess designated uses, citations are included.

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

SUMMARY

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

RECOMMENDATIONS

Additional monitoring and implementation needs.

LAKES

The assessed lakes (Figure 6), identified with their Water Body System Identification (WBID) code numbers, are listed alphabetically in the *Lake Assessments* section of this report (Tables 5 and 6). The status of the individual uses is presented collectively for all of the lakes in the basin. The location, acreage, and trophic status, as well as the use assessments and causes of impairment are then summarized for each individual lake (listed alphabetically).