

BLACKSTONE RIVER BASIN 1998 WATER QUALITY ASSESSMENT REPORT



Blackstone River - View from King Phillip's Rock, Northbridge

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BLACKSTONE RIVER BASIN
1998 WATER QUALITY ASSESSMENT REPORT

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 - Riverways Program
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- Environmental Protection Agency (EPA)
- United States Army Corps of Engineers (ACOE)
- United States Geological Survey (USGS)
 - Water Resources Division

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- Worcester DPW
- Blackstone River Watershed Association
- Blackstone Headwaters Coalition
- Tatnuck Brook Stream Team
- Coes and Patches Watershed Association
- Flint Pond Stream Team
- Miscoe Brook Stream Team

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Cover photo credit: Blackstone River - Robert J. Maietta, DEP Division of Watershed Management

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LIST OF ACRONYMS

7Q10	Seven-day, ten-year low flow estimate
ACEC	Areas of Critical Environmental Concern
ACOE	United States Army Corps of Engineers
BDL	below detection limit
BMP	best management practice
BRWA	Blackstone River Watershed Association
BPJ	best professional judgement
CFS	cubic feet per second
CMR	Code of Massachusetts Regulations
CNOEC	chronic no observed effect concentration
CWA	Clean Water Act
DDT	Dichlordiphenyltrichloroethane
DEM	Department of Environmental Management
DEP	Department of Environmental Protection
DFWELE	Department of Fisheries, Wildlife, and Environmental Law Enforcement
DMR	Discharge Monitoring Report
DNAPL	Dense Non-Aqueous Phase Liquids
DO	Dissolved oxygen
DPH	Massachusetts Department of Public Health
DWM	DEP's Division of Watershed Management
EPA	United States Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
GIS (MassGIS)	Geographic Information System
GPM (D)	gallons per minute (day)
LC ₅₀	lethal concentration to 50% of the test organisms
MGD	million gallons per day
mg/L	milligram per liter
NCCW	non-contact cooling water
NH ₃ -N	ammonia-nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	non point source
NTU	nephelometric turbidity units
ORW	Outstanding Resource Waters
PAH	polyaromatic hydrocarbons
PALIS	Pond and Lake Information System
PCB	polychlorinated biphenols
PPM	parts per million
PWS	Public Water Supply
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
RBP	Rapid Bioassessment Protocol
SARIS	Stream and River Inventory System
SS	suspended solids
SU	standard units
SWQS	Massachusetts Surface Water Quality Standards
TMDL	total maximum daily load
TOC	total organic carbon
TOXTD	MA DEP DWM Toxicity Testing Database
TRC	total residual chlorine
UBWPAD	Upper Blackstone Water Pollution Abatement District
USGS	United States Geological Survey
WBID	Water Body Identification Code
WMA	Water Management Act
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

BLACKSTONE RIVER BASIN 1998

WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which surface waters in the state shall be protected. The assessment of current water quality conditions is a key step in the successful implementation of the Watershed Approach. This critical phase provides an assessment of whether or not the designated uses are being met (support, partial support, non-support) or are not assessed, as well as basic information needed to focus resource protection and remediation activities later in the watershed management planning process. The Blackstone, Middle, Mill, West and Peters rivers, a portion of the Mumford River, "Mill" and Tatnuck brooks, and a portion of Kettle Brook as well as 88 lakes are on the 1998 303(d) list of impaired waters. Total Maximum Daily Load (TMDL) reports have been or are being developed for some of these waters.

This report presents a summary of current water quality data/information as it relates to assessing the status of the State's designated uses for 13 named streams, brooks, creeks or rivers (the term "rivers" will hereafter be used to include all) and for 116 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) in the Blackstone River Basin. These data represent approximately 15% (13 of 88) of the named rivers and about 55% (113.8 of 207.4) of the river miles in the basin. Detailed information for 19 individual river segments totaling 113.8 river miles is presented for the following designated uses: *Aquatic Life, Fish Consumption, Drinking Water, Primary and Secondary Contact Recreation and Aesthetics*. The report also presents a summary of current information for 116 of the 188 lakes (62%) representing approximately 79% (5,625 of the 7,086.6) of the lake acreage in the Blackstone River Basin. The remaining rivers and lakes (small and/or unnamed) are currently unassessed.

This report contains detailed guidance used for assessing the status each designated use. Each 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**. It is important to note, however, that not all waters are assessed. Many small and/or unnamed rivers and lakes 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.

BLACKSTONE RIVER BASIN - RIVERS

Water quality conditions in the Blackstone River Basin can be summarized as follows: headwaters (Dark, Kettle, Tatnuck, Beaver, "Mill" brooks which flow into the Middle River); the mainstem Blackstone River; and major tributaries to the mainstem (Quinsigamond, Mumford, West, Mill, and Peters rivers). The 13 rivers included in this report (totaling 113.8 river miles) are briefly described below:

- **Headwaters:** A total of 26.6 river miles along six rivers (Dark, Kettle, Tatnuck, Beaver, and "Mill" brooks and the Middle River) were assessed in this area. These rivers drain the city of Worcester and its surrounding area, some of which are protected for public water supply.
- **Blackstone River:** The entire mainstem Blackstone River in Massachusetts (28.8 river miles).
- **Major Tributaries:** A total of 58.4 river miles along five rivers (Quinsigamond, Mumford, West, Mill, and Peters rivers) and Poor Farm Brook (a tributary to Lake Quinsigamond).

A summary of the *Aquatic Life, Fish Consumption, Drinking Water, Primary and Secondary Contact Recreation, and Aesthetics* uses in these rivers is provided below. When sufficient data/current information was not available, the uses were not assessed.

AQUATIC LIFE USE - RIVERS

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

The status of the *Aquatic Life Use* in the Blackstone River Basin is as follows:

<i>Aquatic Life Use Summary – Rivers (miles)</i>			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
28.5	12.1	39.8	33.4

As illustrated in Figure 1, one quarter of the river miles assessed in the Blackstone River Basin support the *Aquatic Life Use* while approximately 45% are impaired (partial or non-support). The remaining 29% of the 113.8 river miles included in this report were not assessed. The assessment of the *Aquatic Life Use* is as follows:

- *Headwaters*: All of the 26.6 river miles in this area were assessed for the *Aquatic Life Use*. A portion of only one stream (the upper 3.5 miles of Kettle Brook) was assessed as supporting this use. The majority, 87%, of the river miles along Dark, Kettle, Tatnuck, Beaver, and “Mill” brooks and the Middle River) were impaired (partial or non-support). Causes of impairment, when known, included organic enrichment, flow and habitat alteration (channelization), habitat degradation (sedimentation), and whole effluent toxicity. Sources of impairment, when known, included urban runoff/storm water, habitat modification, hydromodification (impoundments) and an industrial point source discharge.
- *Blackstone River*: The entire 28.8 mile length of the mainstem Blackstone River in Massachusetts was assessed as non-support for the *Aquatic Life Use*. Habitat alteration, organic enrichment, elevated nutrients, instream and whole effluent toxicity, sediment contamination (heavy metals), and flow alteration were identified as causes of impairment. Sources, when known, included municipal point source and combined sewer overflow discharges, urban runoff/storm water, contaminated sediments and hydromodification (hydropower operations).
- *Major Tributaries*: Portions of three tributaries, the Mumford, West, and Mill rivers, totaling 25 river miles were assessed as supporting the *Aquatic Life Use*. The remaining 33.4 river miles of these major tributaries were not assessed for this use.



BLACKSTONE RIVER BASIN AQUATIC LIFE USE ASSESSMENT SUMMARY - RIVERS

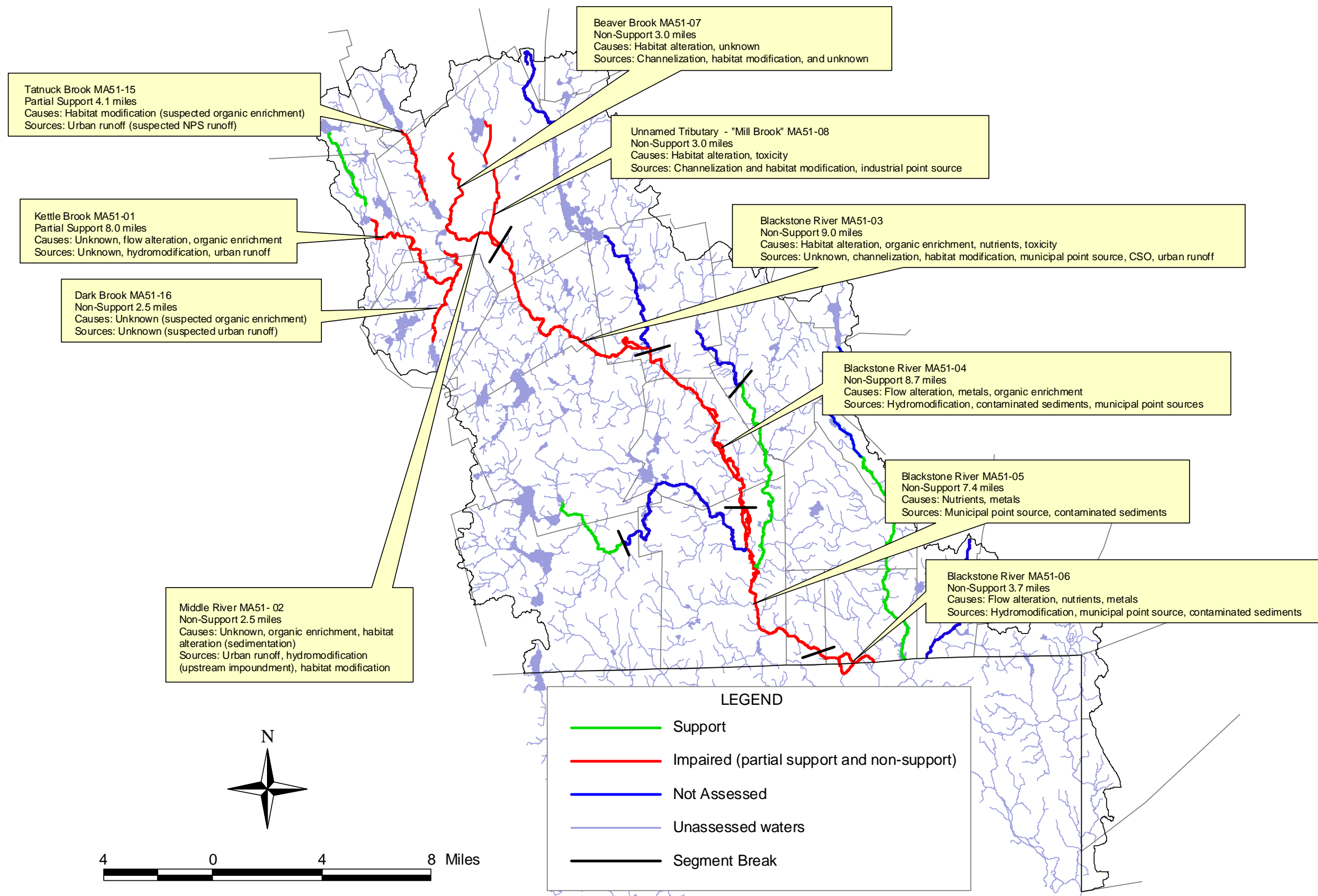


Figure 1. Blackstone River Basin *Aquatic Life Use* Assessment Summary - Rivers

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FISH CONSUMPTION USE – RIVERS

The *Fish Consumption Use* is met when there are no pollutants present that 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 this statewide interim advisory, no fresh waters can be assessed as support or partial support of the *Fish Consumption Use*.

The status of the *Fish Consumption Use* in the Blackstone River Basin is as follows:

<i>Fish Consumption Use Summary – Rivers (miles)</i>			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
0	0	6.7	107.1

DPH issued advisories for three impoundments along the mainstem Blackstone River (Riverdale Pond, Rice City Pond, and the Blackstone River Impoundment above the Blackstone Gorge) as well as a reach of the Mill River (the outlet of Hopedale Pond to the Spindleville Pond Dam) because of elevated PCB concentrations in fishes (MA DPH 1999). The *Fish Consumption Use* is therefore assessed as non-support for a total of five miles of the mainstem Blackstone River and a 1.7-mile reach of the Mill River. No other river miles were assessed for the *Fish Consumption Use* in the Blackstone River Basin.

DRINKING WATER USE – RIVERS

The term *Drinking Water Use* has been used to indicate sources of public drinking water. 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. These waters are subject to stringent regulation in accordance with the Massachusetts Drinking Water Regulations. DEP’s Drinking Water Program (DWP) has primacy for implementing the provisions of the federal Safe Drinking Water Act. DWP has also initiated work on its Source Water Assessment Program (SWAP) which requires that the state delineate protection areas for all public ground and surface water sources; inventory land uses in these areas that may present potential threats to drinking water quality; determine the susceptibility of water supplies to contamination from these sources; and publicize the results. Except for Suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) public water suppliers monitor their finished water (tap water) for major categories of contaminants (e.g., bacteria, volatile and synthetic organic compounds, inorganic compounds, etc.) and report their data to DWP.

RECREATIONAL USES - RIVERS

PRIMARY AND SECONDARY CONTACT

The *Primary Contact Recreational Use* is supported when conditions are suitable (fecal coliform bacteria densities meet surface water quality standards) for any recreational or other water activity during which there is prolonged and intimate contact with the water with a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing and water skiing. The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreational or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact incident to shoreline activities.

The status of the *Primary* and *Secondary Contact Recreational* uses in the Blackstone River Basin is as follows:

Primary and Secondary Contact Recreational Use Summary – Rivers (miles)			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
8.8	11.7	26.2	67.7

As illustrated in Figure 2, only a portion of the West River (from the Upton WWTP to its confluence with the Blackstone River) was assessed as supporting the *Primary* and *Secondary Contact Recreational* uses. While one third (33%) of the assessed river miles in the Blackstone River Basin were impaired (partial or non-support) for these uses, approximately 60% of the river miles were not assessed. The assessment of the recreational uses is as follows:

- *Headwaters:* The *Primary* and *Secondary Contact Recreational* uses were assessed as non-support for the entire lengths of Beaver and “Mill” brooks and the Middle River (8.5 river miles) representing approximately 32% of the river miles in this area. The remaining three brooks, Kettle, Dark and Tatnuck, were not assessed (18.1 river miles). Impairment of the *Primary* and *Secondary Contact Recreational* uses was a result of elevated fecal coliform bacteria and aesthetic degradation (oil, grease and odors) from urban runoff/storm water and illicit sewer connections.
- *Blackstone River:* The entire 28.8 mile length of the mainstem Blackstone River in Massachusetts was assessed as either partial or non-support for the *Primary* and *Secondary Contact Recreational* uses because of elevated fecal coliform bacteria, turbidity, and odor. Sources, when known, included municipal point source and combined sewer overflow discharges, illicit sewer connections, and urban runoff/storm water.
- *Major Tributaries:* A portion of only one tributary, an 8.8 mile reach of the West River, was assessed as support for the *Primary* and *Secondary Contact Recreational* uses. The remaining 49.6 river miles (representing 85% of the 58.4 major tributary river miles) were not assessed for these uses.



BLACKSTONE RIVER BASIN PRIMARY AND SECONDARY CONTACT RECREATIONAL USE ASSESSMENT SUMMARY - RIVERS

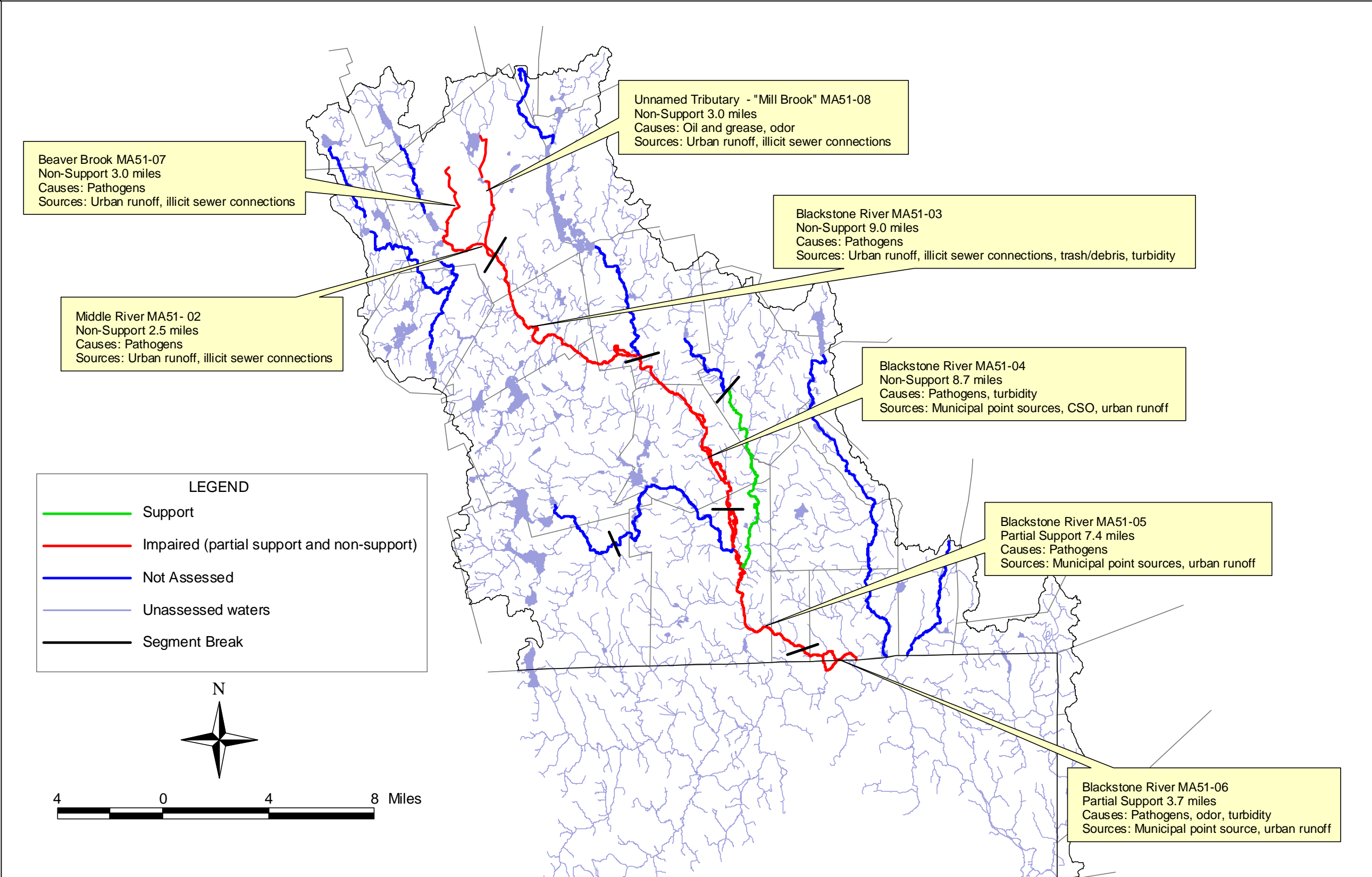


Figure 2. Blackstone River Basin Primary and Secondary Contact Recreational Use Assessment Summary - Rivers

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AESTHETICS USE - RIVERS

The *Aesthetics Use* is supported when surface waters are free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.

The status of the *Aesthetics Use* in the Blackstone River Basin is as follows:

<i>Aesthetics Use Summary – Rivers (miles)</i>			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
31	23.2	26.2	33.4

Approximately 27% of the river miles (portions of Kettle Brook, the Mumford, West and Mill rivers, and the entire length of Dark Brook) were assessed as supporting the *Aesthetics Use*. Forty-three percent of the assessed river miles in the Blackstone River Basin were impaired (partial or non-support) for this use, while 29% of the 113.8 river miles included in this report were not assessed. The assessment of the *Aesthetics Use* is as follows:

- *Headwaters:* A 3.5 mile reach of Kettle Brook and the entire length of Dark Brook (2.5 river miles) were assessed as support for the *Aesthetics Use*. The entire length of Beaver, Tatnuck and “Mill” brooks and the Middle River (12.6 river miles) and the lower 8.0 miles of Kettle Brook, representing approximately 77% of the river miles in the headwaters area, were impaired (partial or non-support. Impairment of the *Aesthetics Use* was a result of aesthetic degradation (trash/debris, turbidity, oil, grease and odors) from urban runoff/storm water and illicit sewer connections.
- *Blackstone River:* The entire 28.8 mile length of the mainstem Blackstone River in Massachusetts was assessed as either partial or non-support for the *Aesthetics Use* because of objectionable conditions (trash/debris, turbidity and odor). Sources, when known, included municipal point source and combined sewer overflow discharges, illicit sewer connections, and urban runoff/storm water.
- *Major Tributaries:* Portions of three tributaries, the Mumford, West, and Mill rivers, totaling 25 river miles were assessed as supporting the *Aesthetics Use*. The remaining 33.4 river miles (representing 57% of the 58.4 major tributary river miles) were not assessed for this use.

SUMMARY - RIVERS

In addition to specific issues for the individual river segments, the evaluation of current water quality conditions in the Blackstone River Basin has revealed the need for the following:

- Implement and track the progress of combined sewer overflow (CSO) abatement activities, identify other sources of bacteria and storm water contaminants (e.g., illicit sewer connections) and remediate problems,
- Reduce the impacts of storm water runoff in the Blackstone River Basin by
 - evaluating storm water management practices and pollution prevention plans,
 - enforcing compliance with storm water regulations (construction sites, highway operation and maintenance activities, Phase I and Phase II Communities of the National Pollutant Discharge Elimination System – NPDES Storm Water Program),
 - implementing Best Management Practices - BMPs (e.g., restoration of riparian vegetative buffers, erosion controls, etc.) with ensured operation and maintenance plans, and
 - educating the public

- Conduct bacteriological monitoring (use indicator organism specified in the Massachusetts Surface Water Quality Standards - SWQS) to assess the effectiveness of the CSO and storm water remediation projects as well as to assess the status of the *Primary* and *Secondary Contact Recreational* uses,
- Conduct stream cleanups and encourage/strengthen local stewardship,
- When the DEP Drinking Water Program SWAP evaluations are completed, review them, and develop and implement recommendations to protect the Class A rivers in the Blackstone River Basin.
- Continue to evaluate compliance with Water Management Act (WMA) registration and permit limits,
- Optimize water withdrawal and reservoir management practices to maintain minimum streamflow, and to the extent possible, natural flow regimes in the rivers,
- Collect additional data to determine the frequency, duration, and spatial extent of low flow conditions and assess habitat quality as it is related to streamflow,
- The following facilities should collect river water upstream of their discharges to use as dilution water in their whole effluent toxicity tests: Grafton WWTP, Northbridge WWTP, Uxbridge WWTF, Upton WWTF, Hopedale WWTP and the New England Plating Company. If the river water does not meet the control test acceptability criteria (i.e., survival > 80% at 7-day exposure), then it should be utilized in the whole effluent toxicity test as a site control but not used as the diluent,
- Toxicity Identification Evaluations and Toxicity Reduction Evaluations (TIE/TREs) should be conducted at facilities that either frequently and/or severely violate their whole effluent toxicity permit limits,
- Reissue the remaining municipal and industrial NPDES permits in the Blackstone River Basin with appropriate permit limits and monitoring requirements,
- Continue to implement remedial actions that will clean up contaminated groundwater, sediments, and soil in the Blackstone River Basin,
- In the next revision of the SWQS designate various rivers as Cold Water Fisheries (if supported by Division of Fisheries, Wildlife, and Environmental Law Enforcement - DFWELE), and
- Continue to support the US Army Corps of Engineers Aquatic Habitat Restoration Study ongoing in the Blackstone River Basin.

The municipal NPDES permits will address phosphorus loading to the watershed in an attempt to reduce nutrient loading to the Blackstone River (and ultimately to Narragansett Bay). The need to control phosphorus and nitrogen loads will be refined during the upcoming development of the TMDL, which will be the culmination of the decade long Blackstone River Project which began in the 1990s. The city of Worcester is developing a long-range control plan that addresses abatement of impacts related to CSOs. Implementation of the requirements of the city's storm water permit will also be incorporated into this plan. Additionally, several communities including Auburn, Blackstone, Grafton, Millbury, Millville, Northbridge, Shrewsbury, Sutton, and Uxbridge will be required to obtain Phase II storm water permits to reduce impacts of storm water to the river by the development of BMPs, elimination of cross-connections and significant public education.

BLACKSTONE RIVER BASIN - LAKES

Information on 138 of the 188 lakes (73%) in the Blackstone River Basin is presented in this report. These lakes represent approximately 95% (6,743.6 of 7,086.6 acres) of the basin's total lake acreage. In cases where the dam control structure was breached or aquatic plant density reduced ponds to channels and marshlands the designated uses were considered non-attainable due to the perennial 'loss' of pond acreage. DWM synoptic surveys in 1994 found this to be the case for six lakes (Forge, Mayo, Merrill No.6, Middle River, Thompson, Williams Street ponds) and portions of four lakes (City Farm Pond, Curtis Pond south basin, Rice City Pond and Sibley Reservoir) totaling 175 acres in the Blackstone River Basin. Therefore, the actual assessed lake-acreage is 6,568.6 acres (6,743.6 less 175 not attainable acres).

Lakes in the Blackstone River Basin represent all stages of succession, as described in terms of trophic status estimates (Table 1). Excessive plant growth in lakes (both rooted aquatics and algae) was the most frequently recorded cause of impairment for multiple uses (*Aquatic Life*, *Primary and Secondary Contact Recreation* and *Aesthetics*).

Table 1. Blackstone River Basin 1998 lake trophic status summary.

TROPHIC STATUS	NUMBER OF LAKES	ACRES
Oligotrophic	5	639.0
Mesotrophic	29	2,333.0
Eutrophic	78	2,791.6
Hypereutrophic	11	288.0
Undetermined*	9	517.0
Not Attainable	6 entire (and portions of 4)	175.0
Total	138	6,743.6

* It should be noted that some lakes or portions of lakes are listed as undetermined when indicators were not readily observable. With this approach, only the most obvious impairments are reported and so the assessment of lakes in the Blackstone River Basin is limited to a "best case" picture. Potentially more of the lake acreage would be listed as impaired, or in a more enriched trophic status, if more variables were measured and more criteria assessed.

AQUATIC LIFE USE – LAKES

The status of the *Aquatic Life Use* for the Blackstone River Basin lakes (acres) is as follows:

<i>Aquatic Life Use Summary – Lakes (acres)</i>			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
0	3,277.6	171.0	3,120.0

Four non-native aquatic plant species (Eurasian water milfoil, variable milfoil, bushy pondweed, and fanwort) were found in lakes in the Blackstone River Basin. These plants are particularly invasive species and reproduce vegetatively; so they may spread readily on downstream currents or between lakes by mechanical transport. Based on the presence of these non-native aquatic species, 53 lakes were assessed as partial or non-support for the *Aquatic Life Use*. Approximately half of the lake-acreage was not assessed for this use.

FISH CONSUMPTION USE – LAKES

The status of the *Fish Consumption Use* for the Blackstone River Basin lakes is as follows:

<i>Fish Consumption Use Summary – Lakes (acres)</i>			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
0	0	94.0	6,474.6

Because of health concerns associated with exposure to mercury, DPH issued a fish consumption advisory for Waite Pond in Leicester (MA DPH 1999). DPH issued fish consumption advisories because of PCB contamination for Riverdale Pond in Northbridge, Rice City Pond in Uxbridge/Northbridge (impoundments of the Blackstone River) and Spindleville Pond in Hopedale (an impoundment of the Mill River) (MA DPH 1999). Because of these advisories, the *Fish Consumption Use* was assessed as non-support for 94 of the 6,568.6 lake-acres in the Blackstone River Basin. The remaining acreage was not assessed because of DPH's statewide interim advisory for mercury (see *Fish Consumption Use – Rivers*) that encompasses all freshwater in Massachusetts.

DRINKING WATER USE – LAKES

The *Drinking Water Use* has been used to indicate sources of public drinking water. 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. These waters are subject to stringent regulation in accordance with the Massachusetts Drinking Water Regulations. The DWP has primacy for implementing the provisions of the federal Safe Drinking Water Act. DWP has also initiated work on SWAP which requires that the state delineate protection areas for all public ground and surface water sources; inventory land uses in these areas that may present potential threats to drinking water quality; determine the susceptibility of water supplies to contamination from these sources; and publicize the results. Except for Suppliers with surface water sources for which a waiver from filtration has been granted (these systems also monitor surface water quality) public water suppliers monitor their finished water (tap water) for major categories of contaminants (e.g., bacteria, volatile and synthetic organic compounds, inorganic compounds, etc.) and report their data to DWP.

PRIMARY CONTACT RECREATIONAL USE - LAKES

The status of *Primary Contact Recreational Use* in the Blackstone River Basin lakes is as follows:

Primary Contact Recreational Use Summary – Lakes (acres)			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
0	490.0	1,322.0	4,756.6

None of the lakes in the Blackstone River Basin were assessed as support for the *Primary Contact Recreational Use* while all or portions of 83 lakes (1,812 acres) were impaired (partial or non-support) for this use. Because of the focus of the surveys conducted (macrophyte cover, transparency and biocommunity modifications), the major causes of impairment included noxious/overabundant plant growth (both native and non-native vegetation), taste/odor/color, and/or objectionable turbidity. This use was not assessed for the majority (72%) of the lake-acreage in the Blackstone River Basin.

SECONDARY CONTACT RECREATIONAL AND AESTHETICS USES – LAKES

The status of *Secondary Contact Recreational* and *Aesthetics* uses in the Blackstone River Basin lakes is as follows:

Secondary Contact Recreational and Aesthetics use Summary – Lakes (acres)			
SUPPORT	PARTIAL SUPPORT	NON-SUPPORT	NOT ASSESSED
2,560.0	490.0	1,322.0	2,196.6

The *Secondary Contact Recreational* and *Aesthetics* uses were assessed as support in all or portions of 38 lakes (2,560 acres). These uses were impaired (partial or non-support), however, in all or portions of 83 lakes (1,812 acres). Because of the focus of the surveys conducted (macrophyte cover, transparency and biocommunity modifications), the major causes of impairment included noxious/overabundant plant growth (both native and non-native vegetation), taste/odor/color, and/or objectionable turbidity. Approximately one-third of the lake-acreage in the Blackstone River Basin was not assessed for the *Secondary Contact Recreational* and *Aesthetics* uses.

SUMMARY - LAKES

Potentially more of the lake acreage would be listed as impaired or in a more enriched trophic status if additional variables were measured and more criteria assessed. In the Blackstone River Basin there is a need to:

- conduct monitoring for fecal coliform bacteria and Secchi disk depth to assess the *Primary Contact Recreational Use*,
- conduct monitoring for water chemistry data including dissolved oxygen and temperature profiles, total phosphorus and chlorophyll *a* to assess the *Aquatic Life Use*,
- monitor/control the spread and growth of non-native aquatic and wetland vegetation,
- implement recommendations identified in the TMDLs and lake Diagnostic/Feasibility studies, including lake watershed surveys to identify sources of impairment, and
- review the DEP Drinking Water Program SWAP evaluations are when they are completed to develop and implement recommendations for the protection of Class A lakes in the Blackstone River Basin .including Holden Reservoirs #1 and 2, Kettle Brook Reservoirs #1-4, Lynde Brook Reservoir, Miscoe and Wallum lakes, and Southwick Pond.

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