31-AC-2

FARMINGTON RIVER WATERSHED

WATER QUALITY ASSESSMENT REPORT

West Branch Farmington River, Otis

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
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FARMINGTON RIVER WATERSHED

2001 WATER QUALITY ASSESSMENT REPORT

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Report Number:

31-AC-2

DWM Control Number:

CN 091.0

Massachusetts Department of Environmental Protection
Division of Watershed Management
Worcester, Massachusetts

January 2005

ACKNOWLEDGEMENTS

Coordination of local, state and federal agencies and private organizations is fundamental to the success of the Massachusetts Watershed Initiative.

Data and information used in this report was provided in part by the following agencies and organizations.

State
- MA Department of Environmental Protection (MA DEP):
  - Bureau of Strategic Policy and Technology, Wall Experiment Station (WES)
  - Bureau of Resource Protection (BRP)
  - Bureau of Waste Prevention (BWP)
  - Bureau of Waste Site Cleanup (BWSC)
- MA Department of Public Health (MDPH)
- MA Department of Fish and Game (DFG)
  (formerly the MA Department of Fisheries, Wildlife, and Environmental Law Enforcement - MDFW)
  - Division of Fisheries and Wildlife (DFW)
- MA Department of Conservation and Recreation (DCR)
  (formerly the MA Department of Environmental Management - MA DEM)

Federal
- United States Environmental Protection Agency (EPA)
- United States Geological Survey (USGS)
  - Water Resources Division

Regional
- Berkshire Regional Planning Commission (BRPC)
- Pioneer Valley Planning Commission (PVPC)

Other
- ENSR, Inc. (private consultant)

Much appreciation is also extended to several MA DEP employees for their contributions: Richard Chase, Susan Connors, Ken Dominick, Laurie Kennedy, Richard S. McVoy, PhD., Jane Ryder, and Arthur Screpetis.

It is impossible to thank everyone who contributed to the assessment report process. Field sampling, laboratory analysis, data management, writing, editing, and graphics preparation, meeting participation, phone calling, and e-mailing were all a part of its completion. All who contributed to these efforts are very much appreciated.

Cover photo credit: P. Mitchell, MA DEP, Division of Watershed Management

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cfs	cubic feet per second
cfu	colony forming unit
ft^3	cubic feet
gpm	gallons per minute
km	kilometers
km^2	square kilometers
KW	kilowatts
m	meters
MGD	million gallons per day
MGY	million gallons per year
mi^2	square miles
µg/kg	microgram per kilogram
µS/cm	microsiemans per centimeter
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
msl	mean sea level
ng	nanograms
NTU	nephelometric turbidity units
ppb	parts per billion
ppm	parts per million
SU	standard units
TEQ/kg	toxic equivalents per kilogram

LIST OF ACRONYMS

7Q10.....seven day, ten year low flow
ACEC .....Area of Critical Environmental Concern
ACOE .....Army Corps of Engineers (United States)
ADB .....assessment database
BMP.....best management practice
BPJ.....best professional judgment
BRP .....Bureau of Resource Protection
BRPC .....Berkshire Regional Planning Commission
CMR .....Code of Massachusetts Regulations
CNOEC .....chronic no observed effect concentration
CT DEP .....Connecticut Department of Environmental Protection
CVP .....certified vernal pool
CWA..... Clean Water Act
CWF .....cold water fishery
DCR.....Department of Conservation and Recreation
DDT..... dichlorodiphenyltrichloroethane
DDD.....dichlorodiphenyldichloroethane
DDE.....dichlorodiphenyldichloroethylene
DFG.....Department of Fish and Game
DFW .....Division of Fisheries and Wildlife
DMF ..... Division of Marine Fisheries
DMR .....discharge monitoring report
DO .....dissolved oxygen
DPW .....Department of Public Works (municipal)
DRC.....Department of Resource Conservation
DWM .....Division of Watershed Management
DWP .....Drinking Water Program
E .....endangered
EOEA .....Executive Office of Environmental Affairs
EPA .....United States Environmental Protection Agency
EPH.....extractable petroleum hydrocarbons
EPT .....Ephemeroptera, Plecoptera, and Trichoptera
FERC .....Federal Energy Regulatory Commission
FPOM.....fine particulate organic matter
GEIR.....generic environmental impact report
GIS .....Geographic Information System
LC_{50} .....lethal concentration to 50% of the test organisms
L-EL.....low effect level
MA DEM.....Massachusetts Department of Environmental Management (now the MA Department of Conservation and Recreation)
MA DEP .....Massachusetts Department of Environmental Protection
MDFW .....Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement (now the MA Department of Fish and Game)
MDPH.....Massachusetts Department of Public Health
MA NHESP ....Massachusetts Natural Heritage and Endangered Species Program
MassGIS .....Massachusetts Geographic Information System
MBTE .....Methyl Tertiary-Butyl Ether
MCL.....Maximum Contaminant Level
MDL.....Minimum Detection Limit
MPN .....Most Probable Number
NAS/NAE ..... National Academy of Sciences/National Academy of Engineers
NAWQA.....National Water-Quality Assessment
N-EL..... no effect level
NPDES.....National Pollutant Discharge Elimination System
NPS .....nonpoint source pollution
ORW .....Outstanding Resource Water
PAH.....polyaromatic hydrocarbons
PALIS .....Pond and Lake Information System
PCB .....polychlorinated biphenyls
QA/QC.....quality assurance/ quality control
PWS .....public water supply
RBP .....rapid bioassessment protocol
SARIS .....Stream and River Inventory System
SC .....special concern
SDWA .....Safe Drinking Water Act
S-EL .....severe effect level
SWAP.....Surface Water Assessment Program
SWPPP .....Stormwater pollution prevention plan
SWQS .....Surface Water Quality Standards
T .....threatened
TKN .....total Kjeldahl nitrogen
TMDL .....total maximum daily load
TNTC.....too numerous to count
TOXTD .....DEP/DWM Toxicity Testing Database
TOC.....total organic carbon
TP.....total phosphorus
TPH .....total petroleum hydrocarbons
TRC.....total residual chlorine
USGS .....United States Geological Survey
WBID.....waterbody identification code
WBS .....waterbody system database
WERO.....Western Regional Office (MA DEP)
WES .....Wall Experiment Station
WMA .....Water Management Act
WPCF.....water pollution control facility
WQC .....water quality criteria
WTF.....water treatment facility
WWTF.....wastewater treatment facility
WWTP.....wastewater treatment plant

EXECUTIVE SUMMARY
FARMINGTON RIVER WATERSHED
2001 WATER QUALITY ASSESSMENT REPORT

The Massachusetts Surface Water Quality Standards (SWQS) designate the most sensitive uses for which surface waters in the Commonwealth shall be protected. 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 supported, impaired, or not assessed, as well as basic information needed to focus resource protection and remediation activities later in the watershed management planning process.

This assessment report presents a summary of current water quality data/information in the Farmington River Watershed used to assess the status of the designated uses as defined in the SWQS. It should be noted that water chemistry data from 1996/97 surveys were used to help assess the *Aquatic Life Use* for the West Branch Farmington River even though the data from these surveys was more than 5 years old. This exception was made due to the sampling frequency and the fact that land use changes in the watershed have been slight. The designated uses, where applicable, include: *Aquatic Life, Fish Consumption, Drinking Water, Primary* and *Secondary Contact Recreation* and *Aesthetics*. Each use, within a given segment, is individually assessed as ***support*** or ***impaired***. When too little current data/information exists or no reliable data are available the use is ***not assessed***. However, if there is some indication of water quality impairment, which is not "naturally occurring", the use is identified with an "Alert Status". It is important to note that not all waters are assessed. Many small and/or unnamed rivers and lakes are currently ***unassessed***; the status of their designated uses has never been reported to the EPA in the Commonwealth's Summary of Water Quality Report (305(b) Report) nor is information on these waters maintained in the Assessment Database (ADB).

The Farmington River watershed drains a total area of 602 square miles in Massachusetts and Connecticut. Only 156 square miles, or about 25% of the total watershed, is located in Massachusetts and this part lies between the Housatonic and Westfield River Watersheds. A major portion of the Massachusetts section of the watershed drains the West Branch of the Farmington River and its tributaries. Originating in Becket in the southern Berkshire Mountains of southwestern Massachusetts, the West Branch of the Farmington River runs for 18 miles before entering northwestern Connecticut. Just over the border in Connecticut it is impounded to form Colebrook Reservoir, a back-up drinking water supply for the City of Hartford. The remaining eastern-most Farmington River subwatersheds in Massachusetts drain to form Pond, Hubbard, and Valley Brooks, which converge to form the East Branch of the Farmington River just below the state line in Connecticut. The East Branch is impounded in Connecticut to form Barkhamsted Reservoir and Lake McDonough. Barkhamsted Reservoir is the primary drinking water supply for the Greater Hartford area. In Connecticut, the Farmington flows for over 60 miles before joining the Connecticut River in Windsor.

In Massachusetts the Farmington River watershed is predominately undeveloped and rural, encompassing major portions of the towns of Becket, Otis, Sandisfield, Tolland, and Granville. Small areas of the watershed also reach into the towns of Southwick, Blandford, Tyringham, Monterey, and New Marlborough. Over 85% of the watershed in Massachusetts is forested, providing timber resources for related industries for over two centuries. Approximately 31% of the watershed area is characterized as having greater than 25% slope, a factor that has likely shaped its development patterns. Population density ranges from 32 persons per square mile in Becket to 9 persons per square mile in Tolland and is mostly aggregated around village centers.

There are a total of 41 named rivers, streams, brooks or creeks (the term "rivers" will hereafter be used to include all) stretching over 116 miles (Halliwell *et al*. 1982) within the Massachusetts portion of the Farmington River Watershed. There are 13 named rivers (59.0 miles), representing 51% of the total named river miles in the Massachusetts portion of the Farmington River Watershed, assessed in this report. These include: West Branch Farmington River, Shales Brook, Thomas Brook, Cone Brook, Dimmock Brook, Benton Brook, Fall River, Clam River, Buck River, Silver Brook, Sandy Brook, Valley Brook, and Hubbard Brook. In addition there are three unnamed tributaries representing 4.2 more river miles assessed in the report. The remaining rivers are small and/or unnamed and currently unassessed.

This report also presents information on 18 of the 48 named lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) in the Farmington River Watershed. The 18 lakes listed in this report represent approximately 75% of the total lake acreage in the Massachusetts portion of the watershed (2,135 of the 2,840 acres) (Ackerman 1989).

AQUATIC LIFE USE

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

Aquatic Life Use Summary – Rivers (Figure 1)

As illustrated in Figure 1, 87% of the river miles in the Farmington River Watershed included in this report were assessed (either as support or impaired) for the *Aquatic Life Use*. A total of 38.9 river miles, representing eight tributaries in the Farmington River Watershed are assessed as supporting the *Aquatic Life Use*. The *Aquatic Life Use* is assessed as impaired in the 16.1mile stretch of the West Branch Farmington River in Massachusetts. This impairment represents 25% of the river miles included in this report. The suspected cause of impairment is due to elevated water temperatures during the summer months that exceeded the cold water fishery standard (20°C). The effect of high temperatures was corroborated by fish population information that documented the absence of any species of cold water fish. The remaining four named rivers and three unnamed tributaries in this report, totaling 8.2 miles (13% of the river miles in the watershed), are currently not assessed for the *Aquatic Life Use*.

FARMINGTON RIVER WATERSHED
***Aquatic Life Use* assessment for rivers**
(Total length assessed in report is 63.2 miles.)

- **Support – 38.9 miles (62%)**
- **Impaired – 16.1 miles (25%)**
- **Not Assessed – 8.2 miles (13%)**

***Aquatic Life Use* assessment for lakes**
(Total area assessed in report is 2,135 acres.)

- **Support – 989 acres (46%)**
- **Impaired – 307 acres (14%)**
- **Not Assessed – 839 acres (39%)**

Aquatic Life Use Summary – Lakes (Figure 1)

Four out of the 18 lakes that were assessed in the Farmington River Watershed have been surveyed for variables used to assess the status of the *Aquatic Life Use* (i.e., DO, pH, nutrients, macrophytes and plankton/chlorophyll *a*) (Figure 1). Only Otis Reservoir, totaling 989 acres, was assessed as supporting the *Aquatic Life Use*. The three other assessed lakes, totaling 307 acres, were impaired for *Aquatic Life Use* because of the presence of non-native aquatic vegetation. This impairment represents 14% of the lake acreage assessed in this report. The remaining 14 lakes are currently not assessed for the *Aquatic Life Use*.

FISH CONSUMPTION USE

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

> The MDPH “is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MDPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age (MDPH 2001).” Additionally, MDPH “is recommending that

pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MDPH 2001)." MDPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

Fish Consumption Use Summary - Rivers (Figure 2)

No site-specific fish consumption advisories exist for river segments in the Farmington River Watershed. Therefore, all river segments default to Not Assessed for the *Fish Consumption Use* because of the statewide advisory.

FARMINGTON RIVER WATERSHED
***Fish Consumption Use* assessment for rivers**
(Total length assessed in report is 63.2 miles.)
- **Not Assessed – 63.2 miles (100%)**

***Fish Consumption Use* assessment for lakes**
(Total area assessed in report is 2,135 acres.)
- **Impaired – 1,314 acres (62%)**
- **Not Assessed – 821 acres (38%)**

Fish Consumption Use Summary – Lakes (Figure 2)

Because of health concerns associated with exposure to mercury MDPH issued fish consumption advisories for Otis Reservoir and Big Pond (MDPH 1994, 2004). The advisories recommend the following.

For Otis Reservoir -

1. "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body.
2. The general public should limit consumption of all fish from this waterbody to two meals per month."

For Big Pond -

1. "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body.
2. The general public should not consume largemouth bass from this waterbody.
3. The general public should limit consumption of all fish from this waterbody to two meals per month. "

Therefore, the *Fish Consumption Use* is impaired for Otis Reservoir (989 acres) and Big Pond (325acres) (representing 62% of the lake acreage assessed in the Farmington River Watershed). The remaining 16 lakes representing 821 acres or 38% of the lake acreage, default to Not Assessed for the *Fish Consumption Use* because of the statewide advisory. Sources of mercury in this area are currently unknown, although atmospheric deposition is suspected.

DRINKING WATER USE

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

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

PRIMARY AND SECONDARY CONTACT RECREATIONAL USES

The *Primary Contact Recreational Use* is supported when conditions are suitable (fecal coliform bacteria densities, turbidity and aesthetics meet the SWQS) for any recreational or other water-related activity during which there is prolonged and intimate contact with the water and there exists a significant risk of ingestion. Activities include, but are not limited to, wading, swimming, diving, surfing and water skiing. The *Secondary Contact Recreational Use* is supported when conditions are suitable for any recreational or other water use during which contact with the water is either incidental or accidental. These include, but are not limited to, fishing, boating and limited contact related to shoreline activities. For lakes, macrophyte cover and/or transparency data (Secchi disk depth) are also evaluated to assess the status of the recreational uses.

Primary and Secondary Contact Recreational Uses Summary – Rivers (Figure 3)

Only the West Branch Farmington River is assessed as support for the *Primary and Secondary Contact Recreational uses*. Due to a lack of current bacteria data the remaining 47.1 river miles were not assessed for either the *Primary* or *Secondary Contact Recreational uses*.

FARMINGTON RIVER WATERSHED
***Primary and Secondary Contact Recreational Use* assessment for rivers**
(Total length assessed in report is 63.2 miles.)
- **Support – 16.1 miles (25%)**
- **Not Assessed – 47.1 miles (75%)**

***Primary and Secondary Contact Recreational Use* assessments for lakes**
(Total area assessed in report is 2,135 acres.)
- **Support – 1,018 acres (48%)**
- **Not Assessed – 1,117 acres (52%)**

Primary and Secondary Contact Recreational Uses Summary – Lakes (Figure 3)

Two lakes (Otis Reservoir, Otis/Tolland/Blandford and York Lake, New Marlborough) totaling 1,018 acres were assessed as supporting both the *Primary and Secondary Contact Recreational uses*. Due to a lack of current bacteria data the remaining 1,117 acres (representing 52% of the assessed lake acreage from 16 lakes) were not assessed in the Farmington River Watershed.

AESTHETICS USE

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.

Aesthetics Use Summary – Rivers (Figure 4)

Nine river segments in the Farmington River Watershed (55.0 miles representing 87% of the assessed river miles) support the *Aesthetics Use*. The remaining seven segments (totaling 8.2 miles and representing 13% of the assessed river miles) were not assessed.

FARMINGTON RIVER WATERSHED
***Aesthetics Use* assessment for rivers**
(Total length assessed in report is 63.2 miles.)
- **Support – 55.0 miles (87%)**
- **Not Assessed – 8.2 miles (13%)**

***Aesthetics Use* assessments for lakes**
(Total area assessed in report is 2,135 acres.)
- **Support – 1,018 acres (48%)**
- **Not Assessed – 1,117 acres (52%)**

Aesthetics Use Summary – Lakes (Figure 4)

Two lakes (Otis Reservoir, Otis/Tolland/Blandford and York Lake, New Marlborough) totaling 1,018 acres were assessed as supporting the *Aesthetics Use*. The remaining 1,177 acres (representing 52% of the assessed lake acreage from 16 lakes) were not assessed for the *Aesthetics Use* in the Farmington River Watershed due to a lack of current information.

RECOMMENDATIONS

In addition to specific actions identified for each individual segment, this assessment report has revealed the need for the following actions to be taken in the Farmington River Watershed to protect, restore and/or improve water quality conditions.

- DWM should continue to periodically conduct surface water, biological, and habitat quality sampling in the Farmington River Watershed to assess the status of the designated uses *(Aquatic Life, Fish Consumption, Primary and Secondary Contact Recreation,* and *Aesthetics)*.
- DWM should continue to conduct biological and water quality monitoring to evaluate the effect(s), if any, of nonpoint sources of pollution, water withdrawals, and flow regulation and to document any changes in water quality conditions as a result of infrastructure improvements and/or implementation of nonpoint source best management practices.
- Although none of the communities in the Farmington River Watershed are currently regulated as operators of small municipal separate storm sewer systems under the EPA Storm Water Phase II NPDES permit, it is recommended that municipalities in the watershed proactively develop and implement appropriate stormwater management BMPs to protect water quality.
- Recommendations for long-term restoration/preservation that are contained in the Otis Reservoir diagnostic/feasibility study (ENSR 2001) should be reviewed and steps taken to implement them.
- A total maximum daily load (TMDL) analysis should be conducted by MA DEP on the Farmington lakes in Category 5 of the Integrated List of Impaired Waters.
- The Berkshire Regional Planning Commission (BRPC) prepared a Farmington River Watershed Action Plan – A Comprehensive Management Plan to Address Nonpoint Source Pollution in 1997 funded with a 604(b) Water Quality Management Planning grant. This project inventoried physical characteristics and natural features, identified existing and potential nonpoint source pollution problems, and developed a watershed action plan and management strategy to address remediation of existing nonpoint source pollution problems and prevention of potential future nonpoint source pollution. In general, towns and local groups in the watershed should review and implement the recommendations of the watershed action plan, as appropriate. In particular, specific recommendations focused on the following water quality concerns.
    - Above ground and underground storage tanks and accompanying filling and disposal pipes and hoses were identified as threats to water quality in the Farmington Watershed by BRPC (1997). Watershed towns should review the recommendations regarding storage tanks in the BRPC 604(b) report and take steps to implement them.
    - Most of the homes in the watershed rely on septic systems for wastewater disposal. Inadequately designed or failed septic systems or homes without approved systems pose a serious threat to water quality in the watershed. Some of these homes are located on small lots very close to surface water resources. Efforts should be made, therefore, to ensure that on-site systems are properly sited, maintained and inspected. Town by town recommendations outlined in the BRPC Watershed Action Plan should be reviewed and implemented, as appropriate.
    - Leachate from landfills was identified as a potential source of contamination to surface and groundwater in the Farmington Watershed by BRPC (1997). A comprehensive identification and evaluation of existing and historic landfills and undocumented disposal sites should be conducted in the watershed to assess the potential risks of contamination from these areas to sensitive receptors and/or environmental resources.
    - The storage, handling, and spreading of road salt and snow dumping practices was identified as one of the most important nonpoint source pollution problems in the Farmington River Watershed by local residents and the Farmington Watershed Team. The Watershed Team had been working with local and state highway departments to address this concern and these efforts should be continued among interested local, regional, and state groups to resolve the problem. Water quality and biological sampling should be performed in the West Branch Farmington River to continue to assess the impact of ongoing and/or changing road salting practices and to evaluate the effectiveness of BMPs that may be implemented.
    - There is a large amount of forested land in the watershed that could be logged. In the mid-90's MA DEM reported an average of about 20 forest cutting plans filed yearly covering approximately 1,400 acres (BRPC 1997). Efforts to conduct ongoing outreach to landowners and loggers to encourage implementation of forestry BMPs should be supported.

- As part of the Water Management Act (WMA) 5-year review process MA DEP should continue to evaluate compliance with registration and/or permit limits for withdrawals in the Farmington River Watershed. Work with water suppliers to encourage the development and implementation of local watershed and wellhead protection plans.
- The Farmington River Watershed is made up of rural communities whose natural resources are an important part of their character and livelihood. Without a current Open Space Plan towns may not be ready to act if important parcels become available for protection and would not be eligible for state assistance through the Self-help Program. Towns should seek funding and assistance to develop or update their municipal open space plans to protect important natural resources, recreational areas, wildlife habitat, and the aesthetic quality of the watershed.
- In order to preserve the watershed and prevent degradation of water quality it is recommended that land use planning techniques be applied to direct development to desired zones, preserve sensitive areas, and maintain or reduce the impervious cover. Communities should review the information generated through the buildout analysis performed by EOEA that created a profile of how the community would look at full buildout according to its current zoning (EOEA 2000-2001) as well as follow the recommendations to protect priority and/or sensitive water resources described in their individual town open space plans, if one exists.
- According to the Massachusetts Natural Heritage and Endangered Species Program there are approximately 89 potential in the Farmington River Watershed. Currently, only one of these pools has been officially certified (MA NHESP 2003a). These pools should be prioritized for nonpoint source protection measures and to pursue a course of certification to obtain further protection under the Wetlands Protection Act.
- Efforts should continue to document and describe the natural or man-made barriers to migration of fish and wildlife in tributaries of the Farmington River similar to the road-stream crossing inventory work done by the University of Massachusetts with volunteers in the Deerfield, Millers and Connecticut watersheds. Information can be used to help determine if crossings are a barrier to fish and wildlife movement, and cause habitat fragmentation. Barriers that are identified can be prioritized for removal or reconstruction to improve passage.
- Encourage the use of riparian buffers to protect water and habitat quality.
- To help curb illegal dumping in the watershed consideration should be given to offering educational programs to inform residents of the negative effects of illegal solid waste dumping on the environment and to encourage towns to offer incentives to residents to properly dispose of household items and building materials.
- Monitor and control the spread and growth of non-native, invasive aquatic and wetland vegetation. Determine the effectiveness of various control options on the non-native plant growth. Prevent the spread of these plants to unaffected areas by alerting lake-users and landowners to the problem and the responsibility of controlling the spread of these species.
- Support the efforts of the Massachusetts Division of Fisheries and Wildlife, Riverways Program to organize and direct stream teams in subwatersheds of the Farmington River in order to document and address local non-point source problems affecting water quality.
- Support efforts of citizen groups, such as the Farmington River Watershed Association, to build watershed awareness, foster watershed stewardship, and increase the number of volunteers active in watershed education and protection projects, such as river cleanups and volunteer water quality monitoring. Encourage the formation of a Massachusetts section of the Farmington River Watershed Association or a similar local group to represent Massachusetts residents' issues and environmental goals for the watershed.
- Continue efforts to resolve the differences between Massachusetts and Connecticut water quality standards in the Farmington River watershed. The Massachusetts portion of the Farmington River watershed is classified as Class B. Because the Farmington River serves as a water supply for Connecticut there is concern by the Connecticut Department of Environmental Protection that Massachusetts should classify these waters under the more protective Class A, reserved for drinking water supplies in Massachusetts. Connecticut wants some assurances that the sources of their drinking water in Massachusetts will be protected at a level comparable to what is required in Connecticut.

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FIGURE 1: FARMINGTON RIVER WATERSHED
AQUATIC LIFE USE ASSESSMENT SUMMARY – RIVERS AND LAKES

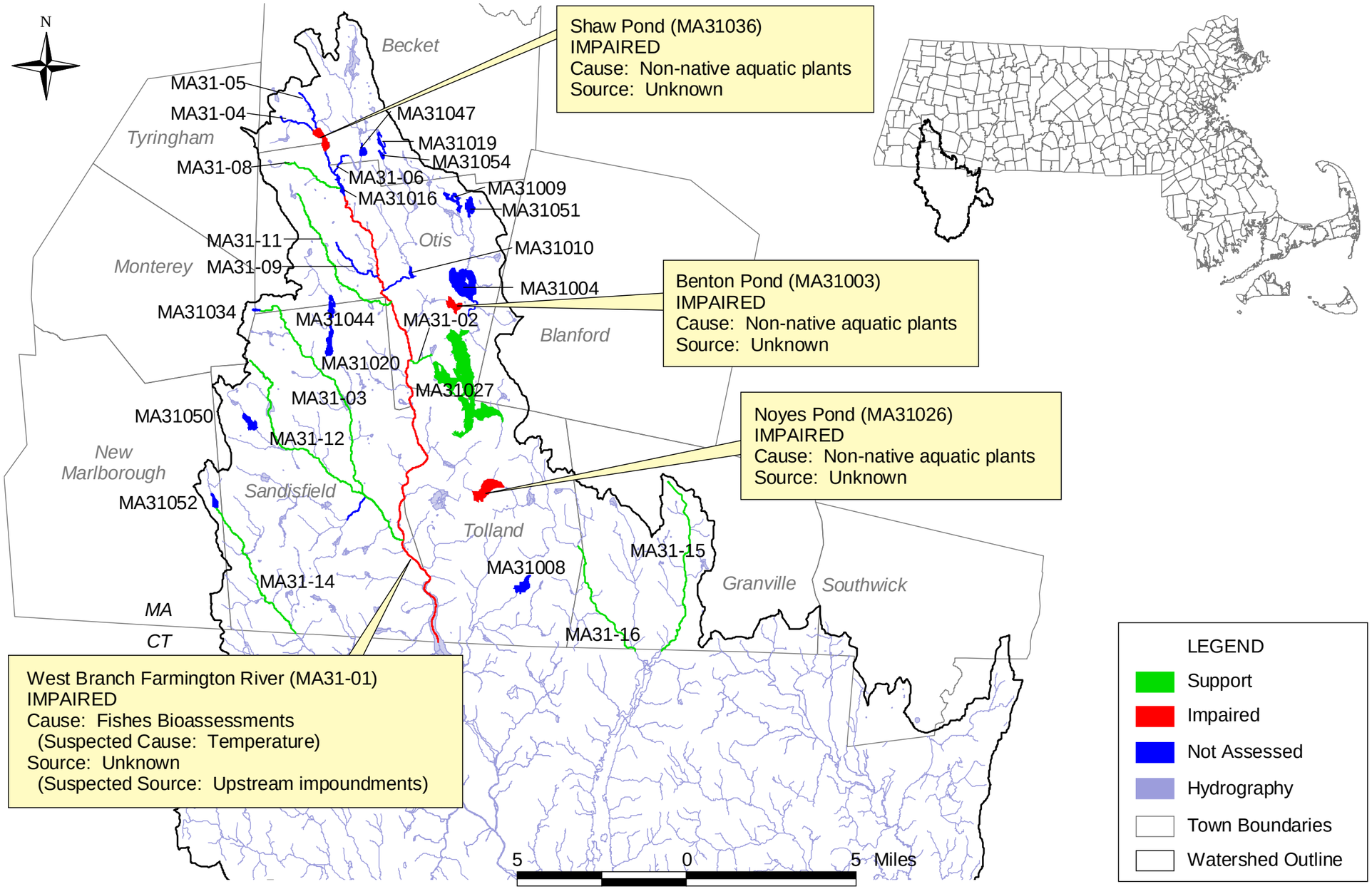

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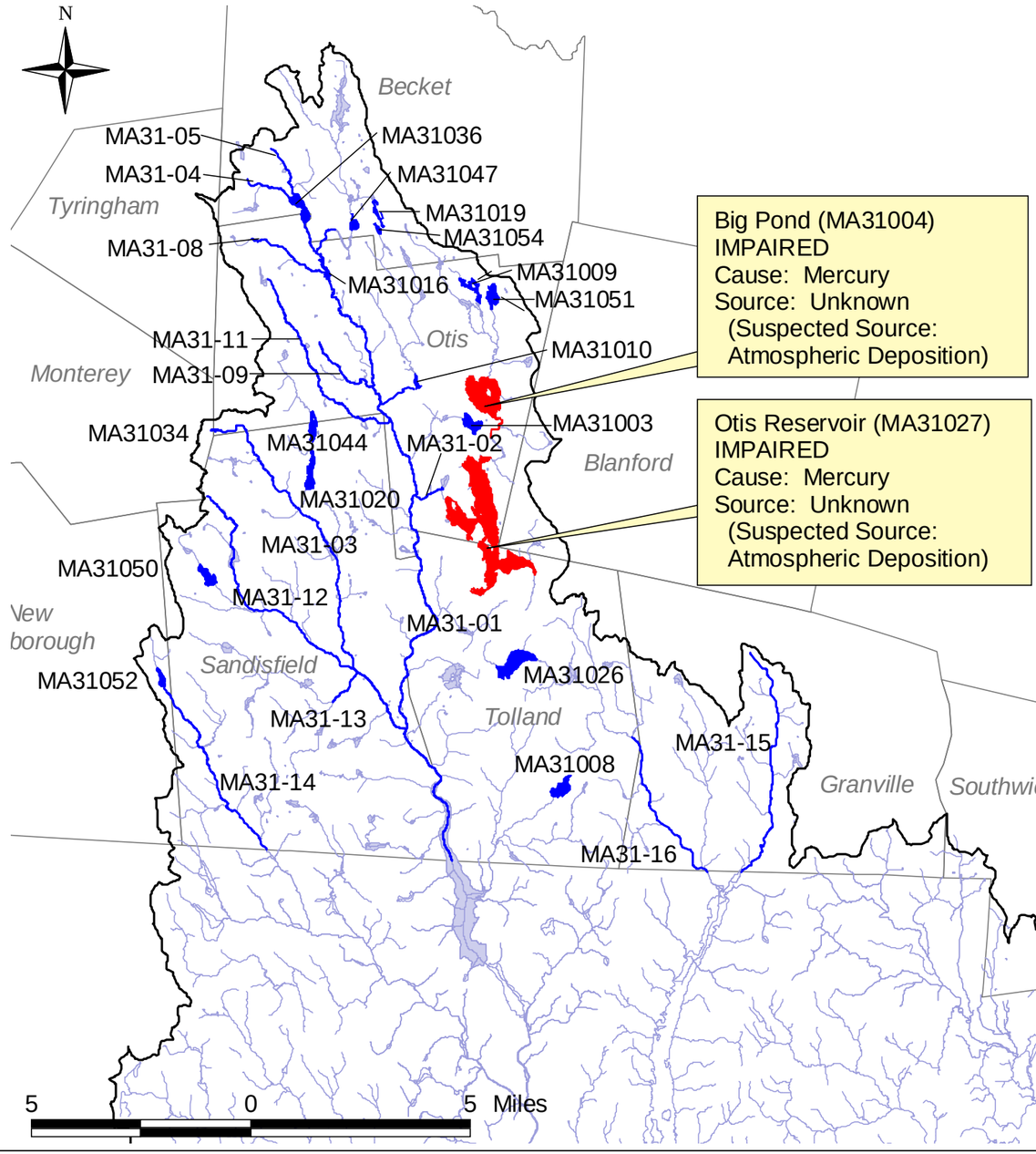
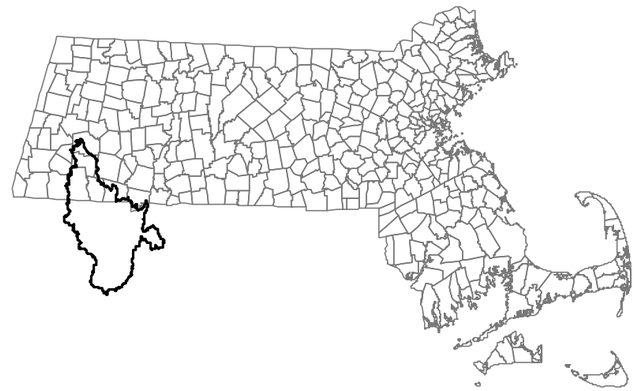
FIGURE 2: FARMINGTON RIVER WATERSHED
FISH CONSUMPTION USE ASSESSMENT SUMMARY – RIVERS AND LAKES



Big Pond (MA31004)
IMPAIRED
Cause: Mercury
Source: Unknown
(Suspected Source: Atmospheric Deposition)

Otis Reservoir (MA31027)
IMPAIRED
Cause: Mercury
Source: Unknown
(Suspected Source: Atmospheric Deposition)



The current MA DPH statewide advisory (MA DPH 2004):
The MA DPH "is advising pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age to refrain from eating the following marine fish; shark, swordfish, king mackerel, tuna steak and tilefish. In addition, MA DPH is expanding its previously issued statewide fish consumption advisory which cautioned pregnant women to avoid eating fish from all freshwater bodies due to concerns about mercury contamination, to now include women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age." Additionally, MA DPH "is recommending that pregnant women, women of childbearing age who may become pregnant, nursing mothers and children under 12 years of age limit their consumption of fish not covered by existing advisories to no more than 12 ounces (or about 2 meals) of cooked or uncooked fish per week. This recommendation includes canned tuna, the consumption of which should be limited to 2 cans per week. Very small children, including toddlers, should eat less. Consumers may wish to choose to eat light tuna rather than white or chunk white tuna, the latter of which may have higher levels of mercury (MA DPH 2001)." MA DPH's statewide advisory does not include fish stocked by the state Division of Fisheries and Wildlife or farm-raised fish sold commercially.

LEGEND
- Support
- Impaired
- Not Assessed
- Hydrography
- Town Boundaries
- Watershed Outline

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FIGURE 3: FARMINGTON RIVER WATERSHED
PRIMARY AND SECONDARY CONTACT RECREATIONAL USE ASSESSMENT SUMMARY
RIVERS AND LAKES

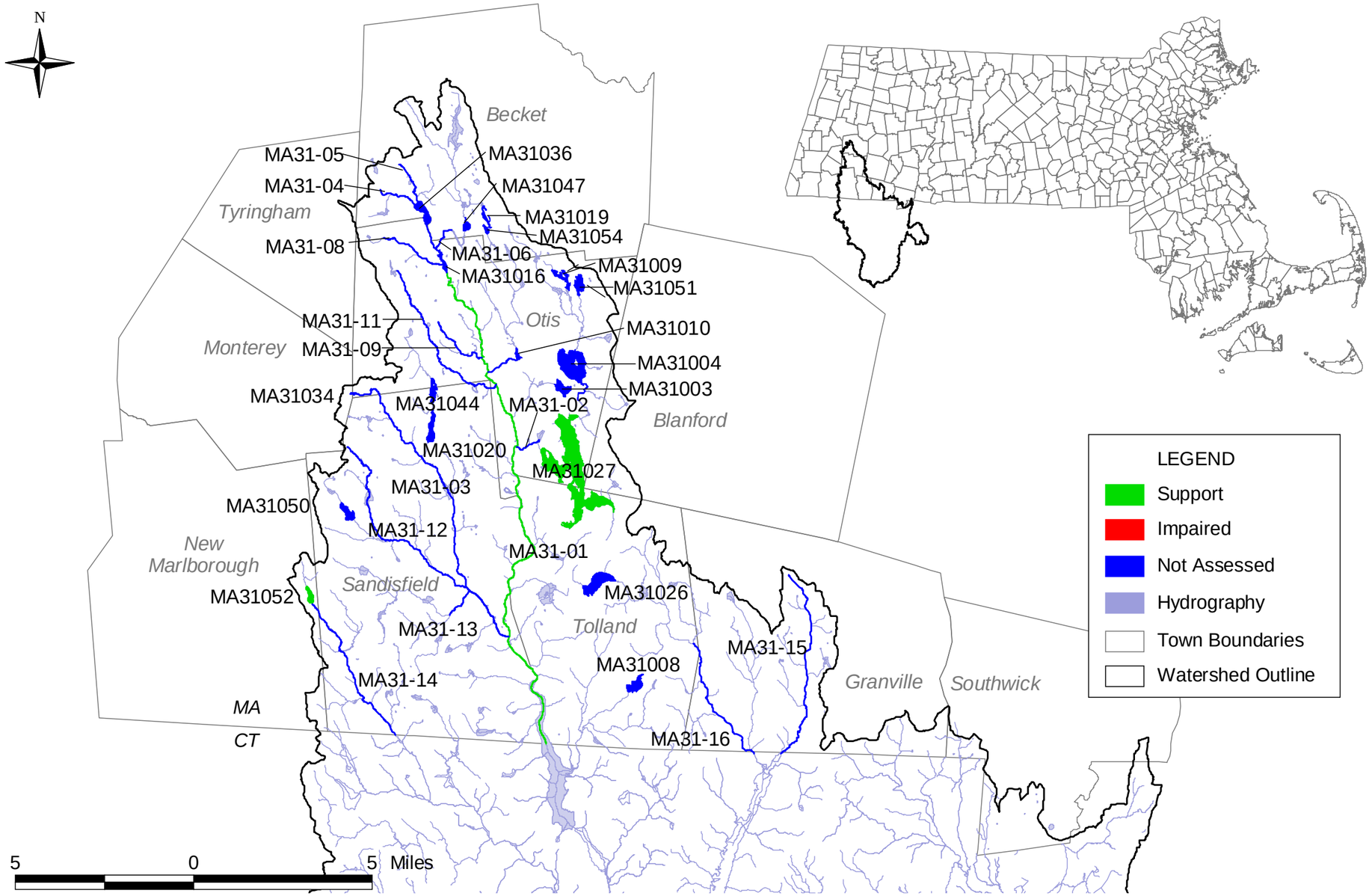

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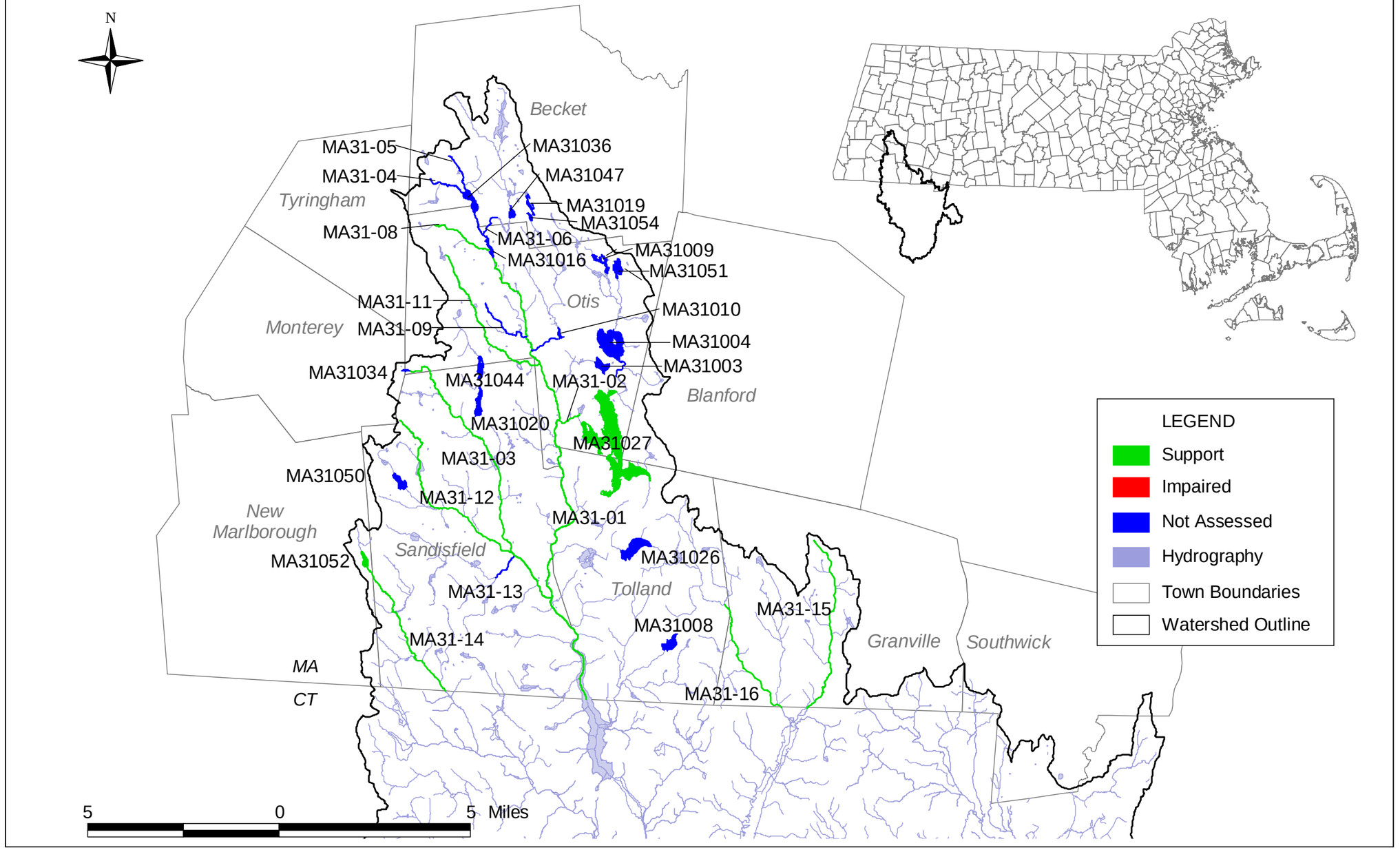
FIGURE 4: FARMINGTON RIVER WATERSHED
AESTHETICS USE ASSESSMENT SUMMARY – RIVERS AND LAKES



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INTRODUCTION

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

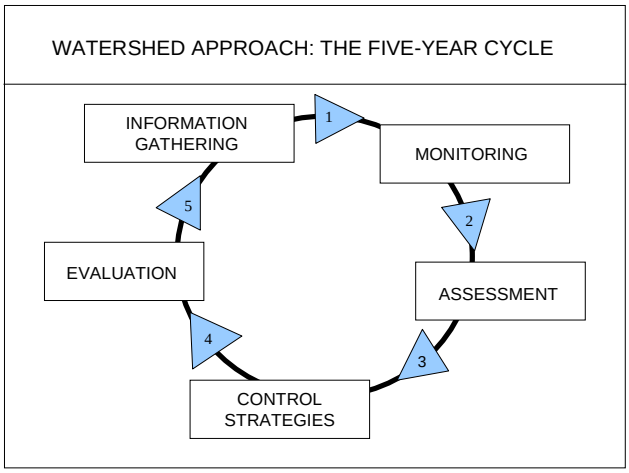


Figure 5. Five-year cycle of the Watershed Approach

The goal of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (Environmental Law Reporter 1988). To meet this objective the CWA requires states to develop information on the quality of the Nation's water resources and report this information to the U.S. Environmental Protection Agency (EPA), the United States Congress, and the public. Together, these agencies are responsible for implementation of the CWA mandates. Under Section 305(b) of the Federal Clean Water Act MA DEP must every two years submit to EPA a statewide report that describes the status of water quality in the Commonwealth. Up until 2000 this was accomplished as a statewide summary of water quality (the 305(b) Report). States are also required to submit, under Section 303(d) of the CWA, a list of waters requiring a total maximum daily load (TMDL) calculation. In 2002, however, EPA recommended that the states combine elements of the statewide 305(b) Report and the Section 303(d) List of Waters into one "Integrated List of Waters". This statewide list is based on the compilation of information for the Commonwealth's 27 watersheds. Massachusetts has opted to write individual watershed water quality assessment reports and use them as the supporting documentation for the Integrated List of Waters. The assessment reports utilize data compiled from a variety of sources and provide an evaluation of water quality, progress made towards maintaining and restoring water quality, and the extent to which problems remain at the watershed level. In stream biological, habitat, physical/chemical, toxicity data and other information are evaluated to assess the status of water quality conditions. This analysis follows a standardized process described in the Assessment Methodology section of this report. Once the use assessments have been completed the segments are categorized for the Integrated List of Waters.

ASSESSMENT METHODOLOGY

WATER QUALITY CLASSIFICATION

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

Inland Water Classes

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

Coastal and Marine Classes

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

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

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

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

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

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

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

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

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

Note: *Italics are direct quotations.*

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

Table 1 c*ontinued*. Summary of Massachusetts Surface Water Quality Standards (MA DEP 1996 and MA DPH 2002a) -

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

DESIGNATED USES

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

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

The guidance used to assess the *Aquatic Life, Fish Consumption, Drinking Water, Shellfish Harvesting, Primary* and *Secondary Contact Recreation* and *Aesthetics* uses follows. In lieu of any information to the contrary both the *Agricultural* and *Industrial* uses, where applicable, are considered by the Department to be supported.

AQUATIC LIFE USE

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

Variable	***Support -*** Data available clearly indicates support or minor modification of the biological community. Excursions from chemical criteria (Table 1) not frequent or prolonged and may be tolerated if the biosurvey results demonstrate support.	***Impaired*** There are frequent or severe violations of chemical criteria, presence of acute toxicity, or a moderate or severe modification of the biological community.
BIOLOGY		
Rapid Bioassessment Protocol (RBP) III*	Non/Slightly impacted	Moderately or Severely Impacted
Fish Community	Best Professional Judgment (BPJ)	BPJ
Habitat and Flow	BPJ	Dewatered streambed due to artificial regulation or channel alteration, BPJ
Eelgrass Bed Habitat (Costello 2003)	No/minimal loss, BPJ	Moderate/severe loss, BPJ
Macrophytes	BPJ	Exotic species present, BPJ
Plankton/Periphyton	No/infrequent algal blooms	Frequent and/or prolonged algal blooms
TOXICITY TESTS**		
Water Column/Ambient	≥75% survival either 48 hr or 7-day exposure	<75% survival either 48 hr or 7-day exposure
Sediment	≥75% survival	<75% survival
CHEMISTRY-WATER**		
Dissolved oxygen (DO)/percent saturation (MA DEP 1996, EPA 1997)	Infrequent excursion from criteria (Table 1), BPJ (minimum of three samples representing critical period)	Frequent and/or prolonged excursion from criteria [river and shallow lakes: exceedances >10% of measurements; deep lakes (with hypolimnion): exceedances in the hypolimnetic area >10% of the surface area].
pH (MA DEP 1996, EPA 1999b)	Infrequent excursion from criteria (Table 1)	Criteria exceeded >10% of measurements.
Temperature **(**MA DEP 1996, EPA 1997)	Infrequent excursion from criteria (Table 1)	Criteria exceeded >10% of measurements.
Toxic Pollutants (MA DEP 1996, EPA 1999b) Ammonia-N (MA DEP 1996, EPA 1999a) Chlorine (MA DEP 1996, EPA 1999b)	Infrequent excursion from criteria (Table 1) 1.32 mg/L NH_3-N [2] 0.011 mg/L total residual chlorine (TRC)[3]	Frequent and/or prolonged excursion from criteria (exceeded >10% of measurements).
CHEMISTRY-SEDIMENT**		
Toxic Pollutants (Persaud et al. 1993)	Concentrations ≤ Low Effect Level (L-EL), BPJ	Concentrations ≥ Severe Effect Level (S-EL)[4], BPJ
CHEMISTRY-TISSUE		
PCB – whole fish (Coles 1998)	≤500 µg/kg wet weight	BPJ
DDT (Environment Canada 1999)	≤14.0 µg/kg wet weight	BPJ
PCB in aquatic tissue (Environment Canada 1999)	≤0.79 ng TEQ/kg wet weight	BPJ

*RBP II analysis may be considered for assessment decision on a case-by-case basis, **For identification of impairment, one or more of the following variables may be used to identify possible causes/sources of impairment: NPDES facility compliance with whole effluent toxicity test and other limits, turbidity and suspended solids data, nutrient (nitrogen and phosphorus) data for water column/sediments.
[2] [NH_3-N] at pH = 7.7 SU and 30°C, actual "criterion" varies with pH and temperature and is evaluated case-by-case. [3] The minimum quantification level for TRC is 0.05 mg/L. [4] For the purpose of this report, the S-EL for total polychlorinated biphenyl compounds (PCB) in sediment (which varies with Total Organic Carbon (TOC) content) with 1% TOC is 5.3 ppm while a sediment sample with 10% TOC is 53 ppm.

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

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

In April 2004 MDPH issued new consumer advisories on fish consumption and mercury contamination (MDPH 2004).

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

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

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

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

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

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

DRINKING WATER USE

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

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

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

SHELLFISH HARVESTING USE

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

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

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

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

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

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

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

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

PRIMARY CONTACT RECREATION USE

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

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

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

SECONDARY CONTACT RECREATION USE

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

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

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

AESTHETICS USE

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

Variable	***Support*** Narrative "free from" criteria met	***Impaired*** Objectionable conditions frequent and/or prolonged
Odor, oil and grease, color and turbidity, floating matter	Narrative "free from" criteria met or excursions neither frequent nor prolonged*, BPJ.	Narrative "free from" criteria not met - objectionable conditions either frequent and/or prolonged*, BPJ.
Nuisance organisms	No overabundant growths (i.e., blooms) that render the water aesthetically objectionable or unusable, BPJ.	Overabundant growths (i.e., blooms and/or non-native macrophyte growth dominating the biovolume) rendering the water aesthetically objectionable and/or unusable, BPJ.

FARMINGTON RIVER WATERSHED DESCRIPTION AND CLASSIFICATION

FARMINGTON RIVER WATERSHED DESCRIPTION

The Farmington River watershed drains a total area of 602 square miles in Massachusetts and Connecticut. Only 156 square miles, or about 25%, of the total watershed is located in Massachusetts and this portion lies between the Housatonic and Westfield River Basins (Figure 6). A major portion of the Massachusetts section of the watershed drains the West Branch Farmington River and its tributaries. Originating in Becket in the southern Berkshire Mountains of southwestern Massachusetts, the West Branch Farmington River runs for approximately 16 miles before entering northwestern Connecticut. Just over the border in Connecticut it is impounded to form Colebrook Reservoir, a back-up drinking water supply for the City of Hartford. The remaining eastern-most subwatersheds in Massachusetts drain to form Pond, Hubbard and Valley Brooks, which converge to form the East Branch Farmington River just below the state line in Connecticut. The East Branch Farmington River is impounded in Connecticut to form the Barkhamsted Reservoir and Lake McDonough. Barkhamsted Reservoir is the primary drinking water supply for the Greater Hartford area. In Connecticut the Farmington River flows for over 60 miles before joining the Connecticut River in Windsor.

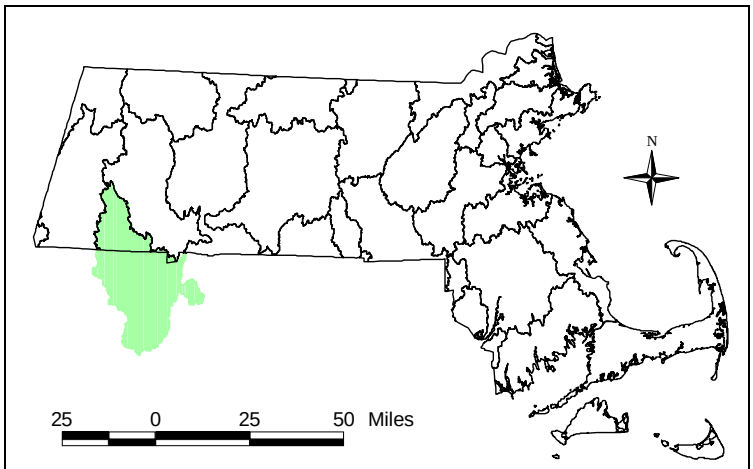


Figure 6. Location of the Farmington River Watershed.

In Massachusetts the West Branch Farmington River is characterized by numerous rapids created by an average fall rate of nearly 100 feet per mile. The major tributaries are the Clam and Fall Rivers. The Fall River is formed primarily by drainage from Big Pond and Otis Reservoir. Flow in the Fall River is regulated by Otis Reservoir, which is used for storage and recreational activities. The headwaters of the Clam River are formed by many small streams in large tracts of undeveloped forested land. The Clam River is joined by the Buck River about two miles above its confluence with the West Branch Farmington River. There are a total of 41 named streams, stretching over 116 miles, in the Massachusetts portion of the basin and 48 named lakes and ponds covering 2,840 acres in the Massachusetts area of the watershed.

The USGS operates a stream-flow gage on the West Branch of the Farmington in Roosterville, a village of Sandisfield, 0.3 miles below the confluence with the Clam River. This gage measures drainage from an area of 91.7 square miles. The average discharge has been 182 cfs over 82 years of record. Extremes at this gage ranged from a low of 2.4 cfs in 1957 to a maximum of 34,300 cfs during the 1955 flood (USGS 2002).

In Massachusetts the West Branch Farmington River flows through a predominately undeveloped and rural area with the watershed encompassing major portions of the towns of Becket, Otis, Sandisfield, Tolland, and Granville. Small areas of the watershed also reach into the towns of Southwick, Blandford, Tyringham, Monterey, and New Marlborough. Over 85% of the watershed in Massachusetts is forested, providing timber resources for related industries for over two centuries. Approximately 31% of the watershed area is characterized as having greater than 25% slope. The hilly terrain contributes to the basin's rugged beauty, but it also has discouraged development. Development in the watershed is low density and often aggregated around village centers. Becket, with a population density of 32 persons per square mile, and Otis, with a density of 30 persons per square mile, are generally the hilliest and most forested communities in the watershed. Sandisfield and Tolland, with population densities of 13 and 9 persons per square mile, respectively, are also heavily forested but also contain more rolling hills and areas of agricultural open spaces (BRPC 1997). Seasonal residents in the area double the population in the summer months.

Three general soil types predominate in the watershed. These are the Lyman-Tunbridge-Peru unit, the Ashfield-Shelburne unit, and the Charlton-Woodbridge-Paxton unit. The Lyman-Tunbridge-Peru unit, which covers the largest part of the watershed, including the towns of Becket, Otis, Sandisfield, Tolland, and Blandford, consists of gently sloping to very steep loamy soils on hilltops and hillsides formed in glacial till. There are areas of rock outcrops and stone and boulders on the surface. These soils are poorly suited for agriculture and development due to their slope, shallowness to bedrock and stoniness. The shallow depth to bedrock and moderate permeability of these soils minimize their effectiveness to attenuate infiltration of groundwater pollution (BRPC 1997).

Almost one third of the watershed has a slope greater than 15%. These areas are potential areas of erosion regardless of soil type and vegetative cover. Almost half the watershed can be considered rolling to hilly with slopes between 8 – 15%. There are few relatively flat areas in the watershed (BRPC 1997).

The Farmington River watershed supports a variety of habitat types and a diverse assemblage of wildlife. The Farmington River watershed is home to several endangered (E), threatened (T), or species of special concern (SC), including: the spring salamander (SC), spotted turtle (SC), wood turtle (SC), American bittern (E), peregrine falcon (E), eastern box turtle (SC), triangle floater (SC), swollen wedge mussel (E), lyre-leaved rock cress (T), shore sedge (T), thread rush (T), golden club (T), slender blue-eyed grass (T), and dwarf mistletoe (SC) (MA NHESP 2003b).

Numerous lakes and several state forests, including those in Sandisfield, Otis, Granville and Tolland cover large areas of the watershed and provide popular areas for outdoor recreation, including fishing, hunting, camping, canoeing, and hiking.

CLASSIFICATION OF THE FARMINGTON RIVER WATERSHED

Consistent with the National Goal Uses of “fishable and swimmable waters”, the classification of waters in the Farmington River Basin according to the SWQS include the following (MA DEP 1996).

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

In the Farmington River watershed the following waterbody is classified as A.

- Unnamed Reservoir (Sandisfield Road Reservoir and Spring) - Reservoir to outlet in Sandisfield and those tributaries thereto.
  Note - This waterbody is listed in the Massachusetts SWQS as Class A. However, according to records at MA DEP, Western Regional Office this water supply does not exist and a recommendation has been made to remove it from the list of SWQS Class A waterbodies (Rick Larson 2003)

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

Vernal pools are small, shallow ponds characterized by lack of fish and by periods of dryness. Vernal pool habitat is extremely important to a variety of wildlife species including some amphibians that breed exclusively in vernal pools, and other organisms such as fairy shrimp, which spend their entire life cycles, confined to vernal pool habitat. Many additional wildlife species utilize vernal pools for breeding, feeding and other important functions. Certified vernal pools are protected if they fall under the jurisdiction of the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00). Certified vernal pools are also

afforded protection under the state Water Quality Certification regulations (401 Program), the state Title 5 regulations, and the Forest Cutting Practices Act regulations. However, the certification of a pool only establishes that it functions biologically as a vernal pool. Certification does not determine that the pool is within a resource area protected by the Wetlands Protection Act.

Within the Town of Becket there are currently eight Certified Vernal Pools (CVPs), but only one of these lies within the watershed of the Farmington River. No other Farmington watershed towns have certified vernal pools, although the Natural Heritage Program has identified approximately 89 potential vernal pools within the watershed (MA NHESP 2003a).

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

In the Farmington River Watershed the following waters are classified as B Cold Water Fishery:

- all surface waters in the Farmington River Basin with the exception of those designated otherwise

SUMMARY OF EXISTING CONDITIONS AND PERCEIVED PROBLEMS

The West Branch Farmington River is unique in Massachusetts as the only major river that does not receive a single municipal or industrial surface wastewater discharge. In addition, there are no major water withdrawals for consumptive use in the Massachusetts portion of the basin. All surface waters in the Farmington River Basin in Massachusetts are Class B, cold water fishery (CWF), high quality waters. Due to the very rural character of the watershed and the absence of any point source discharges any water quality problems in the basin will be the result of non-point sources of pollution.

Non-point source pollution results from a variety of land-use or land disturbing activities. Examples of potential sources of non-point pollution in the Farmington River Basin include: runoff from dirt and paved roads and other impervious surfaces, failing septic systems, construction or land disturbing activities such as forestry or sand and gravel operations, recreational boating, leaking underground storage tanks, landfills, and agricultural activities. Potential pollutants from these land-uses are varied and may include: sediments, nutrients, pathogens, pesticides, salts, toxic chemicals, and heavy metals. Water quality and habitat degradation may occur when these pollutants are washed into ground and surface water resources by rain runoff and snowmelt.

Specific concerns voiced at a public meeting held by the Farmington Watershed Team in January of 1996 in Sandisfield revealed that road salting practices, lack of sufficient litter receptacles at road turnouts, and failing septic systems were localized problems that may impair water quality in the Farmington River Watershed. Results obtained from a stakeholder survey conducted by the Berkshire Regional Planning Commission (1997) in the Farmington reported that road chemicals and salts, soil erosion and waste disposal from construction, petro-chemicals related to boating, septic systems, and automobiles are the greatest sources of pollution in the watershed with the greatest volume of pollution coming from road chemicals and salts, acid rain, and land use activities such as construction, farming, and development. Existing and potential sources of pollution were identified as potential concerns for the watershed in a 604b Water Quality Assessment and Management project (BRPC, 1997) through a combination of field reconnaissance, aerial photography, state and municipal permit data, and interviews with municipal officials. These sources included: underground and above-ground storage tanks; landfills, junkyards, and dumping areas; erosion and sedimentation from unpaved roads; storage, handling and spreading of road salt and sand; snow dumping; vehicle maintenance yards (including marinas); forest cutting operations; septic system problems; and stormwater runoff.

The EOEA Farmington River Watershed Team, through its annual work planning process during the Massachusetts Watershed Initiative (1998 – 2003), consistently identified the following issues and problems as priorities to address with available agency, regional, and local resources.

- Capacity building – the Massachusetts section of the Farmington River watershed has no local group to echo the citizen concerns about the environment. A failed Wild & Scenic designation attempt in the early 90's has left a bad feel for government in many citizens' minds.
- Nonpoint source pollution – this remains the number one threat to water quality in the watershed. Runoff from dirt roads, road salting efforts, and impervious surfaces is the leading culprit.
- Water quality standards differences – the Massachusetts and Connecticut portions of the watershed have different water quality standards and because the Farmington River serves as a water supply for Connecticut there has been some concern expressed by the Connecticut Department of Environmental Protection that Massachusetts has classified its portion of the West Branch of the Farmington River as Class B water, rather than the more protective Class A reserved for drinking water supplies in Massachusetts. Connecticut wants some assurances that Massachusetts will send clean water to them for use in the drinking water supply for greater Hartford.
- Lakes and ponds – the 303[d] listing (MA DEP 1999a) and the Integrated List of Impaired Waters (MA DEP 2003a) indicated that several of the lakes and ponds within the Farmington River Watershed are impaired.

TOTAL MAXIMUM DAILY LOADS (TMDLs)

Section 305(b) of the CWA defines the process whereby states monitor and assess the quality of their surface and groundwater and report on the status of those waters every two years. Section 303(d) of the CWA requires states to periodically identify and list those waterbodies for which existing controls on point and nonpoint sources of pollutants are not stringent enough to attain or maintain compliance with applicable surface water quality standards. Through the year 2000 the MA DEP fulfilled the 305(b) and 303(d) reporting requirements in two completely separate documents. In 2001 the EPA released guidance that provided states with the option of preparing a single Integrated List of Waters to be submitted in 2002 that would meet the reporting requirements of both Sections 305(b) and 303(d) of the CWA.

The Massachusetts Year 2002 Integrated List of Waters was published by the MA DEP in September 2003 (MA DEP 2003a). In this report each waterbody or segment thereof was placed in one of five major categories. Category 1 included those waters that were meeting all designated uses. However, often insufficient data and information existed to assess all designated uses of any particular waterbody or segment. No Massachusetts waters were listed in Category 1 because a state-wide health advisory pertaining to the consumption of fish precludes any waters from being in full support of the fish consumption use. Waters listed in Category 2 were found to support the uses for which they were assessed, but other uses were not assessed. Category 3 contained those waters for which insufficient or no information was available to assess any uses.

Waters exhibiting impairment for one or more uses were placed in either Category 4 (impaired but not requiring Total Maximum Daily Loads - TMDLs) or Category 5 (impaired and requiring one or more TMDLs) according to the EPA guidance. Category 4 was further divided into three sub-categories – 4A, 4B and 4C – depending upon the reason that TMDLs were not needed. Category 4A included waters for which the required TMDL(s) had already been completed and approved by the EPA. However, since segments could only appear in one category, waters that had an approved TMDL for some pollutants but not others remained in Category 5. Category 4B was to include waters for which other pollution control requirements were reasonably expected to result in the attainment of the designated use before the next listing cycle (i.e., 2004). Because of the uncertainty related to making predictions about conditions in the future the MA DEP made a decision not to utilize Category 4B in the 2002 Integrated List. Finally, waters impaired by factors, such as flow modification or habitat alteration, that are not subjected to TMDL calculations because the impairment is not related to one or more pollutants were included in Category 4C.

While the EPA's guidance for the preparation of the Integrated List provided an overall framework for a five-part list of waters, the development, submittal, and review of Category 5 was subject to the prevailing regulation governing the implementation of Section 303(d) of the CWA and, as such, this category was approved as the Massachusetts 2002 303(d) List by the EPA on October 1, 2003. States must develop TMDLs for each of the waterbodies in Category 5 and establish pollution control strategies to restore these waters to meet water quality standards. Table 2 identifies those waterbodies in the Farmington River Watershed that were included on this list. These five Farmington Watershed lakes in Category 5 have not yet been scheduled for TMDL development (Mattson 2004).

Table 2. Integrated List of Waters, Category 5 – Waters requiring a TMDL in the Farmington River Watershed (MA DEP 2003a).

Name	Location	Cause of Impairment
Big Pond	Otis	Metals Organic enrichment/low DO
Otis Reservoir	Otis/Tolland/Blandford	Metals
Shaw Pond	Becket	Organic enrichment/low DO
Upper Spectacle Pond	Sandisfield/Otis	Organic enrichment/low DO Noxious aquatic plants
York Lake	New Marlborough	Organic enrichment/low DO

Massachusetts is currently assigning no waters to Category 1 - "Waters attaining all designated uses" - of the Integrated List due to the 1994 issuance by the Massachusetts Department of Public Health of a state-wide health advisory pertaining to the consumption of finfish. This advisory precludes any waters from being in full support of the fish consumption use. This fish consumption advisory named mercury as the associated stressor/pollutant and was aimed at pregnant women only; the general public was not considered to be at risk from fish consumption and encompassed all freshwaters in Massachusetts (MDPH 1994).

In July 2001 MDPH issued a new, more inclusive, fish consumption advisory for both fresh and salt waters in the Commonwealth (MDPH 2001). Within the last decade the northeastern United States has been identified as receiving elevated rates of mercury deposition from the atmosphere and high levels of mercury contamination in non-commercial freshwater fish (Tatsutani 1998). Mercury is a trace metal that exists in the earth's crust. It is a toxicant that, once mobilized in the environment, can be transformed into methylmercury, a particularly toxic form that can bioaccumulate. Most of the mercury contamination in the northeastern United States has been linked to air emissions (incinerators, fossil fuel combustion facilities) from both local and mid-western sources.

Currently there are MDPH fish consumption advisories for two waterbodies in the Farmington River Watershed (Big Pond and Otis Reservoir) because of elevated levels of mercury (MDPH 2004).

SOURCES OF INFORMATION

Multiple local, state and federal agencies provided information used in the water quality assessment of the Farmington River Watershed. Within the Department of Environmental Protection (MA DEP) information was obtained from the Bureau of Resource Protection (BRP). Specifically, water quality, sediment quality, habitat assessment, biological and lake data were provided by MA DEP, Division of Watershed Management (DWM), Watershed Planning Program. Water withdrawal and groundwater discharge permit information was provided by the DWM Watershed Permitting Program (Water Management Act) and the MA DEP Western Regional Office Farmington River Watershed Team. [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.] Water withdrawals were reviewed to determine where stream segments might be affected by cumulative water withdrawal activities.

Projects funded through various state and federal 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 Farmington River Watershed is provided in Appendix E.

Other state agencies contributing information to this report include: the Massachusetts Department of Public Health (MDPH), the Department of Fish and Game (DFG, formerly the Department of Fisheries, Wildlife, and Environmental Law Enforcement or MDFW), and the MA Department of Conservation and Recreation (DCR, formerly the Department of Environmental Management or MA DEM). Federal agencies contributing include the EPA and United States Geological Survey (USGS).

In August 2001 the Massachusetts "Beach Bill" was enacted by the legislature and signed by the Governor (MGL. C111. S5S). This act created minimum standards for public bathing waters adjacent to any public or semi-public bathing beach in the Commonwealth. A "public bathing beach" is defined as a beach open to the general public, whether or not any entry fee is charged, that permits access to bathing waters. A "semi-public bathing beach" is defined as a bathing beach used in connection with a hotel, motel, trailer park, campground, apartment house, condominium, country club, youth club, school, camp, or similar establishment where the primary purpose of the establishment is not the operation of the bathing beach and where admission to the use of the bathing beach is included in the fee paid for use of the premises. A semi-public bathing beach shall also include a bathing beach operated and maintained solely for the use of members and guests of an organization that maintains such bathing beach. Under the Beach Bill the Massachusetts Department of Public Health (MDPH) was directed to establish minimum uniform water quality standards for coastal and inland beach waters as well as determine the frequency and location of testing, reporting requirements, and requirements for notifying the public of threats to human health or safety. *105 CMR 445.000: Minimum Standards for Bathing Beaches (State Sanitary Code, Chapter VII)* outlines MDPH's guidelines for the Beach Bill and is available online at http://www.state.ma.us/dph/dcs/bb4_01.pdf. Additionally, under the Beach Bill and MDPH guidelines, local boards of health and state agencies are responsible for collecting samples from public beaches using testing procedures consistent with the American Public Health Association's *Standard Methods for Examination of Water and Waste Water* or methods approved by EPA. Operators of semi-public beaches are responsible for the costs of testing their beaches. Results of testing, monitoring, and analysis of public and semi-public beaches must be submitted in an annual report to MDPH by 31 October of each year (MDPH 2002b).

In addition to information from state and federal agencies, the Berkshire Regional Planning Commission (1997) prepared a comprehensive management plan to address nonpoint source pollution in the Farmington River Watershed that helped in the evaluation of water quality and the identification of causes and sources of contamination. Also, ENSR International (2001) conducted a diagnostic/feasibility study of Otis Reservoir and the information was used in the assessment of Otis Reservoir.

OBJECTIVES

This report summarizes information generated in the Farmington River Watershed through *Year 1* (information gathering in 2000) and *Year 2* (environmental monitoring in 2001) activities established in the "Five-Year Cycle" of the Watershed Approach. In addition, where appropriate, information collected during the 1996-97 water quality and biological monitoring surveys are also summarized. Together with other sources of information (identified in each segment assessment) these data were used to assess the status of water quality conditions of rivers and lakes in the Farmington River Watershed in accordance with EPA's and MA DEP's use assessment methods. Data collected by DWM in 1996, 1997 and 2001 are provided in Appendices A, B, C, D, and F of this report. Not all waters in the Farmington River Watershed are included in the MA DEP/EPA WBS or ADB databases or this report.

The objectives of this water quality assessment report are to:

1. evaluate whether or not surface waters in the Farmington River Watershed, defined as segments in the WBS/ADB databases, currently support their designated uses (i.e., meet SWQS);
2. identify water withdrawals (habitat quality/water quantity) and/or major nonpoint (land-use practices, stormwater 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 for the development of a Farmington River Watershed action plan.

REPORT FORMAT

RIVERS

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

SEGMENT IDENTIFICATION

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

Sources of information: coding system (waterbody identification number, e.g., MA31-01) used by MA DEP to reference the stream segment in reports such as 305(b) and 303(d), the Integrated List of Waters, the Massachusetts SWQS (MA DEP 1996), and other descriptive information.

SEGMENT DESCRIPTION

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

Sources of information: descriptive information from USGS topographical maps, base geographic data from MassGIS, land use statistics from a GIS analysis using the MassGIS land use coverage developed at a scale of 1:25,000 and based on aerial photographs taken in 1999 (MassGIS 2002).

Category (2 – 5) that the segment is listed in on the 2002 Integrated List of Waters.

Source of information: Massachusetts Year 2002 Integrated List of Waters (MA DEP 2003a).

SEGMENT LOCATOR MAP

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

Sources of information: MassGIS data layers (stream segments and quadrangle maps from MassGIS 2001).

WATER WITHDRAWALS AND WASTEWATER DISCHARGE PERMIT INFORMATION

Water withdrawal, NPDES wastewater discharge

Sources of information: WMA Database Printout (LeVangie 2003).

USE ASSESSMENT

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

Sources of information include: MA DEP DWM 1996/1997 and 2001 survey data (Appendix A, B, C, D, F). The MDPH Freshwater Fish Consumption Advisory and List (MDPH 2001 and MDPH 2004) were used to assess the *Fish Consumption Use*. Where other sources of information were used to assess designated uses, citations were included.

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

SUMMARY

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

RECOMMENDATIONS

Additional protection, monitoring and implementation needs.

Sources of information include: Farmington River Watershed Action Plan – A Comprehensive Management Plan to Address Nonpoint Source Pollution (BRPC 1997), Diagnostic Feasibility Study of Otis Reservoir (ENSR 2001), EOEA Farmington Watershed Team Annual Workplans (EOEA 2001, 2002, 2003, 2004).

LAKES

The assessed lakes, identified with their WBID code numbers, are listed alphabetically in the Lake Assessment section of this report (Table 4). The status of the individual uses is summarized for these lakes. The location, acreage, trophic status, use assessments, and causes of impairment, are then summarized for each individual lake (listed alphabetically).

FARMINGTON RIVER WATERSHED RIVER SEGMENTS

There are a total of 16 rivers in the Farmington River Watershed assessed in this report comprising 16 segments (Figure 7). These are as follows:

MA31-01	West Branch Farmington River	MA31-06	Thomas Brook	MA31-12	Buck River
MA31-02	Fall River	MA31-07	Unnamed Tributary	MA31-13	Silver Brook
MA31-03	Clam River	MA31-08	Cone Brook	MA31-14	Sandy Brook
MA31-04	Shales Brook	MA31-09	Unnamed Tributary	MA31-15	Valley Brook
MA31-05	Unnamed Tributary	MA31-10	Dimmock Brook	MA31-16	Hubbard Brook
		MA31-11	Benton Brook		

While the 13 named rivers represent only a small number (32%) of the 41 named rivers they account for approximately 51% of the named river miles in the watershed (Halliwell *et al*. 1982). The three unnamed tributaries represent an additional 4.2 assessed river miles. The remaining rivers are small and/or unnamed and are currently unassessed.

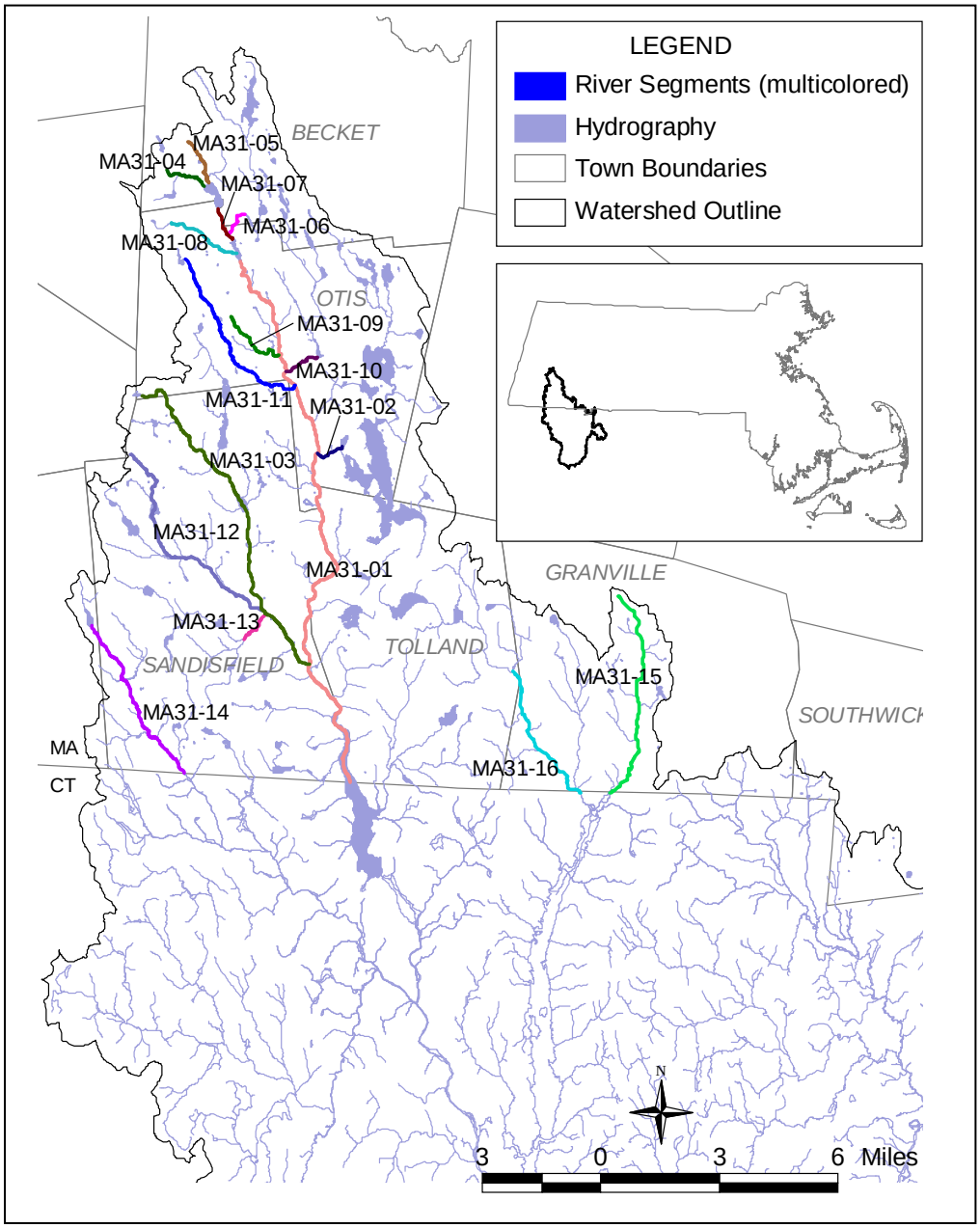
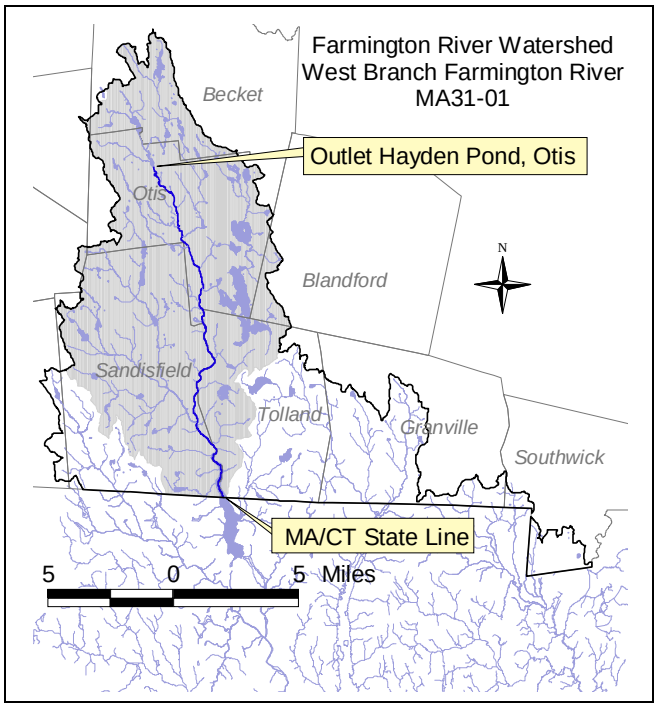


Figure 7. River Segments in the Farmington River Watershed (Massachusetts Portion).

WEST BRANCH FARMINGTON RIVER (SEGMENT MA31-01)
Location: Outlet of Hayden Pond, Otis to border of Sandisfield/Tolland, Massachusetts and Colebrook, Connecticut in the Colebrook Reservoir.
Segment Length: 16.1 miles
Classification: Class B, Cold Water Fishery



The drainage area of this segment is approximately 101.2 square miles (map inset, gray shaded area). Land-use estimates (top 4, excluding water) for the subwatershed:

Forest..... 84.0%
Residential 4.4%
Agriculture..... 1.9%
Open land 1.9%

The outflow from Hayden Pond in Otis spills over the dam forming the West Branch Farmington River and continues flowing southeast over fairly flat terrain paralleling Route 8. The river enters a wetland area and then a series of small impoundments as it passes through the town center of Otis. The river then enters a relatively long, straight, low gradient reach and receives the flow from Fall River. The West Branch Farmington River continues to the southeast, paralleling Route 8, flowing by the Cold Spring Campground and then enters a narrow steep river valley, forming the corporate boundary between the towns of Sandisfield and Tolland. The river makes some large meanders in this narrow section and begins to flow to the southwest to the village of New Boston in Sandisfield. About a mile below New Boston, just above the Village of Roosterville, is the confluence with the Clam River. Continuing to parallel Route 8 the West Branch Farmington swings back to the southeast and then enters the impounded area of Colebrook River Reservoir. The interstate boundary between Massachusetts and Connecticut cuts across the reservoir marking the end of this segment. The surface area of Colebrook Reservoir is 728 acres, 176 of which are in Massachusetts.

MDFW collected smallmouth bass, tessellated darter, and rock bass from Lake Marguerite Brook, a tributary to the West Branch Farmington River, in September 2001 (Richards 2003a).

Based on the last evaluation of water quality conditions in the Farmington Watershed (1996/97) the West Branch of the Farmington River is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life, Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics) and was not assessed for the other (Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals in the subwatershed of this segment.

There are no NPDES regulated surface wastewater discharges within the subwatershed. There is one municipal wastewater treatment system that opened in 2000 in Otis that serves the school and the town center (approximately 70 residences). It is a Bioclere treatment process that discharges to groundwater (groundwater discharge permit # GW-648-0). The facility is designed for 30,000 gpd and receives average flows of approximately 10,000 gpd with peaks of approximately 18,000 gpd. MA DEP WERO reports that the facility has been in and out of compliance since it opened for exceedances of total nitrogen limits during the winter months. This problem is currently being rectified. Monitoring well data has not yet indicated any impacts to the groundwater (Juskalian 2003).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

Throughout the subwatershed there are twelve small public water supplies (mostly non-community) that draw water from groundwater wells (MA DEP 2003b). The largest user is the New Boston Nursing Home that withdraws an average of 1.67 MGY, based on 2000, 2001 and 2003 water withdrawals. The cumulative total average water withdrawals from this segment from all of the water users for these three years is 2.83 MGY. This translates to a total average flow of 0.012 cfs. This amount is very insignificant compared to the annual mean flow of the river (168 cfs). It is made more so by the fact that much of the water withdrawn from these systems is recharged to the aquifer via local on-site septic systems.

The outlet stream from Otis Reservoir joins the West Branch Farmington River in Otis approximately one mile upstream from the Sandisfield/Tolland line. The water level in Otis Reservoir has been drawn down since its formation in the mid 1800s with annual winter drawdowns reported since at least the 1930s. ENSR (2001) reports that the Reservoir has been lowered in October of each year since the late 1960s by just over 8 feet and then raised after ice-out to its full level, typically by May. The drawdown results in flow alteration in the Fall River and the lower 9.6 miles of the West Branch Farmington River.

DWM biologists sampled this segment of the West Branch Farmington River during August of 1996 and 2001 (see Table 3 below for sampling locations and comparative data). At the time of the August 1996 survey the river was between 7 – 20 meters wide at the four stations sampled, with depths ranging from 0.3 to 1.0 m (Appendix C). The substrates were comprised primarily of boulders and cobble. Habitat quality was high at all sites and limited only slightly by in-stream cover (at Stations FR05A and FR05B) and riparian vegetated zone width (at Stations FR01B, FR05A and FR05B). Channel alteration and bank stability received the highest possible score at all four stations.

Stations FR01A and FR01B bracketed the MassHighway DPW yard in Otis. DWM biologists noted that although the downstream station, FR01B received a high habitat assessment score, in stream habitat degradation immediately upstream of the sampling reach was observed. Large quantities of sand, apparently originating from the edge of the DPW yard appeared to be eroding into the stream. While in-stream sedimentation was apparently confined to only a small stream area during the time of the survey, continued displacement of otherwise superb microhabitat was predicted without adequate runoff control (Appendix C).

During the August 2001 survey (Appendix A) the river was between 10 to 18 meters wide at the two stations sampled (FR01B and FR05B) with depths ranging from 0.1 to 0.75 m. The substrates were comprised primarily of boulders and cobble. Habitat quality was diminished at Station FR01B due to riparian zone degradation and in stream sedimentation. DWM biologists note that sedimentation effects at FR01B were more pronounced than during 1996 survey and were likely from runoff from the MassHighway DPW property and a riverside horse paddock. Habitat quality at FR05B was high and ranked slightly better than during the 1996 survey due to improved channel flow status.

According to USGS (remarks from gaging station records on the Farmington River 1 mile south of New Boston - 01185500) flows are regulated by Otis Reservoir, 7.0 miles upstream on the Fall River. The drainage area at this gage is 91.7mi^2. Data from the USGS gage revealed that the 2001 water year annual mean flow (168 cfs) was less than the mean annual flow for the 88-year period of record (184 cfs, Socolow *et al*. 2002). The estimated 7Q10 flow at the gage is 5.9 cfs (USGS 2003).

Biology

Macroinvertebrate biomonitoring was conducted in this segment of the Farmington River during August 1996 and August 2001(Appendices C and A, respectively). Fish community and periphyton sampling were conducted during August 2001 (Appendix G and B, respectively).

Table 3. Sampling locations and results for the 1996 and 2001 benthic macroinvertebrate surveys

Station	Location	1996 Habitat Assessment Score	2001 Habitat Assessment Score	1996 Bioassessment (RBP II)	2001 Bioassessment (RBP III)
FR01A	Otis, MA above the Mass Highway Department of Public Works (DPW) yard	193/200	Not sampled	Non-impaired	Not sampled
FR01B	Otis MA below the Mass Highway DPW yard	182/200	170/200	Non-impaired	Non-impacted
FR05A	Sandisfield, MA approx. 500 m upstream from confluence with the Clam River	180/200	Not sampled	Non-impaired	Not sampled
FR05B	Sandisfield, MA approx. 500 m downstream from confluence with the Clam River in the Village of Roosterville	173/200	186/200	Non- impaired	Non-impacted

Macroinvertebrates

During the August 1996 survey at Station FR01A the RBP II analysis was 93% comparable to reference conditions (Hubbard Brook Station FR09), indicating the benthic community was non-impaired. The downstream site (FR01B) was also non-impaired and very similar to the upstream station (FR01A), indicating that the activities associated with the DPW property did not appear to have detrimental effects on downstream community integrity in terms of water quality and habitat quality in 1996 (Appendix C).

The 1996 sampling stations (FR05A and FR05B) bracketed the riverside community of New Boston and the drainage of the Clam River subwatershed. RBP II analysis for benthic macroinvertebrates at Station FR05B was 86% comparable to the best attainable conditions upstream at Station FR05A. DWM biologists concluded that inputs from the Clam River and New Boston did not significantly alter the status of water quality, habitat quality, or biological integrity at the downstream site (Appendix C).

During the 2001 survey Station FR01B again was highly (95%) comparable to the reference station (FR09 at Hubbard Brook) using RBP III analysis and found to be non-impacted. However, EPT taxa were reduced here, possibly due to sediment deposition. DWM biologists noted that sediment deposition may be threatening biological potential at this station. Station FR05B was 100% comparable to the reference condition at Station FR09, resulting in a bioassessment of non-impacted at this site (Appendix A).

Fish

Fish were sampled by DWM at two stations in this segment of the West Branch Farmington River in August of 2001 (in Otis near macroinvertebrate Stations FR01A and FR01B and in Sandisfield near macroinvertebrate Stations FR05A and FR05B, described above). MDFW also conducted fish population sampling at three stations in the West Branch Farmington River in August/September 2001- upstream from the confluence with Fall River, downstream from the confluence with Fall River and at the upper end of Colebrook Reservoir near the Connecticut state line.

Fish species captured by DWM at the Otis station in order of abundance included: common shiner (*Luxilus cornutus*), dace (*Rhinichthys* sp.), smallmouth bass (*Micropterus dolomieu*), white sucker (*Catostomus commersoni*), cutlips minnow (*Exoglossum maxillingua*), and golden shiner (*Notemigonus crysoleucas*) (Appendix G). The fish population was dominated by fluvial dependants/specialists. The cutlips minnow is considered to be intolerant of pollution, while all others are classified as moderate or tolerant to pollution. There was a large number of smallmouth bass present, the only top-level predator represented.

MDFW collected eight species of fish in the West Branch Farmington River upstream from the confluence with the Fall River in August/September 2001 (near the snowmobile club road). These

included fallfish (*Semotilus corporalis*), white sucker, cutlips minnow, common shiner, smallmouth bass, creek chub (*Semotilus atromaculatus*), longnose dace (*Rhinichthys cataractae*) and blacknose dace (*Rhinichthys atratulus)* (Richards 2003a). With the exception of creek chub, all seven species were also collected from the West Branch Farmington River by MDFW in August 2001 at a site downstream from the confluence with the Fall River (near the rest area at Forest Bridge).

DWM noted that sampling efficiency during their fish population survey in the West Branch Farmington River at the Sandisfield station was poor and "many fish were seen, but escaped capture" (Appendix G). A total of 15 fish representing five species were collected. Fish species captured in order of abundance, included dace (*Rhinichthys* sp.), smallmouth bass, cutlips minnow, pumpkinseed (*Lepomis gibbosus*), and tessellated darter (*Etheostoma olmstedi*). Although fluvial dependants/specialists were present, due to the small number of fish collected, it is not possible to evaluate the fish population data from this location.

MDFW collected a total of four species of fish from the West Branch Farmington River near the bridge at the upstream end of Colebrook River Reservoir in September 2001. These included rock bass (*Ambloplites rupestris*), a bluegill (*Lepomis macrochirus*), smallmouth bass, and tessellated darter (Richards 2003a). The lack of fluvial species (excluding darters) is likely due to the impounded nature of the river at this location.

Periphyton
DWM biologists collected periphyton samples from Stations FR01B and FR05B (described above) in August of 2001. At both sites canopy cover was estimated as 5%. Percent algal cover was 5% at Station FR01B and 10% at Station FR05B. The dominant algal type and form at both stations were greens-cobble/riffle-filamentous – *Oedogonium* sp. No nuisance algal growth was documented (Appendix B).

Chemistry – water
No water quality sampling was conducted in the Farmington River Watershed during the 2001 survey season. DWM did, however, conduct water quality sampling in this segment monthly from March 1996 through October 1996 and every other month thereafter until June 1997 at three stations (n = 11); Station FR01 (milepoint 16.50, located in Otis at Ed Jones Road, approximately 150 feet below Hayden Pond outlet/dam), Station FR02 (milepoint 10.0 in Otis at Reservoir Road just downstream from bridge), and Station FR03 (milepoint 3.5, located in the village of Roosterville in Sandisfield at Clark Road, just downstream from the bridge near the USGS flow gage). Although the data from these surveys are more than five years old, due to the sampling frequency and the fact that land use changes in the watershed have been slight, these data have been used to help assess the *Aquatic Life Use* for the West Branch Farmington River. Comparison of landuse changes in the West Branch Farmington River subwatershed from 1985 to 1999 show less than 2% of the total acreage has experienced a change in landuse (MassGIS 2003). Furthermore, the changes that have occurred are not concentrated in a particular area of the segment's subwatershed or along the riparian corridor where they would be more likely to directly impact water quality.

It should be noted that three other stations were sampled infrequently for limited parameters associated with salt runoff by DWM in 1996 and 1997 (FR04, located at milepoint 12.7, located south of Otis center across from intersection of Beech Plain Road and Route 8; NB01, located at milepoint 4.6 in Sandisfield in the center of the village of New Boston approximately 50 feet downstream from Route 8 bridge; and NB02 (at milepoint 4.6 from a storm drain in New Boston center approximately 50 yards below Route 8 bridge crossing). In addition, a storm drain near Otis center (Station OC01) was sampled on seven dates from May 1996 through June 1997 for metered parameters and limited water quality parameters. These data are considered too limited and were not used for this assessment. All of the water quality data from the 1996-97 survey are presented in Appendix D, Tables D3, D4, and D5.

DO
For the eleven sampling events conducted from March 1996 through June 1997 DO in the Farmington River at Stations FR01, FR02, and FR03 ranged from 7.4 to 13.4 mg/L. Saturation at

these stations ranged from 85.5% to 102.4%. It should be noted that these data do not represent the worse-case (pre-dawn) conditions (Appendix D).

Temperature
The highest temperatures were recorded by DWM in this segment of the West Branch Farmington River in June 1996 (maximum 24.7°C just downstream from Hayden Pond). Temperatures exceeding 20°C were documented at all three stations at least once during the June, July and/or August sampling events. The elevated temperatures observed at Station FR01 during the summer months were likely, in part, due to influence from the impounded warmer water of Hayden Pond flowing over the dam just upstream.

pH and Alkalinity
The in-stream pH and alkalinity of the West Branch Farmington River at all three stations (FR01, FR02, FR03) ranged from 6.5 – 7.5 and alkalinity ranged from 4 to 24 mg/L during the survey year (1996-97) (Appendix D).

Specific Conductance
Conductivity measurements in the West Branch Farmington River ranged between 42 and 140 µS/cm during the survey year (1996-97) for all three stations (Appendix D).

Suspended Solids
Suspended solids measurements in the West Branch Farmington River for all three stations during the survey year (1996-97) were low, ranging between <2.5 to 4.0 mg/L (Appendix D).

Turbidity
Measurements for turbidity in the West Branch Farmington River (Stations FR01, FR02, FR03) during the survey year (1996-97) were very low ranging between 0.4 to 1.5 mg/L NTU (Appendix D).

Ammonia-Nitrogen
Concentrations of ammonia-nitrogen at Stations FR01, FR02, and FR03 ranged from <0.02 to 0.07 mg/L during the survey year (1996-97) (Appendix D).

Nitrate-Nitrogen
Measurements for nitrate-nitrogen in the West Branch Farmington River (Stations FR01, FR02, FR03) ranged from <0.02 to 0.13 mg/L during the survey year (1996-97) (Appendix D).

Phosphorus
Total phosphorus measured by DWM in the West Branch Farmington River (Stations FR01, FR02, FR03) ranged from <0.01 to 0.024 mg/L during the survey year (1996-97) (Appendix D).

Hardness
Hardness in the West Branch Farmington River (Stations FR01, FR02, FR03) did not exceed 26 mg/L (Appendix D).

Chemistry - sediment
Three replicate sediment grabs were collected in October 1997 at one station (FR06A, B, C) to determine the quality of sediments settling out in the West Branch Farmington River before it enters Colebrook Reservoir. The station was located in the West Branch of the Farmington River at the beginning of Colebrook River Reservoir at an old Route 8 bridge crossing. Samples were analyzed for nutrients, metals, PCB and other organics. These data are reported in Appendix D, Table D7 and D8.

No PCB or organochlorine pesticides were detected in any of the three replicate samples. Several semivolatile organic compounds were detected in each replicate sample, however no standard was available for quantification or verification at WES. The mass spectrum was compared to a mass spectral index and a mass spectral database for tentative identification. Compounds detected were reported to be high molecular weight petroleum hydrocarbons and high molecular weight organic acids (Flaherty

1998). One replicate sample (FR06A) exceeded the S-EL (severe effect level) for TKN by a factor of 1.3 and the other two replicates were between the L-EL (lowest effect level) and S-EL as defined by Persaud *et al.* 1993. (L-EL represents the concentration of a contaminant that can be tolerated by the majority of benthic organisms and S-EL represents the level found that would be detrimental to the majority of benthic organisms.) Cadmium and TP were between the L-EL and S-EL range in all three replicates. Several metals (Cu, Fe, Pb, Ni, and Zn) at FR06A were also between the L-EL and S-EL. However, in the other two replicates all were below the L-EL. Three metals (As, Cr, and Hg) were below the L-EL in all samples analyzed.

The *Aquatic Life Use* is assessed as impaired due to the fish population information that did not document the presence of any species of cold water fish (Richards 2003b). Elevated water temperatures exceeding the cold water fishery standard (20° C) during the summer months are suspected to be impacting the cold water fishery habitat. Of additional concern are the diminished habitat quality documented in one localized area due to sediment deposition in Otis noted in the 2001 bioassessment survey and the fact that sediments collected from the riverbed near the CT/MA border had somewhat elevated levels of TKN, TP and some metals (Cd, Cu, Pb, Ni, and Zn) and contained several semivolatile organic compounds.

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

Fecal coliform bacteria samples were collected by DWM only during dry weather from the Farmington River at stations FR01, FR02, and FR03 (described above) on 5 occasions from April to September 1996 and in April of 1997. Fecal coliform bacteria counts at these stations ranged from <2 to 90 cfu/100 mls (Appendix D, Table D4). No bacteria sampling was conducted by DWM in 2001.

Although the data from these surveys are more than five years old, due to the sampling frequency and the fact that land use changes in the watershed have been slight, these data have been used to assess the *Primary and Secondary Contact Recreational* uses for the West Branch Farmington River. Comparison of landuse changes in the West Branch Farmington River subwatershed from 1985 to 1999 show less than 2% of the total acreage has experienced a change in landuse (MassGIS 2003). Furthermore, the changes that have occurred are not concentrated in a particular area of the segment's subwatershed or along the riparian corridor where they would be more likely to directly impact water quality.

This segment of the Farmington River is very scenic and can be viewed frequently from Route 8, which parallels the river for the length of the segment. Despite the easy access to the river provided by numerous pull-offs along this state highway very little littering or dumping was observed at these areas during the 1996-97 DWM water quality survey. In addition, no objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 or 2001 biomonitoring surveys (Appendix C and Appendix A, respectively).

The *Primary* and *Secondary Contact Recreationa*l and *Aesthetics* uses are assessed as support for this segment of the Farmington River based on the low fecal coliform bacteria counts and habitat quality information.

WEST BRANCH FARMINGTON RIVER (MA31-01) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Cause: Fishes Bioassessments (Suspected Cause: Temperature) Source: Unknown (Suspected Source: Upstream impoundments)
Fish Consumption		NOT ASSESSED
Primary Contact		SUPPORT
Secondary Contact		SUPPORT
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-01)

- Work with the MDFW to investigate elevated temperatures (e.g., natural vs. anthropogenic causes) in the West Branch Farmington River and the impact this may have on the cold-water fishery in this segment.

- Considerable deposition of sand was noted in the river adjacent to the Massachusetts Highway Department property in Otis during both the 1996 and 2001 bioassessment surveys. The Massachusetts Highway DPW should take immediate measures to prevent runoff of sand from their property into the West Branch Farmington River. Future bioassessment surveys should check to see if the river is still being impacted by runoff from this property.

- An investigation of the extent of the impact of drawdown practices at Otis Reservoir on in-stream biota downstream from the confluence with the Fall River is recommended for a future survey.

- Work with riverside landowners in Otis to implement best management practices to control runoff from their properties. Encourage the continuation of nonpoint source education outreach efforts to landowners in the subwatershed communities of Becket, Otis, Sandisfield and Tolland initiated by the Berkshire Regional Planning Commission and the Farmington Watershed Team.

- Work with the Town of Otis Municipal Wastewater Treatment Facility operator to eliminate groundwater discharge permit violations for total nitrogen.

- Conduct monitoring surveys to investigate impacts of dirt roads to the water and habitat quality of tributary streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Work with the Sandisfield Fire Chief to verify the existence and location of reportedly large underground storage tanks near the Farmington River in Sandisfield and have the tanks removed. Develop a watershed-wide program to minimize the threat to water quality from residential underground storage tanks (BRPC 1997).

- Sediment samples need further analysis to determine the meaning and magnitude of the semivolatile organic constituents detected. Additional sediment samples should be collected at selected sites upstream to characterize sediment quality in the West Branch Farmington River and to bracket areas of potential sources of elevated metals (Cd, Cu, Pb, Ni, and Zn) and semivolatile organic compounds.

- A Farmington Watershed Team project in 2002 worked with the Town of Otis and a consultant to gather and analyze existing data on salt contamination in local drinking water wells along Route 8 in Otis and to develop a guidance document for the communities to direct further action. Work with Massachusetts Highway Department to develop a strategy for road salting along Route 8 and implement the recommended actions from this guidance document to address suspected salt contamination.

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed municipalities on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP, develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

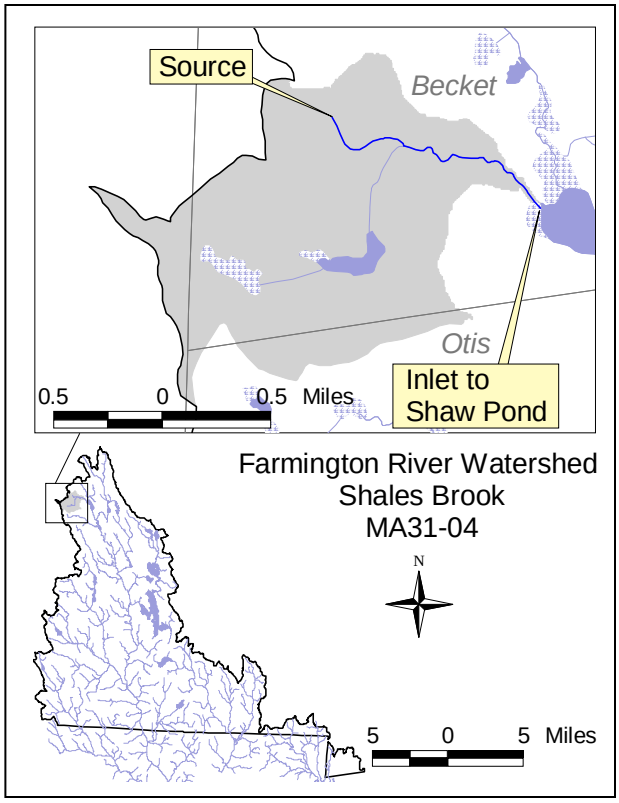
SHALES BROOK (SEGMENT MA31-04)
Location: Source north of Tyringham Road, Becket to inlet Shaw Pond, Becket.
Segment Length: 1.2 miles
Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 1.52 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 94.4%
Wetlands..... 2.2%
Residential..... 2.0%
Agriculture..... 0.6%

Shales Brook forms west of the Village of West Becket in Becket, just north of Tyringham Road. The brook flows southeast over moderately steep terrain, crosses under Route 8, and flows by some houses before entering Shaw Pond, Becket.

Based on water quality monitoring conducted by DWM in 1996 Shales Brook is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life, Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics) and was not assessed for others (Fish Consumption).



WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT

DWM collected water quality and bacteria samples from Shales Brook at Station SH04 on two occasions in 1996 (May and August). The station is 20 feet upstream from the segment confluence with Shaw Pond in Becket. These data are reported in Appendix D.

Too limited current data are available so the uses are not assessed.

SHALES BROOK (MA31-04) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS (SEGMENT MA31-04)

- Conduct water quality and/or biological monitoring during the next monitoring year (2006) to fully assess this segment.

- Conduct monitoring surveys to investigate impacts of dirt roads to the water and habitat quality of streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed municipalities on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

UNNAMED TRIBUTARY (SEGMENT MA31-05)

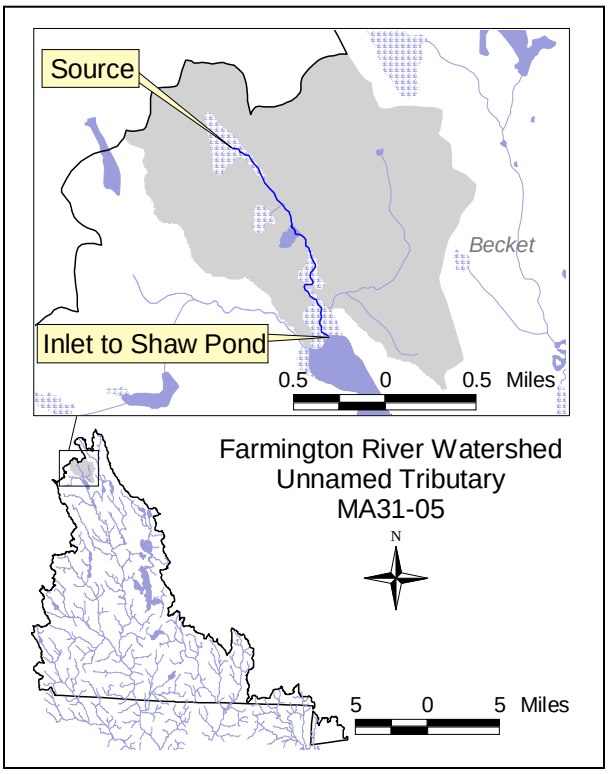
Location: Source in wetlands southwest of Route 90 and east of Route 20, Becket to inlet Shaw Pond, Becket.

Segment Length: 1.3 miles

Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 2.03 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 76.2%
Residential 5.7%
Agriculture..... 5.3%
Open Land 4.9%



The headwaters of this small, unnamed tributary to Shaw Pond are in a wetland southeast of where Route 20 passes under Route 90 (just southeast of Greenwater Pond) in Becket. From there it parallels the eastbound lane of Route 90 in a southeasterly direction for most of its course before turning to the south southeast and running under Route 20/8. Another stream joins the segment in a wetland just upstream from Route 20/8. As it approaches its confluence with Shaw Pond the tributary flows through another wetland area. This is the eastern-most tributary into the northern lobe of Shaw Pond.

Based on the last evaluation of water quality conditions in the Farmington Watershed (1996/97) this unnamed tributary is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment was not assessed for any uses.

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT

DWM collected water quality and bacteria samples from this unnamed tributary at Station SH03 on two occasions in 1996 (May and August). The station is 20 feet upstream from the segment confluence with Shaw Pond in Becket. The data are reported in Appendix D.

Too limited current data are available so the uses are not assessed.

UNNAMED TRIBUTARY (MA31-05) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS (SEGMENT MA31-05)

- Conduct water quality and/or biological monitoring during the next monitoring year (2006) to fully assess this segment.

- Conduct monitoring surveys to investigate impacts of dirt roads to the water and habitat quality of streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed municipalities on a site-specific basis.

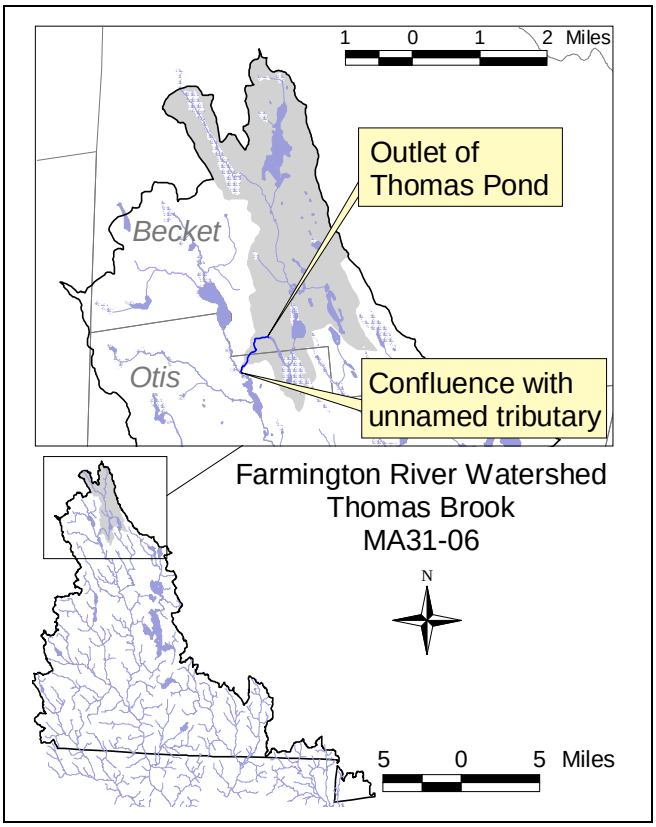
  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

THOMAS BROOK (SEGMENT MA31-06)
Location: Outlet Thomas Pond, Becket to confluence with unnamed tributary, Otis.
Segment Length: 0.8 miles
Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 6.21 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 77.7%
Residential..... 7.0%
Wetlands..... 6.3%
Open Land..... 2.4%



Thomas Brook begins at the outlet of Thomas Pond in the southwest corner of Becket just south of the Mass. Turnpike. The brook flows west and then southwest down steep terrain, crossing under Route 8, to its confluence with an unnamed river that flows from Shaw Pond to Hayden Pond.

Based on the last evaluation of water quality conditions in the Farmington Watershed (1996/97) Thomas Brook is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment was not assessed for any uses.

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT

DWM collected water quality and bacteria samples from Thomas Brook at Station TB01 once in May 1996. The station was located in Becket at the Werden Cross Road Bridge. The data are reported in Appendix D.

Too limited current data are available so the uses are not assessed.

THOMAS BROOK (MA31-06) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS (SEGMENT MA31-06)

- Additional monitoring during the next monitoring year (2006) is needed to fully assess the use support status of this segment for all its designated uses.

- Conduct monitoring surveys to investigate impacts of dirt roads to the water and habitat quality of streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed municipalities on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

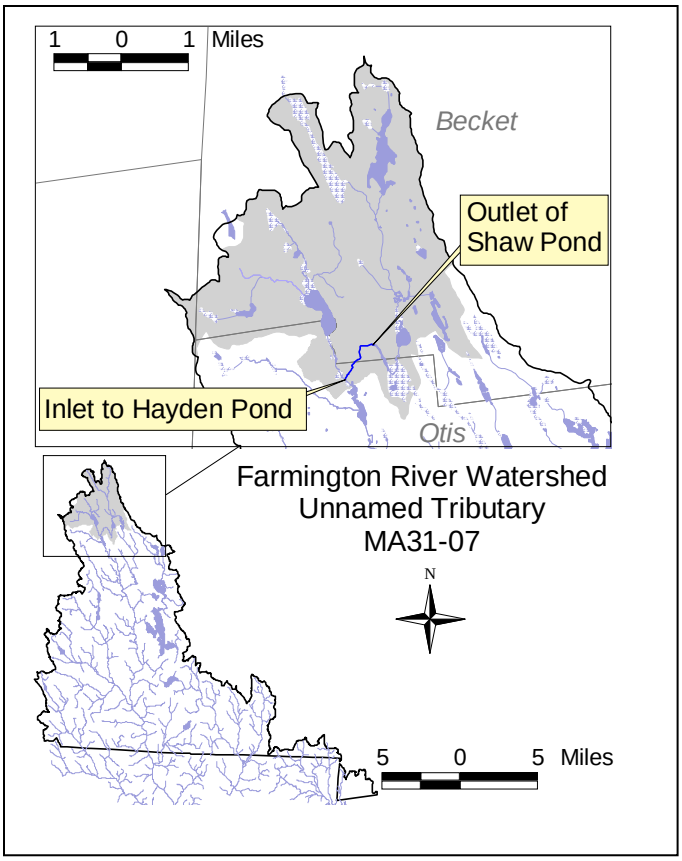
  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

UNNAMED TRIBUTARY (SEGMENT MA31-07)
Location: Outlet Shaw Pond, Becket/Otis to inlet Hayden Pond, Otis.
Segment Length: 0.9 miles
Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 11.16 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 78.6%
Residential 6.3%
Open land 2.8%
Agriculture..... 1.5%

Based on the last evaluation of water quality conditions in the Farmington Watershed (1996/97) this unnamed tributary (Segment MA31-07) is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment was not assessed for any uses.



WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
Too limited current data are available so the uses are not assessed.

UNNAMED TRIBUTARY (MA31-07) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS (SEGMENT MA31-07)

- Water quality and biological monitoring is needed during the next monitoring year (2006) to fully assess the use support status of this segment for all its designated uses.

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed municipalities on a site-specific basis.

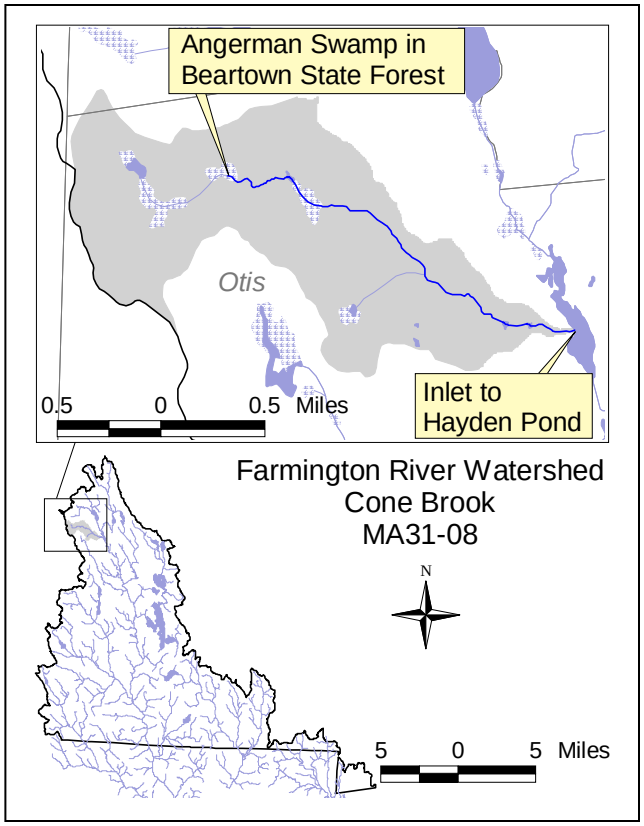
  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

CONE BROOK (SEGMENT MA31-08)
Location: Drainage from Angerman Swamp in Beartown State Forest, Otis to Hayden Pond, Otis.
Segment Length: 2.1 miles
Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 1.53 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 92.1%
Wetlands..... 4.8%
Open land 2.0%
Residential 1.1%



The headwaters of Cone Brook form in Angerman Swamp in Beartown State Forest just south of Dimmock Road in Otis and flow easterly into another wetland. From there Cone Brook flows southeasterly down moderately steep forested terrain into two small ponds and then finally into Hayden Pond in the Village of North Otis.

Based on the last evaluation of water quality conditions in the Farmington Watershed (1996/97) Cone Brook is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life and Aesthetics) and was not assessed for others (Primary Contact Recreation, Secondary Contact Recreation, and Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE

Habitat and Flow

Station FR02M, located approximately 150 meters upstream from the confluence with Hayden Pond, was sampled on 27 August 1996 by DWM biologists. At the time of the survey the brook was approximately 2 meters wide, with depths less than 0.25 meters. The substrates were comprised primarily of boulders, cobble and gravel. FR02M received a "supporting" habitat assessment score of 157, which represents 88% comparability to the primary regional reference station, FR10 (Valley Brook, Granville). Habitat was limited predominately by in stream cover, velocity/depth combinations, and channel flow status. The primary habitat parameters most pertinent to the support of benthic communities (i.e., substrate type and stability, availability of refugia, passage potential) were limited by low flow (Appendix C).

Biology

Macroinvertebrate biomonitoring was conducted by DWM in during August 1996 at Station FR02M (described above). When compared to the reference station at Valley Brook (FR10), FR02M received a total metric score of 21, representing only 50% comparability to reference conditions (RBP II), indicating moderate impairment to the macroinvertebrate community.

It was the opinion of DWM biologists that the moderately impaired biological condition at FR02 is probably a result of two factors working together to shape the downstream benthic community: 1) naturally-induced flow reductions, and 2) a unique upstream environment that may have pronounced effects on a downstream macroinvertebrate assemblage that is not as comparable to reference conditions as initially thought following habitat evaluations. A review of land use patterns showed no obvious anthropogenic sources of impairment. Because of these factors DWM biologists judged the segment to be "fully supporting" the aquatic life use (Appendix C).

Although the data from this survey are more than five years old, comparison of landuse changes in this segment's subwatershed from 1985 to 1999 showed only 2.5% of the total acreage has experienced a change in landuse (MassGIS 2003). Furthermore, the changes that have occurred are not concentrated in a particular area of the subwatershed or along the riparian corridor where they would be more likely to directly impact water quality. Because of this the *Aquatic Life Use* for Cone Brook is assessed as support using the 1996 data.

PRIMARY AND SECONDARY CONTACT RECREATION

Too limited current data are available so the *Primary and Secondary Contact Recreational* uses are not assessed.

AESTHETICS

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 biomonitoring survey (Appendix C).

Although the data from this survey are more than five years old, comparison of landuse changes in this segment's subwatershed from 1985 to 1999 showed only 2.5% of the total acreage has experienced a change in landuse (MassGIS 2003). Furthermore, the changes that have occurred are not concentrated in a particular area of the subwatershed or along the riparian corridor where they would be more likely to directly impact water quality. Because of this the *Aesthetics Use* for Cone Brook is assessed as support.

CONE BROOK (MA31-08) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-08)

- Additional water quality and biological monitoring is needed during the next monitoring year (2006) to fully assess the use support status of this segment for all its designated uses. Fish population and periphyton sampling should accompany the macroinvertebrate sampling effort.

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed municipalities on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

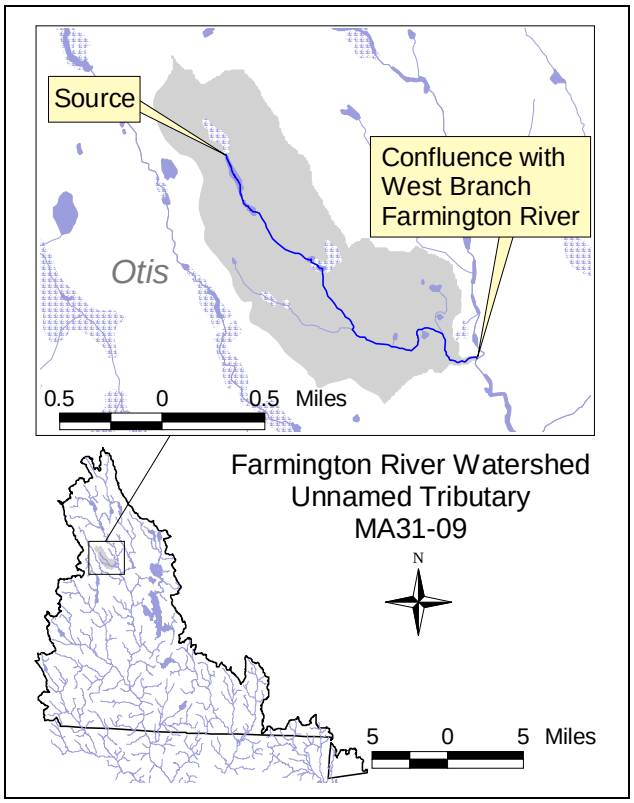
  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

UNNAMED TRIBUTARY (SEGMENT MA31-09)

Location: Source north of Route 23 and east of Harrington Road, Otis to confluence with West Branch Farmington River, Otis.

Segment Length: 2.0 miles

Classification: Class B, Cold Water Fishery



The drainage area of this segment is approximately 1.1 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

- Forest..... 70.8%
- Residential 13.9%
- Open land 7.4%
- Agriculture..... 0.7%

The source begins north of Route 23 and west of Harrington Road in Otis. The tributary then flows in an east southeasterly direction to its confluence with the West Branch Farmington River in Otis.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) this unnamed tributary (Segment MA31-09) is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics) and was not assessed for others (Aquatic Life and Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT

DWM collected water quality and bacteria samples from this unnamed tributary at two locations on May 1996 and June 1997 - Station SA02 (located upstream from Otis Ridge Ski Area) and SA01 (downstream from Otis Ridge Ski Area) and from Station SA01B, a storm drain into this unnamed tributary approximately 100m downstream from SA01 on October and December 1996 and April 1997. These data are reported in Appendix D.

Too limited current data are available so the uses are not assessed.

UNNAMED TRIBUTARY (MA31-09) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS (SEGMENT MA31-09)

- Additional monitoring is needed during the next monitoring year (2006) to fully assess the use support status of this segment.

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997)
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed municipalities on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

DIMMOCK BROOK (SEGMENT MA31-10)

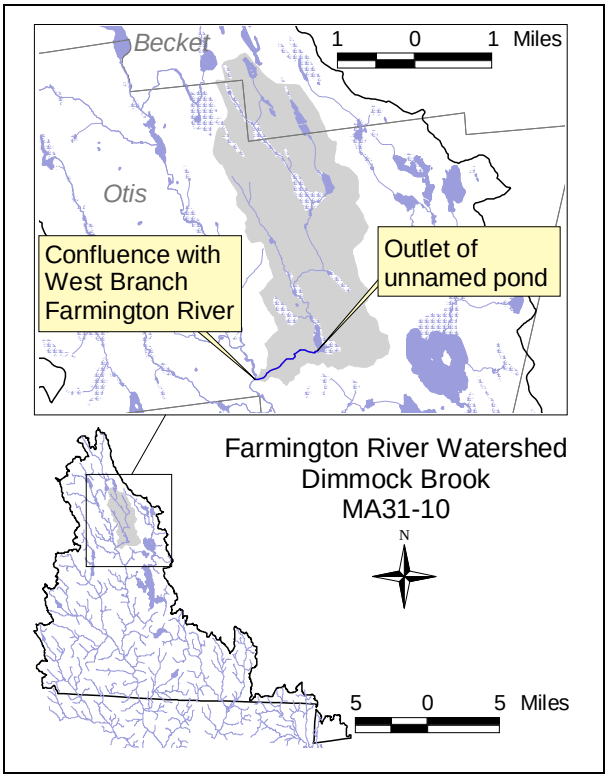
Location: Outlet of unnamed pond near intersection of Route 23 and Gibbs Road, Otis to confluence with West Branch Farmington River, Otis.
Segment Length: 1.0 mile
Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 5.21 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 86.7%
Wetlands..... 6.0%
Residential..... 2.8%
Open land..... 1.3%

Dimmock Brook begins at the outlet of an unnamed pond (listed as Dimmock Brook Pond in PALIS) and flows southwest down steep terrain paralleling Route 23 for a short distance before its confluence with the West Branch Farmington River near Otis town center.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) Dimmock Brook is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment was not assessed for any uses.



WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT

DWM collected water quality and bacteria samples from Dimmock Brook at Station DB01 once in May 1996. The station was located along Route 23, approximately 800 feet downstream from Gibbs Road crossing and 100 feet downstream from first cottage on Route 23. The data are reported in Appendix D.

Too limited current data are available so the uses are not assessed.

DIMMOCK BROOK (MA31-10) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS (SEGMENT MA31-10)

- Additional monitoring during the next monitoring year (2006) is needed to fully assess the use support status of this segment.

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

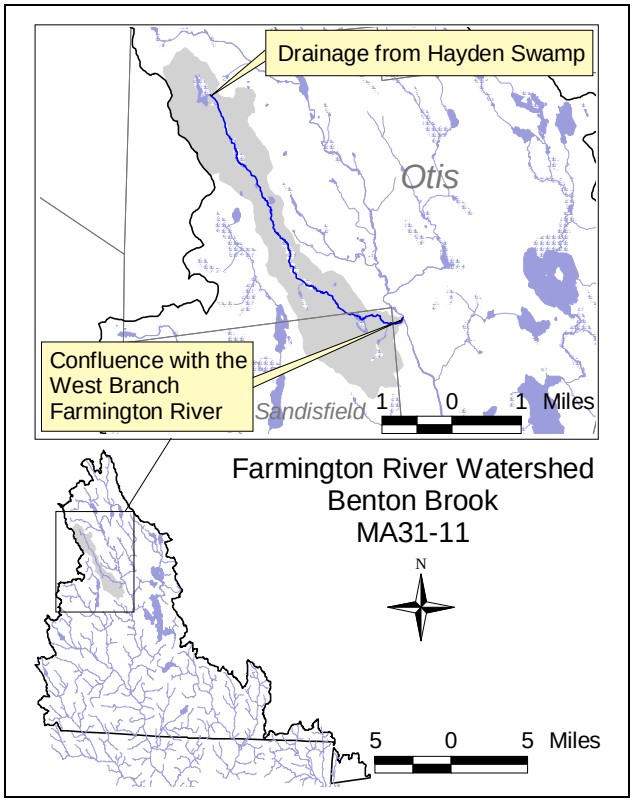
  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

BENTON BROOK (SEGMENT MA31-11)
Location: Drainage from Hayden Swamp, Otis to the confluence with the West Branch Farmington River, Otis.
Segment Length: 5.2 miles
Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 4.19 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 77.6%
Residential 13.3%
Open land 1.3%
Agriculture..... 0.7%



The segment begins as drainage from Hayden Swamp in Otis on the east side of Long Mountain. The brook flows southeast through some wetlands into an impoundment. From there it crosses under West Center Road and then flows into a series of small impoundments before crossing under Route 23. The brook then meanders across a wide floodplain and flows into a small impoundment. It then flows down moderately steep terrain through Camp Sequena Pond in a residential development in the northeast corner of Sandisfield. From here it flows more easterly down steep terrain, crossing under Beech Plain Road and then Route 8, to its confluence with the West Branch Farmington River, just south of the town center of Otis.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) Benton Brook is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life and Aesthetics) and was not assessed for others (Primary Contact Recreation, Secondary Contact Recreation, and Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE
Habitat and Flow

This segment was sampled at Station FR04 by DWM biologists during August of 1996 and 2001. During the 1996 survey the sampling reach was located approximately 100 m downstream from Beech Plain Road. At the time of the August 1996 survey the river was approximately 5 meters wide with depths ranging from 0.25 to 0.5 m. The substrates were comprised primarily of boulders/rubble and cobble. Habitat quality was high and limited only slightly by in stream cover and velocity/depth combinations. FR04 received a habitat assessment score in 1996 of 170, which was 96% comparable to the primary reference Station FR10. (Appendix C)

During the August 2001 survey the sampling reach was located 150 m downstream of Beech Plain Road. The river was approximately 4 m wide and 0.1 m deep. The substrates were comprised primarily of boulders and cobble. This survey resulted in a habitat assessment score of 153/200. DWM biologists noted that because of low baseflow resulting in exposed substrates, shallow pools, and unusable fish cover, habitat quality was diminished here compared to the 1996 biosurvey when water filled the majority of the channel (Appendix A).

Biology

Macroinvertebrates

During the August 1996 survey at Station FR04 (compared to the Valley Brook (FR10) station as the primary regional reference site) the RBP II analysis was 86% comparable to reference conditions, indicating a healthy, non-impaired benthic community. In 1996 FR04 contained the most pollution-intolerant assemblage of macroinvertebrates of any station sampled in the Farmington River Basin survey (Appendix C).

In 2001 the FR04 benthos assemblage received a total metric score of 40 (RBP III), representing 95% comparability to its reference station in Valley Brook (FR10) and resulting in a bioassessment of "non-impacted". The benthic macroinvertebrate sample at this station contained the highest density and richness of pollution sensitive taxa than any of the low-order steams sampled during the 2001 Farmington River watershed survey (Appendix A).

Fish

Fish population sampling was conducted in Benton Brook 15 August 2001 by DWM near the Beech Plain Road crossing in Otis. Fish species captured in order of abundance included: common shiner (*Luxilus cornutus*), dace (*Rhinichthys* sp.), golden shiner (*Notemigonus crysoleucas*), cutlips minnow (*Exoglossum maxillingua)*, creek chub (*Semotilus atromaculatus*), brook trout (*Salvelinus fontinalis*), and white sucker (*Catostomus commersoni*). The fish population was dominated by fluvial dependants/specialists. The presence of young of the year of brook trout and cutlips minnow, both pollution intolerant species, is indicative of excellent water and habitat quality (Appendix G).

Periphyton

DWM biologists collected periphyton samples from Station FR04 (downstream from Beech Plain Road, Sandisfield) in August of 2001. Canopy cover was reported as 90% and percent algal cover was 0. Periphyton was not collected at this site so the dominant algal type and form was not identified (Appendix B).

The *Aquatic Life Use* is assessed as support based on the non-impacted benthic macroinvertebrate community analysis, the fish population and periphyton sampling information.

AESTHETICS

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 and 2001 biomonitoring surveys (Appendix A and C).

The *Aesthetics Use* is assessed as support for this segment based on the habitat quality information.

BENTON BROOK (MA31-11) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-11)

- Additional monitoring is needed to fully assess the use support status of this segment. Though not a high priority, biomonitoring is recommended here during the next MA DEP Farmington River watershed survey in 2006. Fish population sampling should accompany the macroinvertebrate sampling effort.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

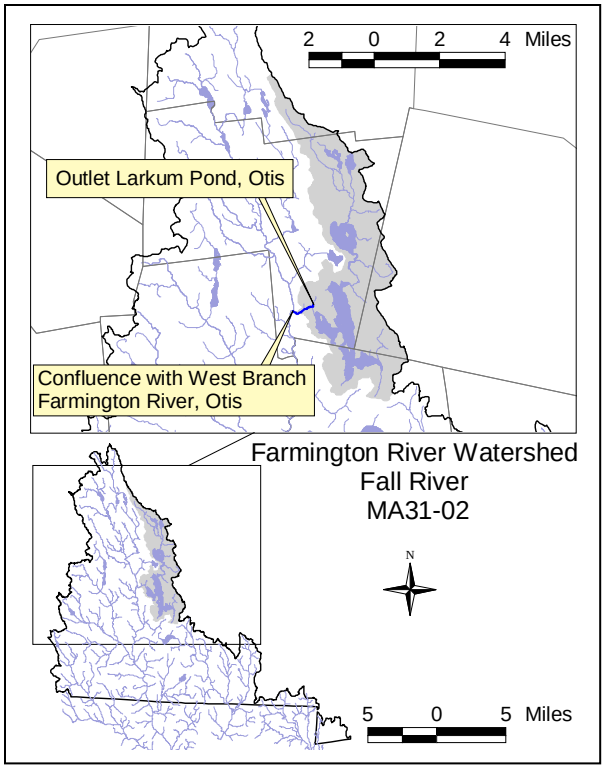
FALL RIVER (SEGMENT MA31-02)
Location: Outlet Larkum Pond, Otis to confluence with West Branch Farmington River, Otis.
Segment Length: 0.8 miles
Classification: Class B, Cold Water Fishery

The drainage area of this segment is approximately 16.55 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 70.6%
Residential 7.5%
Open land 1.8%
Agriculture..... 0.9%

The headwaters of the Fall River begin at the outlet of Larkum Pond in Otis and flow southwest down steep terrain to a confluence with the West Branch Farmington River in Otis. This river is also joined by an unnamed tributary draining Otis Reservoir.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) Fall River is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life and Aesthetics) and was not assessed for others (Primary Contact Recreation, Secondary Contact Recreation, and Fish Consumption).



WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE

Habitat and Flow

The outlet stream from Otis Reservoir joins the Fall River just downstream from the outlet of Larkum Pond. The water level in Otis Reservoir has been drawn down since its formation in the mid 1800s with annual winter drawdowns reported since at least the 1930s. ENSR (2001) reports that the Reservoir has been lowered in October of each year since the late 1960s by just over 8 feet and then raised after ice-out to its full level, typically by May. The drawdown results in flow alteration in the lower 0.63 miles of the Fall River and in the West Branch Farmington River below the confluence with the Fall River.

This segment was sampled at Station FR03 by DWM biologists during August of 1996 and 2001 (Appendices C and A). During the 1996 survey the sampling reach was located approximately midway between Otis Reservoir outlet and the Fall River confluence with the West Branch Farmington River. At the time of the August 1996 survey the river was approximately 4 m wide and 0.5 m deep. The substrates were comprised primarily of boulders/rubble. Habitat quality was high and limited only slightly by channel flow status and bank stability. FR03 received a habitat assessment score in 1996 of 177, which was 99% comparable to the Valley Brook reference station (FR10).

During the August 2001 survey the sampling reach was located approximately 20 m upstream from Reservoir Road in Otis (500 m upstream from the confluence with the West Branch Farmington River). The river was approximately 3 m wide and ranged from 0.2 m to 0.4 m deep. The substrates were comprised primarily of bedrock, boulders and cobble. FR03 received a total habitat assessment score of 174/200, which was higher than the habitat score received by its reference station, FR10. FR03 habitat parameters appeared similar to those recorded here during the 1996 biomonitoring survey.

Biology

Macroinvertebrates

During the August 1996 survey at Station FR03 the RBP II analysis was 71% comparable to reference conditions at the primary regional reference site (Valley Brook, Station (FR10), placing it in the moderately impaired category for biological integrity. It was non-impaired (79 % comparable) to a secondary reference station on Hubbard Brook (FR09) (Appendix C).

In 2001 the FR03 benthos assemblage received a total metric score of 36 (RBP III), representing 86% comparability to its reference station in Valley Brook (FR10) and resulting in a bioassessment of "non-impacted". The 2001 biological assessment of "non-impacted" showed improvement from the 1996 bio-assessment. However, DWM biologists caution that results may be influenced by temporal and spatial variability between the surveys and that the level of analysis (RBP II) performed on the 1996 samples was less rigorous than the bioassessment (RBP III) performed in 2001. DWM biologists concluded that the benthic community at this station reflected the conditions expected downstream from an impoundment (Appendix A).

Fish

Fish population sampling in the Fall River was conducted by DWM on 15 August 2001 approximately 0.7 river miles below the outfall of Otis Reservoir. The stream at this location is considered to be high gradient and the in-stream habitat was optimal. At the time of the survey, however, available habitat was limited by low flow conditions (Appendix G). Fish species, captured in order of abundance included: dace (*Rhinichthys* sp.), brook trout (*Salvelinus fontinalis),* and a largemouth bass (*Micropterus salmoides*). The fish sample was dominated by fluvial specialists. The presence of brook trout is indicative of excellent water quality, but it should be noted that young of the year trout were absent from the sample. In addition, the total number of fish collected was low, possibly due to flow conditions/alterations described in the habitat and flow section above.

Chemistry – water

One station (FL01), located in Sandisfield at the Reservoir Road crossing, was sampled once in May 1996 for temperature, specific conductivity, chloride, suspended solids, and turbidity. These data are reported in Appendix D, but they are too limited to be used in this assessment.

The *Aquatic Life Use* is assessed as support based on the benthic macroinvertebrate community analysis for Fall River. This use, however, is identified with an *Alert Status* because of potential impacts resulting from hydromodification (flow alteration resulting from upstream impoundment releases). These modifications potentially limit the amount of habitat available during spring and summer months (due to reservoir filling and water level maintenance) as well as affect the quality of habitat available during the fall (increased flows resulting from drawdown). The hydromodification from Otis Reservoir affects all but the uppermost 0.1 mile of this river. The low number of fish collected may be the result of habitat alteration.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

One station (FL01, described above) was sampled once in May 1996 for fecal coliform bacteria. The count is reported in Appendix D. However, too limited current data are available, so the recreational uses are not assessed.

AESTHETICS

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 and 2001 biomonitoring surveys (Appendix C and A, respectively).

The *Aesthetics Use* is assessed as support based on the habitat quality information.

FALL RIVER (MA31-02) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

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

RECOMMENDATIONS (SEGMENT MA31-02)

- Additional monitoring is needed to fully assess the use support status of this segment. Biomonitoring is recommended here during the next MA DEP Farmington River watershed survey in 2006 to continue to monitor potential impoundment effects (including flow alteration from drawdown) in this portion of the Fall River. Fish population sampling should accompany the macroinvertebrate sampling effort.

- Continue to implement the recommendations set forth in the of the Otis Reservoir Diagnostic Feasibility Study. (ENSR 2001)

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

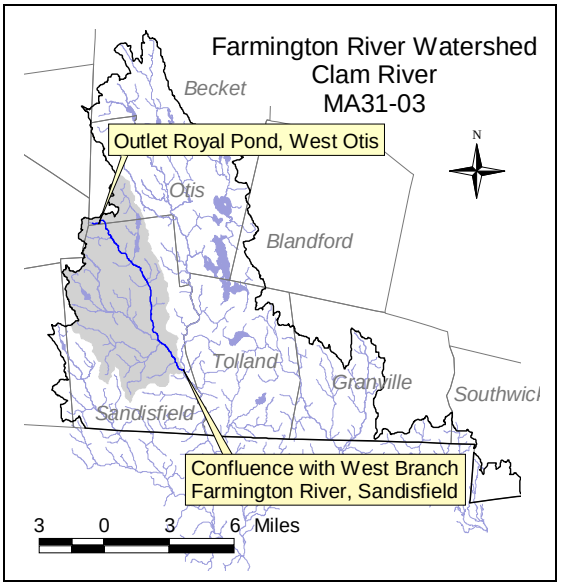
  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

- The outlet control practices at Otis Reservoir should be reviewed and, to the extent possible, managed to minimize the impacts associated with the releases on the flow regimes of the downstream waterbodies.

CLAM RIVER (SEGMENT MA31-03)
Location: Outlet of Royal Pond, West Otis to confluence with West Branch Farmington River, Sandisfield.
Segment Length: 9.5 miles
Classification: Class B, Cold Water Fishery



The drainage area of this segment is approximately 31.33 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 88.3%
Agriculture..... 3.5%
Residential 2.8%
Open land 1.2%

The headwaters of the Clam River drain from Royal Pond, just west of the Village of West Otis in the Town of Otis. The river flows southeast through a series of small impoundments, crosses into the Town of Sandisfield, and then enters a narrow steep river valley for a short distance. The river enters a wider flood plain, flows into two small impoundments, and then enters a reservoir. The river continues to flow southeast through moderately steep terrain to its confluence with the Buck River in the Village of West New Boston. From there the Clam River meanders slightly to its confluence with the West Branch Farmington River just north of the village of Roosterville in Sandisfield (or south of New Boston).

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) the Clam River is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life, Primary Contact Recreation, Secondary Contact Recreation and Aesthetics) and was not assessed for the other (Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE
Habitat and Flow

This segment was sampled at two locations during August of 1996 by DWM biologists. Station FR06A was used primarily as an upstream control site for FR06B in an attempt to bracket the Buck River and suspected NPS inputs. FR06A was approximately 10 m upstream from the confluence with the Buck River. The FR06B sampling reach was located downstream between Beech Pain Road, Sandisfield and the mouth of the Buck River. In August of 2001 DWM biologists sampled only at Station FR06B.

At the time of the August 1996 survey the river was approximately 8 m wide and ranged between 0.25 m and 0.5 m deep. The substrates at both sites were comprised primarily of boulders, cobble and gravel. Habitat quality at the upstream station (FR06A) was excellent, limited only slightly by sediment deposition. The site received a habitat assessment score of 181, representing 93% comparability to the regional reference station (Hubbard Brook - FR09). Habitat at FR06B was very similar to the upstream control station except for a reduced vegetative riparian zone and slight reduction of velocity/depth combinations and channel alterations. The downstream site received a habitat assessment score in 1996 of 169, which was 93% comparable to the upstream control site and classified as "supporting" when compared to the regional reference station (FR09) (Appendix C).

During the August 2001 survey Station FR06B received a habitat assessment score of 177/200, which was comparable to habitat conditions at the reference station in Hubbard Brook (Table A4). The reach was approximately 5 m wide with depths ranging from 0.25 m in the riffle areas to almost

0.50 m in the pools. Boulder and cobble/gravel were the predominant substrate types. Habitat parameters at FR06B performed slightly better than during the 1996 biosurvey here (Appendix A).

Biology

Macroinvertebrates

During the August 1996 survey at Station FR06A (compared to the Hubbard Brook (FR09) station as the primary regional reference site) the RBP II analysis was 86% comparable to reference conditions, indicating a non-impaired benthic community. The downstream Station FR06B was also found to be 86% comparable to reference conditions (in this case the upstream control station), placing it in the non-impaired category. DWM biologists concluded that the NPS inputs upstream or adjacent to the sampling reach are not impacting biological conditions at FR06B (Appendix C).

In 2001 the FR06B benthos assemblage received a total metric score of 38 (RBP III), representing 90% comparability to its reference station in Hubbard Brook (FR09) and resulting in a bioassessment of "non-impacted" (Appendix A).

Fish

Fish were sampled by DWM in the Clam River 15 August 2001 at Station FR06B just upstream from the confluence with the Buck River in the village of West New Boston. Fish species captured in order of abundance included: dace (*Rhinichthys* sp.), cutlips minnow (*Exoglossum maxillingua)*, slimy sculpin (*Cottus cognatus*), brown trout (*Salmo trutta*), white sucker (*Catostomus commersoni*), brook trout (*Salvelinus fontinalis*), and pumpkinseed (*Lepomis gibbosus*) (Appendix G). The presence of multiple age classes of brook trout, brown trout and slimy sculpin, which are fluvial dependants/specialist pollution intolerant species, are indicative of excellent water quality and stable flow regimes. In addition, three other fluvial dependant/specialists were present.

Periphyton

DWM biologists collected periphyton samples from Station FR06B in August of 2001. Canopy cover was reported as 10% and percent algal cover was 95%. Dominant algal type/habitat /growth form was green thin film found in the riffles and a green filamentous macroalgae in the pools (Appendix B).

Chemistry – water

Water quality sampling was conducted at two stations in the Clam River - CR01 located at the Route 57 bridge crossing in Sandisfield, and CR02 located in the Village of West New Boston midway between the confluence with Silver Brook and Beech Plain Road crossing. Samples were collected at CR02 in May, June and July of 1996 and April of 1997, while CR01 was sampled only in May 1996. These data are reported in Appendix D.

The *Aquatic Life Use* is assessed as support in the Clam River based on the benthic macroinvertebrate community analysis and the fish population information.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Station CR01 (described above) was sampled for fecal coliform bacteria in May 1996 and Station CR02 (described above) was sampled for fecal coliform bacteria in May, June, and July of 1996 and April of 1997. These data are reported in Appendix D.

Too limited current data are available so the recreational uses are not assessed.

AESTHETICS

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 and 2001 biomonitoring surveys (Appendix C and A, respectively).

The *Aesthetics Use* is assessed as support.

CLAM RIVER (MA31-03) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-03)

- Additional monitoring is needed to fully assess the use support status of this segment. As a major tributary to the West Branch Farmington River biomonitoring is recommended here during the next MA DEP Farmington River watershed survey in 2006. Fish population and periphyton sampling should accompany the macroinvertebrate sampling effort. Surveys should also investigate the impacts of runoff from dirt roads to the water and habitat quality of streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

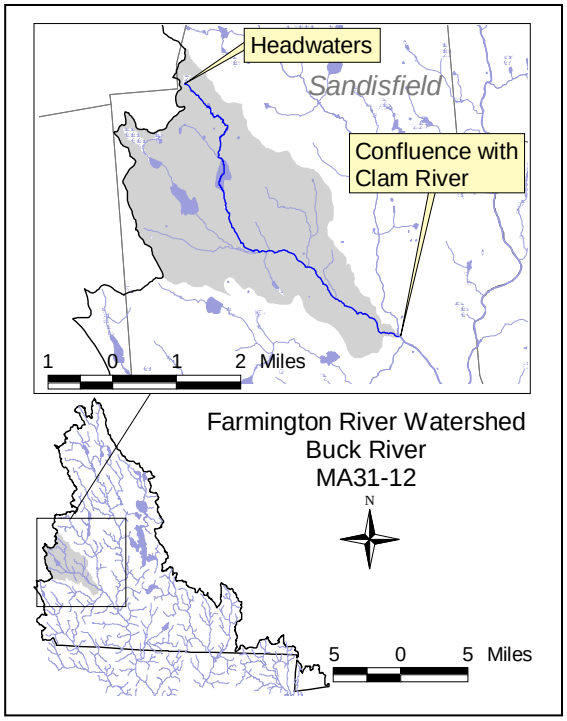
  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

- Work with riverside landowners in Sandisfield and Otis to implement best management practices to control runoff from their properties. Encourage the continuation of nonpoint source education outreach efforts to landowners in the subwatershed initiated by the Berkshire Regional Planning Commission and the Farmington Watershed Team.

BUCK RIVER (SEGMENT MA31-12)

Location: Headwaters draining wetland just south of Morley Hill and Cronk Road, Sandisfield to confluence with the Clam River, Sandisfield.
Segment Length: 6.4 miles
Classification: Class B, Cold Water Fishery



The drainage area of this segment is approximately 8.77 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 87.6%
Agriculture..... 4.6%
Residential..... 4.1%
Wetlands..... 1.6%

The headwaters of the Buck River drain a wetland just south of Morley Hill in northwest Sandisfield. The river flows southeast over moderately steep terrain and flows into a series of small ponds and impoundments before entering Abbey Lake in Sandisfield State Forest. From the Abbey Lake dam the river continues flowing southeast to a confluence with the outflow from West Lake and an unnamed tributary. The river flows in an easterly direction over moderately steep terrain to the village of Montville where it then turns southeast again, paralleling Route 57. The river continues flowing southeast over moderately steep terrain to its confluence with the Clam River in the Village of West New Boston in Sandisfield.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) the Buck River is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life and Aesthetics) and was not assessed for others (Primary Contact Recreation, Secondary Contact Recreation, and Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

Station FR07, located immediately above the confluence with the Clam River, was sampled by DWM biologists on 27 August 1996. At the time of the survey the brook was approximately 8 meters wide with depths ranging from 0.25 to 0.5 m. The substrates were comprised primarily of boulders and cobble. FR07 received a "supporting" habitat assessment score of 168, which represents 94% comparability to the primary regional reference Station FR10 (Valley Brook, Granville). Habitat was limited predominately by velocity depth combinations, bank stability (right bank) and riparian vegetative zone width (right bank) (Appendix C).

Biology

Macroinvertebrate biomonitoring was conducted on 27 August 1996 at Station FR07 (described above) by DWM biologists. When compared to the reference station at Valley Brook (FR10), FR07 received a total metric score of 36, representing 86% comparability to reference conditions (RBP II), placing the community in the non-impaired category. DWM biologists concluded that NPS inputs in this subwatershed do not appear to be impacting the health of the aquatic community in this area (Appendix C).

Water Quality

Limited water quality sampling was conducted at two stations on the Buck River - Station BR01, located in Sandisfield approximately 100 feet upstream of West Street crossing and Station BR02, located in Sandisfield approximately 1500 feet below Montville from Route 57 - in June or October 1996. These data are reported in Appendix D.

The *Aquatic Life Use* is assessed as support in the Buck River based on the benthic macroinvertebrate community analysis. Although the data from this survey are more than five years old, comparison of landuse changes in this segment's subwatershed from 1985 to 1999 showed only 2.5% of the total acreage has experienced a change in landuse (MassGIS 2003). Furthermore, the changes that have occurred are not concentrated in a particular area of the subwatershed or along the riparian corridor where they would be more likely to directly impact water quality.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

Two bacteria samples were collected from the Buck River at one station each (Station BR01 and Station BR02 described above). These data are reported in Appendix D.

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 biomonitoring survey (see above comment regarding older data) (Appendix C).

Too limited current bacteria data are available so the recreational uses are not assessed. The *Aesthetics Use* is assessed as support, however, based on the habitat quality information (see above comment regarding older data).

BUCK RIVER (MA31-12) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-12)

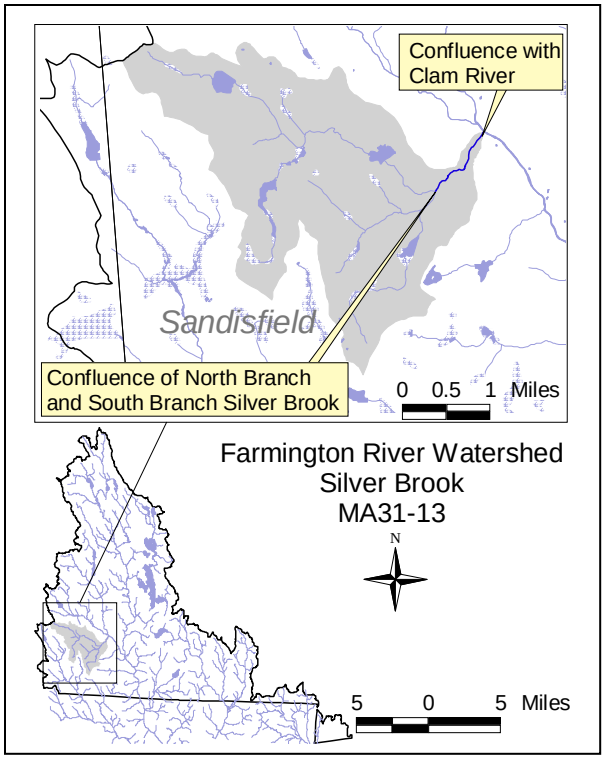
- Additional monitoring is needed to fully assess the use support status of this segment. Fish population and periphyton sampling should accompany the macroinvertebrate sampling effort. Surveys should also investigate the impacts of runoff from dirt roads to the water and habitat quality of streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.
  2. Identify critically eroding areas within the subwatershed on a site-specific basis.
  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.
  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

- Work with riverside landowners in Sandisfield to implement best management practices to control runoff from their properties. Encourage the continuation of nonpoint source education outreach efforts to landowners in the subwatershed initiated by the Berkshire Regional Planning Commission and the Farmington Watershed Team.

SILVER BROOK (SEGMENT MA31-13)
Location: Confluence of North Branch and South Branch Silver Brook, Sandisfield to confluence with Clam River, Sandisfield.
Segment Length: 1.0 mile
Classification: Class B, Cold Water Fishery



The drainage area of this segment is approximately 6.76 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 89.7%
Agriculture..... 3.0%
Residential 2.4%
Open Land 1.2%

Silver Brook begins at the confluence of the North Branch Silver Brook and South Branch Silver Brook in Sandisfield. From this confluence Silver Brook flows northeast over gently sloping terrain and then down steep terrain. From there it crosses under Route 57 to its confluence with the Clam River in the village of West New Boston in Sandisfield.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) Silver Brook is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics) and was not assessed for others (Aquatic Life and Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE
Biology
MDFW biologists sampled fish from Silver Brook and North Branch Silver Brook (tributary to Silver Brook) in July of 2001. Fish species captured in both of these brooks were blacknose dace (*Rhinichthys atratulus*) and brook trout (*Salvelinus fontinalis*). The presence of multiple age classes of brook trout, a fluvial dependant species that is intolerant of pollution, is indicative of excellent water quality (Richards 2003a).

Chemistry – water
Limited water quality sampling was conducted by DWM at one station (SB01) in Silver Brook in May and October 1996 and once in April 1997. Station SB01 was located in Sandisfield at the Route 57 crossing approximately 10 to 15 feet above the confluence with the Clam River. These data are reported in Appendix D.

Although the presence of brook trout is indicative of excellent water quality, too limited current data are available so the *Aquatic Life Use* is not assessed for Silver Brook.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS
Station SB01 was sampled three times, once in May and October 1996 and once in April 1997, for fecal coliform bacteria. These data are in Appendix D.

Too limited current data are available to assess the *Recreational* and *Aesthetics* uses in Silver Brook.

SILVER BROOK (MA31-13) USE SUMMARY TABLE

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
				
NOT ASSESSED				

RECOMMENDATIONS (SEGMENT MA31-13)

- Additional monitoring is needed to fully assess the use support status of this segment. Fish population and periphyton sampling should accompany the macroinvertebrate sampling effort. Studies should also investigate the impacts of runoff from dirt roads to the water and habitat quality of streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

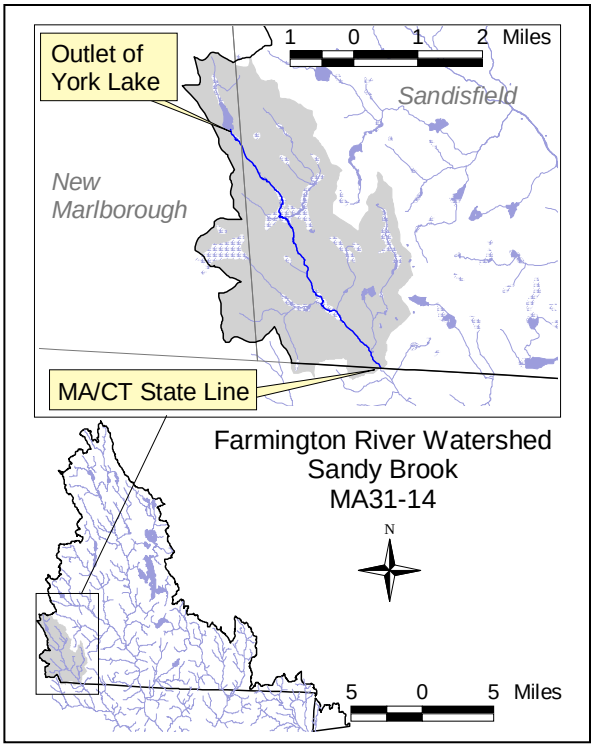
  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

- Work with riverside landowners in Sandisfield to implement best management practices to control runoff from their properties. Encourage the continuation of nonpoint source education outreach efforts to landowners in the subwatershed initiated by the Berkshire Regional Planning Commission and the Farmington Watershed Team.

SANDY BROOK (SEGMENT MA31-14)
Location: Outlet York Lake, New Marlborough to border of Sandisfield, Massachusetts/Norfolk, Connecticut.
Segment Length: 5.0 miles
Classification: Class B, Cold Water Fishery



The drainage area of this segment in Massachusetts is approximately 9.88 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 88.7%
Agriculture..... 1.9%
Residential..... 1.3%
Open Land..... 0.3%

Sandy Brook begins as the outlet from York Lake and then flows southeast over relatively flat terrain through a series of small ponds into a wetland and then into a small impoundment where it is joined by Cherry Brook. From there Sandy Brook flows by the village of South Sandisfield flowing through a narrow river valley closely paralleling the South Sandisfield New Marlborough Road. The brook then enters a wetland where it joins with an unnamed brook originating from Wolf Swamp. From there it continues to flow southeast into a narrow steep valley where it crosses the Massachusetts border into Connecticut.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) Sandy Brook is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life, Primary Contact Recreation, Secondary Contact Recreation, and Aesthetics) and was not assessed for Fish Consumption.

MDFW sampled Riiska Brook, a tributary to Sandy Brook, in July of 2001. Fish species captured in order of abundance included: brook trout (*Salvelinus fontinalis*), Atlantic salmon (*Salmo salar*), blacknose dace (*Rhinichthys atratulus*), longnose dace (*Rhinichthys cataractae*), and American eel (*Anguilla rostrata*). Their sampling also documented multiple age classes of brook trout, an intolerant, fluvial dependent species (Richards 2003a).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE
Habitat and Flow

Station FR08, located approximately 100 m upstream from New Marlboro Road and about 500 m upstream from the Massachusetts-Connecticut border, was sampled by DWM biologists on 26 August 1996. At the time of the survey the brook was approximately 3 m wide with depths ranging from 0.5 m to approximately 1 m. The substrates were comprised primarily of boulders and cobble. FR08 received a "supporting" habitat assessment score of 191, which represents 100% comparability to the primary regional reference station FR10 (Valley Brook, Granville). DWM biologists concluded that upstream activities (saw mill, residences, nearby road) were not having an impact on habitat quality at this site (Appendix C).

Station FR08A was sampled in August 2001 approximately 3 km upstream from the reach sampled in 1996 (Station FR08, described above). At the time of this survey the brook was approximately 4 m wide with depths ranging from 0.1 to approximately 1 m. The substrates were predominately boulders and cobble. FR08A received a total habitat assessment score of 174/200, which was higher than the reference station (Valley Brook – FR10). Habitat was limited somewhat by channel flow status due to reduced flow conditions (Appendix A).

Biology

Macroinvertebrates

During the August 1996 survey at Station FR08 RBP II analysis of the invertebrate community found biological integrity to be non-impaired. The reach received a total metric score of 36, representing 86% comparability to the primary reference station, FR10 (Appendix C).

In 2001 the FR08A benthos assemblage received a total metric score of 40 (RBP III), representing 95% comparability to its reference station (Valley Brook - FR10) and resulting in a bioassessment of "non-impacted". The FR08A sampling reach supported one of the most diverse macroinvertebrate assemblages sampled in 2001 in the Farmington River watershed (Appendix A).

Fish

Fish were sampled in Sandy Brook on 15 August 2001 by DWM biologists just downstream from Norfolk Road Bridge crossing in Sandisfield. Fish species captured in order of abundance included dace (*Rhinichthys* sp), common shiner (*Luxilus cornutus*), creek chub (*Semotilus atromaculatus*), white sucker (*Catostomus commersoni*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), brook trout (*Salvelinus fontinalis*), American eel (*Anguilla rostrata*), and chain pickerel (*Esox niger*). The assemblage was heavily dominated by fluvial species. In addition, the presence of white sucker, brook trout and creek chub are also indicative of a stable flow regime. Pumpkinseed, chain pickerel, and brown bullhead (macrohabitat generalists) most likely emigrated from York Lake or other lentic environments located upstream (Appendix G).

Periphyton

DWM biologists collected periphyton samples from Station FR08A (just downstream from Norfolk Road) in August of 2001. Canopy cover was reported as 98% and percent algal cover was <1%. The dominant algae was blue-green- filamentous (*Lyngbya versicolor*) (Appendix B).

Chemistry – water

Limited water quality data were collected by DWM at three stations in Sandy Brook in June and July 1996. Station SN01 was located in South Sandisfield just downstream from the Norfolk Road bridge crossing. Station SN02 was located above South Sandisfield center and accessed from Route 183. Station SN03 was located in South Sandisfield at the Road Hill Road crossing. These data are reported in Appendix D.

The *Aquatic Life Use* is assessed as support in Sandy Brook based on the benthic macroinvertebrate community analysis and the fish population information.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

Three stations (SN01, SN02, SN03 – described above) were sampled twice each in June and July 1996, for fecal coliform bacteria. These data are reported in Appendix D.

The data are too limited to assess the *Recreational Uses* in Sandy Brook.

AESTHETICS

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 and 2001 biomonitoring surveys (Appendix C and A, respectively).

The *Aesthetics Use* is assessed as support for Sandy Brook based on the habitat quality information.

SANDY BROOK (MA31-14) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-14)

- Additional monitoring is needed to fully assess the use support status of this segment. Biomonitoring is recommended here during the next MA DEP Farmington River watershed survey in 2006. Fish population sampling should accompany the macroinvertebrate sampling effort. Studies should also be designed to investigate the impacts of runoff from dirt roads to the water and habitat quality of streams in this subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

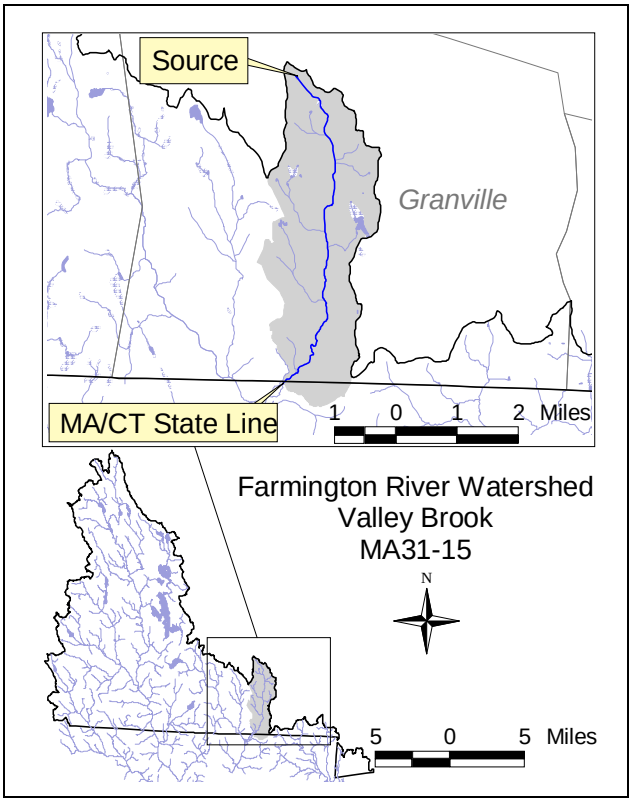
  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

- Work with riverside landowners in Sandisfield to implement best management practices to control runoff from their properties. Encourage the continuation of nonpoint source education outreach efforts to landowners in the subwatershed initiated by the Berkshire Regional Planning Commission and the Farmington Watershed team.

VALLEY BROOK (SEGMENT MA31-15)
Location: Source, northwest of Holden Hill, Granville to border of Granville, Massachusetts/Hartland, Connecticut.
Segment Length: 5.9 miles
Classification: Class B, Cold Water Fishery



The drainage area of this segment in Massachusetts is approximately 6.67 square miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 91.0%
Open Land 3.6%
Agriculture..... 2.8%
Residential 1.2%

The segment drains a small wetland northwest of Holden Hill in Granville and flows south over moderately sloped undeveloped terrain into Twinning Hollow passing under Route 57. Downstream from here the valley floor widens, the stream gradient lessens and there is some floodplain development allowing the brook to meander. The brook then begins to flow toward the southwest, crossing into Connecticut. The segment ends at the Hartland, Connecticut/Granville, Massachusetts border, but the brook continues to its confluence with Hubbard Brook forming the East Branch Farmington River at the north end of Barkhamsted Reservoir.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) Valley Brook is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life and Aesthetics) and was not assessed for others (Primary Contact Recreation, Secondary Contact Recreation, and Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE
Habitat and Flow

Valley Brook Station FR10 began approximately 500 m upstream from Route 57 in Granville and was sampled by DWM biologists on 26 August 1996. At the time of the survey the brook was approximately 4 m wide and approximately 0.25 m deep. The substrates were comprised primarily of boulders, cobble and gravel. The site received a total habitat assessment score of 178/200, limited somewhat by marginal velocity depth combinations likely due to reduced flow conditions. FR10 was designated a regional reference station because of its high habitat evaluation and minimal potential nonpoint source influences in the subwatershed (Appendix C).

Station FR10 (described above) was sampled again in August 2001 by DWM biologists. At the time of this survey the brook was approximately 5-9 m wide with depths ranging from 0.1 to 0.2 m. The substrates were predominately boulders and cobble. FR08A received a total habitat assessment score of 167/200, which was limited by in stream cover and velocity/depth combinations. Station FR10 was again chosen as the regional reference station based on its high habitat evaluation and absence of potential upstream nonpoint source pollution inputs (Appendix A).

Biology

Macroinvertebrates

During the August 1996 survey at Station FR10 RBP II analysis reflected a healthy invertebrate community, although as a reference station it does not receive an impairment score. The reach received a total metric score of 42 out of a possible 42 (Appendix C).

In 2001 the FR10 benthos assemblage received a total metric score of 42 (RBP III). DWM biologists concluded that the optimum community structure and balanced trophic structure exhibited in the macroinvertebrate assemblage at this station indicated that this portion of Valley Brook is indicative of the "best-attainable" conditions in the Farmington River Watershed (Appendix A).

Fish

The fish community was sampled in Valley Brook by DWM on 14 August 2001 at Station FR10, located approximately 300-500 m upstream from Route 57 in Granville. A total of 121 fish were collected at this station. Fish species captured in order of abundance included brook trout (*Salvelinus fontinalis),* dace (*Rhinicthys sp.),* and slimy sculpin (*Cottus cognatus).* This community was representative of a high-quality, cold-water stream. Two of the species were pollution intolerant and all fishes collected were fluvial dependants/specialists. There was also a reproducing population of brook trout based on the range of lengths of those collected (Appendix G).

Periphyton

DWM biologists conducted periphyton sampling from Station FR10 (described above) in August of 2001. Canopy cover was reported as 100% and percent algal cover was not recorded although biologists noted that mosses dominated (90%) the substrate. Algal samples were not collected (Appendix B).

The *Aquatic Life Use* is assessed as support in Valley Brook based on the benthic macroinvertebrate community (regional reference station) and the fish population information.

AESTHETICS

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 and 2001 biomonitoring surveys (Appendix A and C).

The *Aesthetics Use* is assessed as support for Valley Brook based on the habitat quality information.

VALLEY BROOK (MA31-15) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-15)

- Additional monitoring is needed to fully assess the use support status of this segment. As a regional reference station biomonitoring is recommended here during the next MA DEP Farmington River watershed survey in 2006, especially if evaluations of first to second-order stream biota are again planned. Fish population sampling should accompany the macroinvertebrate sampling effort. In addition, water quality monitoring here would help to establish baseline conditions while supplementing the biological data.

- New home construction is occurring in the upper portions of the Valley Brook subwatershed. To maintain the biological integrity of Valley Brook every effort should be made to properly manage land development in this relatively pristine subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

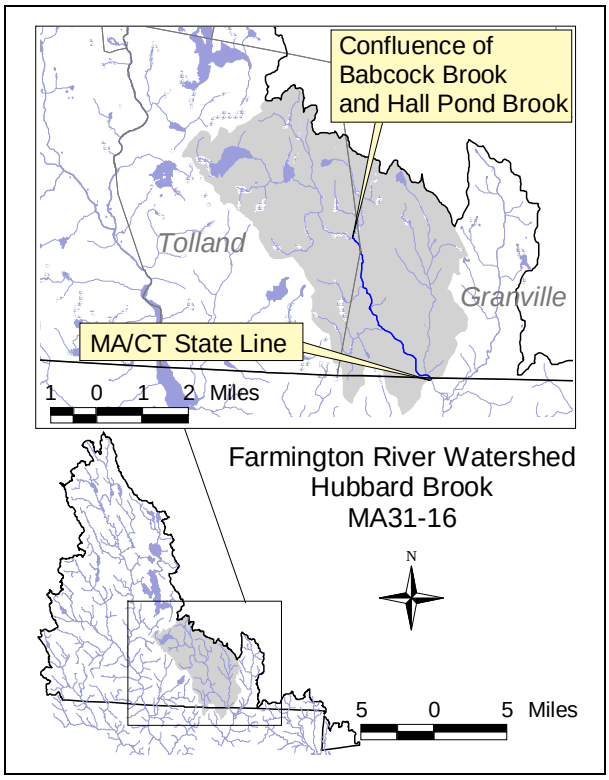
  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

- Work with riverside landowners in Granville to implement best management practices to control runoff from their properties. Encourage the continuation of nonpoint source education outreach efforts to landowners in the subwatershed initiated by the Berkshire Regional Planning Commission and the Farmington Watershed team.

HUBBARD BROOK (SEGMENT MA31-16)
Location: Confluence Babcock Brook and Hall Pond Brook, Tolland to border of Granville, Massachusetts/Hartland, Connecticut.
Segment Length: 4.0 miles
Classification: Class B, Cold Water Fishery



The drainage area of this segment is approximately 20.06 miles. Land-use estimates (top 4, excluding water) for the subwatershed (map inset, gray shaded area):

Forest..... 91.3%
Wetlands..... 2.6%
Agriculture..... 2.2%
Residential..... 1.1%

Hubbard Brook is formed at the confluence of Babcock Brook and Hall Pond Brook in Tolland, just north of where Route 57 crosses into Granville. The brook soon crosses into Granville and flows southeast along the west flank of Ore Hill over moderately steep undeveloped terrain. The brook then flows into Granville State Forest crossing under West Hartland Road. From this point the valley terrain becomes steeper, the stream gradient higher and the brook flows more eastward. The segment ends at the Hartland, Connecticut/Granville, Massachusetts border. Just after crossing the state line into Connecticut the brook enters a delta before flowing into the north end of Barkhamsted Reservoir, which is also the beginning of the East Branch Farmington River.

Based on DWM's last evaluation of water quality conditions in the Farmington Watershed (1996/97) Hubbard Brook is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This segment supported some designated uses (Aquatic Life and Aesthetics) and was not assessed for others (Primary Contact Recreation, Secondary Contact Recreation, and Fish Consumption).

WMA WATER WITHDRAWAL AND NPDES WASTEWATER DISCHARGE SUMMARY
Based on the available information there are no WMA regulated water withdrawals or NPDES surface water discharges in the subwatershed of this segment.

USE ASSESSMENT
AQUATIC LIFE
Habitat and Flow

Hubbard Brook Station FR09 was located approximately 300 m upstream from West Hartland Road in Granville State Forest and was sampled by DWM biologists on 26 August 1996. At the time of the survey the brook was approximately 4 m wide and ranged from 0.25 m to 1 m deep. The substrates were comprised primarily of boulders and cobble. The site received a total habitat assessment score of 195/200, which was the highest of the Farmington River biomonitoring stations. FR09 was designated a regional reference station for the higher order streams in the watershed because of its high habitat evaluation and minimal potential nonpoint source influences in the subwatershed (Appendix C).

Station FR09 (described above) was sampled again in August 2001 by DWM biologists. At the time of this survey the brook was approximately 7 m wide with depths ranging from 0.2 to 0.5 m. The substrates were predominately boulders and cobble. FR09 received a total habitat assessment score of 185/200, limited only slightly by velocity/depth combinations. Station FR10 was again chosen as the regional reference station for the larger order streams sampled in 2001 in the

watershed based on its high habitat evaluation and absence of potential nonpoint source pollution inputs (Appendix A).

Biology

Macroinvertebrates

During the August 1996 survey at Station FR09 RBP II analysis reflected a healthy invertebrate community, although as a reference station it does not receive an impairment score. The reach received a total metric score of 42 out of a possible 42 (Appendix C).

In 2001 the FR10 benthos assemblage again received a total metric score of 42 out of 42 (RBP III). DWM biologists noted that the Hubbard Brook biomonitoring station was characterized by a macroinvertebrates indicative of a healthy aquatic community, good water quality, and "least impacted" conditions (Appendix A).

Fish

The fish community was sampled in Hubbard Brook by DWM on 14 August 2001 at Station FR09 (described above). A total of 93 fish were collected from this station. Fish species captured in order of abundance included brook trout (*Salvelinus fontinalis*), dace (*Rhinicthys sp.*), brown trout (*Salmo trutta*), creek chub (*Semotilus atromaculatus),* white sucker (*Catostomus commersoni*), fallfish (*Semotilus corporalis*). The trout represented a number of different age classes. Brown trout, creek chub, fallfish, and white sucker were also collected, although their overall numbers were low. The dominance of different age classes of brook trout is indicative of excellent water and habitat quality (Appendix G).

Periphyton

DWM biologists conducted periphyton sampling from Station FR09 (described above) in August of 2001. Canopy cover was reported as 5% and percent algal cover was <5%. Dominant algal type was a blue-green species identified as *Phormidium sp*. No nuisance conditions were reported (Appendix B).

The *Aquatic Life Use* is assessed as support in Hubbard Brook based on the benthic macroinvertebrate community (regional reference station) and the fish population information.

AESTHETICS

No objectionable conditions (e.g., water odors, oils, deposits) were recorded by DWM biologists during the 1996 and 2001 biomonitoring surveys (Appendix A and C).

The *Aesthetics Use* is assessed as support for Hubbard Brook based on the habitat quality information.

HUBBARD BROOK (MA31-16) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS (SEGMENT MA31-16)

- Additional monitoring is needed to fully assess the use support status of this segment. As a reference station, biomonitoring is recommended here during the next MA DEP Farmington River watershed survey in 2006, especially if evaluations of larger order stream biota are again planned. Fish population sampling should accompany the macroinvertebrate sampling effort. In addition, water quality monitoring here would help to establish baseline conditions while supplementing the biological data.

- To maintain the water quality and biological integrity of Hubbard Brook, every effort should be made to properly manage land development in this relatively pristine subwatershed.

- Encourage town DPWs to implement dirt roads best management practices as recommended in the S319 Dirt Roads Demonstration Project (BRPC 2001).

- Improve the ability of the subwatershed municipalities to manage stormwater runoff by implementing the following actions recommended in the Farmington River Watershed Action Plan (BRPC 1997).
  1. Work with Massachusetts Highway Department to rectify all existing stormwater management and erosion problems on their property and state maintained roadways in the watershed.

  2. Identify critically eroding areas within the subwatershed on a site-specific basis.

  3. Develop a stormwater management plan for the subwatershed to address problems such as flooding, erosion, and inadequate stormwater management quality control.

  4. Using erosion and sediment control guidelines developed by MA DEP develop best management standards for each subwatershed municipality that are effective in addressing stormwater quality and are appropriate in rural development areas.

- Work with riverside landowners in Tolland and Granville to implement best management practices to control runoff from their properties. Encourage the continuation of nonpoint source education outreach efforts to landowners in the subwatershed initiated by the Berkshire Regional Planning Commission and the Farmington Watershed team.

FARMINGTON RIVER WATERSHED - LAKE ASSESSMENTS

A total of 48 lakes, ponds or impoundments (the term "lakes" will hereafter be used to include all) have been identified and assigned Pond and Lake Information System (PALIS) code numbers in the Farmington River Watershed (Ackerman 1989). The total surface area of the Farmington River Watershed lakes in Massachusetts is 2,840 acres (only 176 acres of 728 acre Colebrook Reservoir is in Massachusetts). They range in size from one to 989 acres. This report presents information on 18 of the Farmington River Watershed lakes that are listed in the WBS/ADB database (Figure 8). The remaining 30 lakes, which total 705 acres, are unassessed and are not currently included as segments in the WBS/ADB database.

The 18 lakes assessed in this report represent 2,135 acres of the 2,840 or 75% of the acreage in the Farmington River Watershed. Baseline lake surveys were conducted on Benton and Shaw Ponds in May and August of 1996 (Appendix D). A Diagnostic/ Feasibility Study was conducted on Otis Reservoir in 2000 (ENSR, 2001). Fish toxics monitoring was performed by DWM on Shaw and Big Ponds and in Otis Reservoir (Appendix F). Synoptic surveys were conducted by DWM at 14 of these lakes in 1996 (Appendix D). The 18 lakes lie wholly or partly within 6 of the basin's 10 communities (Figure 8). One town, Otis, has all or part of nine of those lakes within its boundaries. Eight of the lakes assessed are less than 50 acres in total surface area.

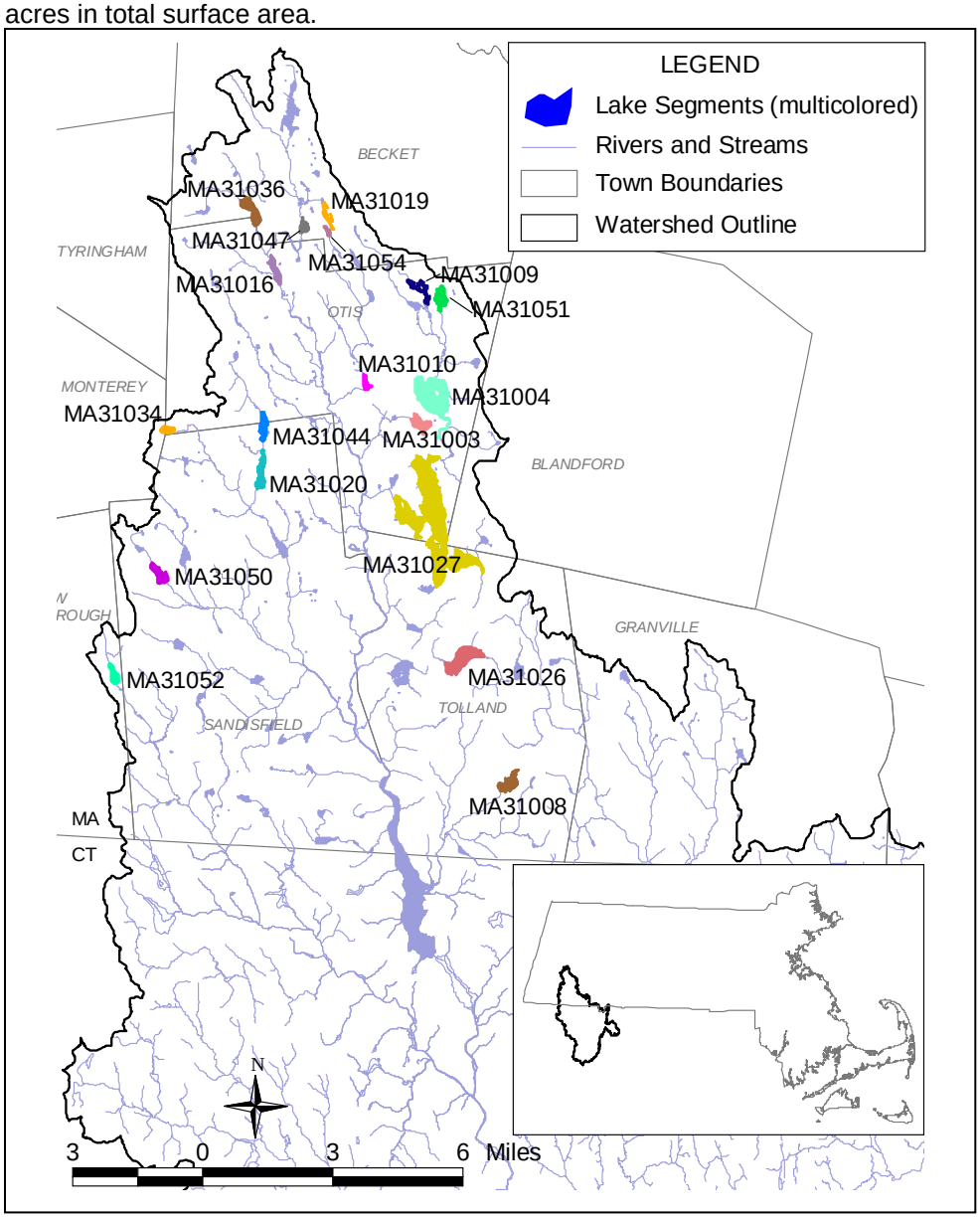


Figure 8. Lake Segments in the Farmington River Watershed - Massachusetts Portion.

LAKE USE ASSESSMENTS

Lake assessments are based on information gathered during DWM surveys (recent and historic) and pertinent information from other reliable sources (e.g., abutters, herbicide applicators, diagnostic/feasibility studies, MDPH, etc.). The 1996 DWM lake synoptic surveys were conducted by making field observations from at least one access point per lake to estimate areal cover of aquatic and wetland macrophyte species, list all aquatic and wetland species observed, and measure transparency where feasible. Synoptic surveys also focused on the presence or absence of non-native macrophytes (Appendix D). The 1996 baseline surveys conducted by DWM on Shaw Pond and Benton Pond included in-lake measurements of dissolved oxygen, pH, temperature, Secchi disk transparency, nutrients, detailed macrophyte mapping, sediment chemistry, and fish tissue analysis (Appendix D and Appendix F). Two tributaries to Shaw Pond were also sampled as part of its baseline survey (Shales Brook – Segment MA31-04 and an unnamed tributary segment, MA31-05). The data are discussed in the segment assessments and also presented in Appendix D. A Diagnostic/Feasibility Study on Otis Reservoir was conducted for MA DEM (now DCR) by ENSR during the spring, summer and fall of 2000 as part of a Massachusetts Watershed Initiative Farmington Watershed Team annual workplan project. The comprehensive diagnostic portion of the study included in-lake and tributary sampling (during both wet and dry weather), groundwater and sediment sampling, biological sampling, and preparation of a hydrologic budget and nutrient loading estimates. To determine the status of the *Fish Consumption Use* fish consumption advisory information was obtained from the MDPH (MDPH 2004).

The use assessments and supporting information are entered into an EPA assessment database (either the WBS or the ADB). Data on the presence of non-native plants were entered into the MA DEP/DWM informal non-native plant-tracking database.

AQUATIC LIFE

Habitat and Flow

Otis Reservoir

The water level in Otis Reservoir has been drawn down since its formation in the mid 1800s with annual winter drawdowns reported since at least the 1930s. ENSR (2001) reports that the Reservoir has been lowered in October of each year since the late 1960s by just over 8 feet and then raised after ice-out to its full level, typically by May. ENSR describes the littoral substrate of Otis Reservoir as a heterogeneous habitat comprised of cobble, rocks, and boulders with limited muck in shallow depths that provides a rocky shoreline habitat, which is rare in Massachusetts lakes. This is likely a result of low macrophyte biomass caused by the repeated drawdowns. Although a reduction of macrophytes may have diminished the available physical habitat structure, ENSR concludes that general overall habitat structure in Otis Reservoir is favorable for many species. However, repeated drawdowns likely have both positive and negative habitat impacts. In addition to influencing inlake habitat structure, water level drawdowns in lakes and the corresponding refill period may cause abnormal fluctuations in flow and water regime downstream of the impoundment (see West Branch Farmington River Segment MA31-01 and Fall River Segment MA31-02).

Biology

Baseline and Synoptic Surveys

Non-native macrophytes were observed in two of the 17 lakes surveyed by DWM in 1996 (Appendix D). *Myriophyllum heterophyllum* (variable water milfoil) was found in Noyes Pond, Tolland and *M. spicatum* (Eurasian water milfoil) was documented in Benton Pond, Otis. Additionally, in 1998 the DCR (formerly MA DEM) Lakes and Ponds grant program provided funds for herbicide treatment of Shaw Pond, Otis for nuisance aquatic macrophytes, including the non-native species, *M. spicatum*. (MA DEP 1999b). The mere presence of these species is considered an imbalance to the native biotic community and so Noyes Pond, Benton Pond and Shaw Pond are listed as impaired (307 acres). Additionally, these species have a high potential for spreading and are likely to have established themselves in downstream lake and river segments in the Farmington River Basin, which may not have been surveyed. Figure 9 indicates where these non-native aquatic species were observed and the likely, or potential, avenues of downstream spreading.

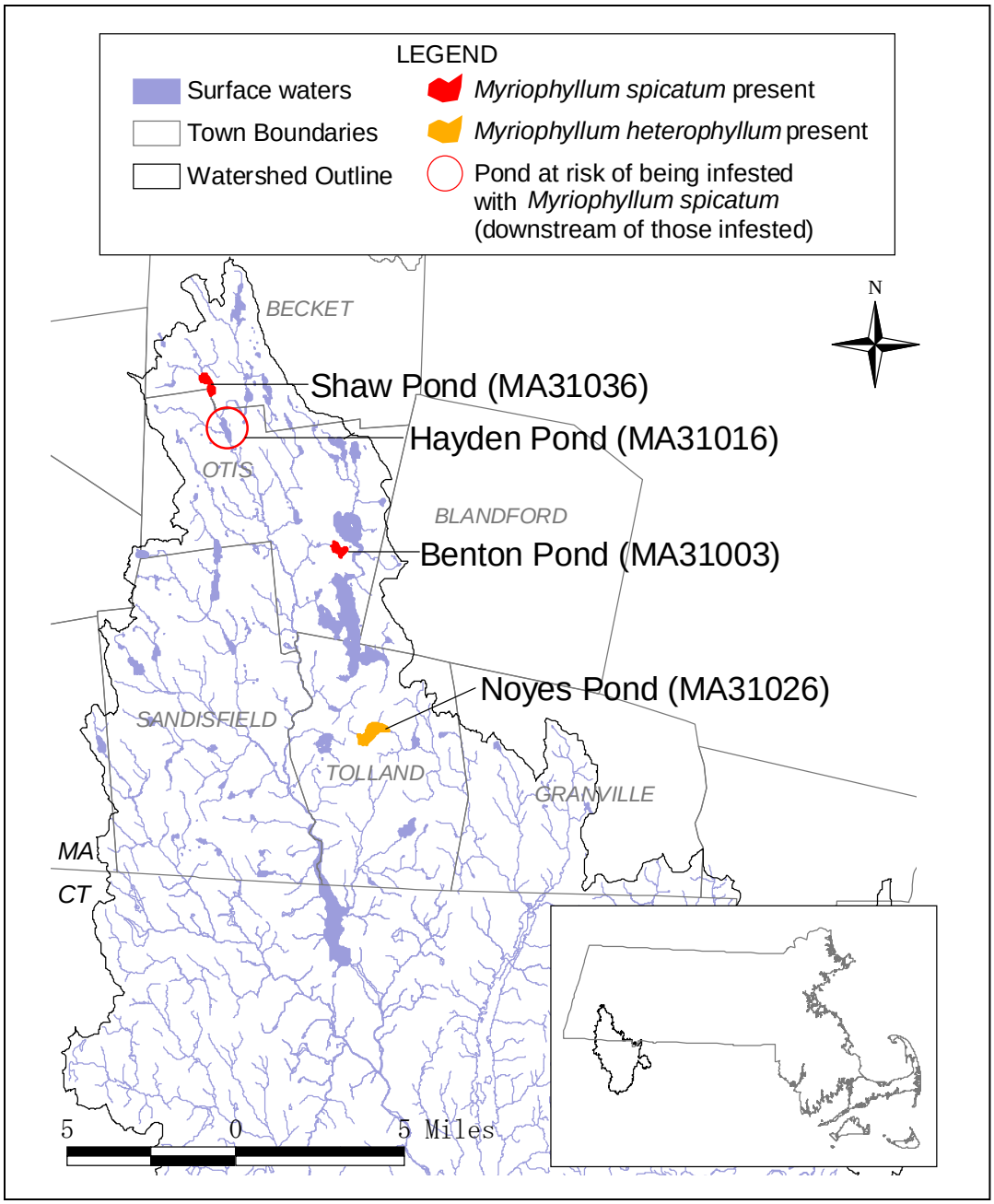


Figure 9. Farmington Lakes with Observed Non-native Vegetation.

At least one of two non-native wetland species, *Lythrum salicaria* (purple loosestrife) and *Phragmites australis* (reed grass), were identified at seven (41%) of the lakes surveyed by DWM in 1996 (Appendix D). Although the presence of these species is not generally a cause of impairment to lakes their invasive growth habit can result in the impairment of wetland habitat associated with lakes.

Otis Reservoir D/F Study

ENSR (2001) reports that no non-native plants were observed during the 2000 Diagnostic/Feasibility Study on Otis Reservoir. During the study macrophytes covered approximately 25% of the total surface area of Otis Reservoir and were comprised of species typical to oligotrophic to mesotrophic waters. ENSR further reported that recent fish sampling information from Otis Reservoir is limited. The last comprehensive survey conducted by MDFW in 1978 documented 12 species of fish that included the endangered bridle shiner (*Notropis bifrenatus*), rainbow smelt (*Osmerus sp.*), and a variety of warm water species, as well as stocked salmonids (ENSR 2001).

Chemistry-water

Baseline Surveys on Benton and Shaw Ponds

Baseline surveys were conducted by DWM in Benton Pond and Shaw Pond in May and August of 1996. Hypolimnetic oxygen was depleted in both ponds during the August survey. Nutrient and ionic concentrations at both ponds were low during both surveys and pH was neutral (Appendix D).

Otis Reservoir Diagnostic Feasibility Study

As part of a comprehensive Diagnostic Feasibility Study of Otis Reservoir ENSR (2001) conducted in-lake sampling at four stations on five occasions from May to October 2000. Water quality parameters measured included: profiles of temperature and dissolved oxygen and surface and bottom samples for pH, specific conductivity, turbidity, alkalinity, total phosphorus, dissolved phosphorus, nitrate-N, and total Kjeldahl nitrogen. Hypolimnetic oxygen depletion occurred at all four in-lake stations during the May through September surveys. The pH ranged from 6.1 to 7.3. Turbidity (range 0.69 to 20.1 NTU) and specific conductivity (range 39 – 90.9 µS/cm) were generally low. Nutrient concentrations were generally low throughout the survey. Trophic state index calculated by ENSR (2001) using Carlson (1977) indicated that Otis Reservoir was borderline between oligotrophic and mesotrophic conditions during summer stratification.

In-lake water quality sampling of Big Pond, Otis was conducted in September 2000 as part of the Diagnostic Feasibility Study of Otis Reservoir. Water chemistry in Big Pond was similar to Otis Reservoir chemistry. Hypolimnetic oxygen was depleted; pH was neutral; and specific conductivity, turbidity and nutrients were all relatively low (ENSR 2001). However, too little data exist to assess the *Aquatic Life Use* in Big Pond.

Chemistry-sediment

Baseline Surveys

Sediment grab samples were collected from both Shaw and Benton Ponds during the August 1996 baseline survey. Samples were analyzed for PCB, organochlorides, metals (As, Cu, Pb, Zn, Cr, Fe, Hg, Ni), % solids, total phosphorus, and total Kjeldahl nitrogen. The results of the sediment chemical analyses (as well as reference L-EL and S-EL concentrations) are presented in Appendix D.

PCB were not detected in the sediments of either lake (see Appendix D) but organochlorine pesticides (DDE and DDD) were detected in both, at low levels. Benton Pond sediments contained approximately 3 - 4 times more of both compounds than Shaw Pond sediments. Comparison of the DDE and DDD levels detected in these lakes to threshold levels established by Persaud et al. (1993) show that concentrations in Shaw Pond are within the No Effect Level (N-EL) and concentrations in Benton Pond are within the Lowest Effect Level (L-EL). The L-EL indicates a level of sediment contamination that can be tolerated by the majority of benthic organisms

The concentration of the heavy metals and the nutrients in Shaw Pond sediments, comprised of 12% solids, exceeded the S-EL for TKN and As. S-EL is the level of a contaminant at which severe detrimental impacts to biota may occur (Persaud et al. 1993). Four metals (Cu, Fe, Pb, and Zn) and TP were within the range between the L-EL and the S-EL. Although Cd is also slightly higher than the L-EL it was reported less than the minimum detection limit so this interpretation should be used with caution. The remaining metals (Cr, Hg, and Ni) were below the L-EL. It should be noted that the As concentration exceeded the S-EL by a factor of three and TKN exceeded the S-EL by almost a factor of two. The reasons for these elevated concentrations are unknown. Enrichment ratios for As, Pb, and Zn exceeded one and were calculated to be 103, 18, and 7, respectively (also reported in Appendix D, Table 3). The sediments collected from Benton Pond were comprised of 7% solids. Both replicate samples exceeded the S-EL level for TKN only. Four metals (As, Cu, Pb, and Zn) and TP fell between the lowest and severe effect levels. Cd was also higher than the L-EL, but since it was reported less than the minimum detection limit this interpretation should be used with caution. All remaining metals (Cr, Fe, Hg, and Ni) were below the L-EL. TKN exceeded the S-EL by a factor of three. Enrichment ratios for Pb, As, Zn, and Cu exceeded one (Appendix D).

Diagnostic Feasibility Study
Sediment samples were collected by ENSR from Otis Reservoir at four inlake stations in August of 2000 as part of the Diagnostic Feasibility Study (ENSR 2001). Samples were analyzed for particle size, total nitrogen, phosphorus, total and volatile solids, total organic carbon, total PAH, EPH aliphatic and aromatic hydrocarbons, and metals (As, Cd, Cr, Hg, Mn, Ni, Pb, Zn).

The percent solids in the sediment of Otis Reservoir ranged from 9.1% to 16.1%. All of the metals concentrations except Cd fell below the L-EL. Cd exceeded the L-EL only slightly at three of the four stations. TKN exceeded the S-EL by about a factor of two at all stations. Concentrations of MBTE and extractable petroleum hydrocarbons were below the method detection limit at all four stations. However, the method detections limit was higher than the threshold levels for L-EL established by Persaud et al. (1993). Consequently, these concentrations should not be used to draw conclusions about Otis Reservoir sediment contamination.

The *Aquatic Life Use* was assessed as impaired in Shaw Pond, Noyes Pond and Benton Pond based on the confirmed presence of non-native macrophyte(s) representing a total of 307 acres. Benton Pond also had elevated levels of As, Cu, Pb, Zn, TKN and organochlorine pesticides in the sediments. Elevated levels of As and TKN in the sediments of Shaw Pond is also a concern. Otis Reservoir (representing 989 acres) was assessed as support for *Aquatic Life Use* but identified with an Alert Status because of potential habitat impacts from drawdown and elevated sediment concentrations of Cd and TKN.

The remaining 14 lakes, representing 839 acres in the Farmington River Watershed were not assessed for the *Aquatic Life Use* because of the cursory nature of the 1996 synoptic surveys and/or the lack of dissolved oxygen data and other more recent observations.

FISH CONSUMPTION

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

During the winter of 1997 fish were collected by DWM from Benton Pond, Otis Reservoir, and Shaw Pond for fish toxics monitoring. During 2001 fish were collected from Big Pond and again from Otis Reservoir because no top-level predators (which typically contain the highest mercury concentrations) were collected in 1997. Samples from both years were analyzed for selected metals, PCB and organochlorine pesticides. All results were submitted to the Massachusetts Department of Public Health (MDPH) for review. These data can be found in Appendix F, Tables 1 and 2.

In the 1997 samples from Benton Pond, Shaw Pond, and Otis Reservoir none of the contaminant analytes were detected in concentrations of concern. In the 2001 samples from Otis Reservoir mercury exceeded the MDPH "trigger level" of 0.5 mg/kg in largemouth bass, smallmouth bass, and white perch (0.68, 0.67, and 0.69 mg/kg respectively). As a result the MDPH issued the following fish consumption advisory in June of 2002 for Otis Reservoir:

"Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body. The general public should limit consumption of all fish from this waterbody to two meals per month."

In the 2001 Big Pond samples mercury exceeded the MDPH "trigger level" of 0.5 mg/kg in both largemouth and smallmouth bass (1.2, and 0.89 mg/kg respectively). The MDPH issued the following fish consumption advisory in June of 2002 for Big Pond:

"Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body. The general public should not consume largemouth bass from this waterbody. The general public should limit consumption of all fish from this waterbody to two meals per month."

Two lakes, representing a total of 1,314 acres, are assessed as impaired (due to mercury contamination) for the *Fish Consumption Use* (Table 4). The source of mercury is unknown, although atmospheric deposition is suspected. The remaining 16 lakes, representing 821 acres, are not assessed for the *Fish Consumption Use*. [NOTE: The MDPH fish consumption advisory list contains the status of each water body for which an advisory has been issued. If a water body is not on the list, it may be because either an advisory was not warranted or the water body has not been sampled. MDPH's most current Fish Consumption Advisory list is available online at http://www.state.ma.us/dph/beha/fishlist.htm.]

PRIMARY AND SECONDARY CONTACT RECREATION AND AESTHETICS

Bacteria samples were collected at the following DCR beaches: Otis Reservoir Beach in Tolland State Forest in Otis and York Lake Beach in Sandisfield State Forest, New Marlborough. With the exception of a 2-day posting in June 2001 at York Lake Beach, no other postings or closures were reported by DCR for either lake in both 2001 and 2002 swimming seasons (MDPH 2002b). Because York Lake Beach was only posted for 2 days in 2001 and no postings or closures occurred at Otis Reservoir Beach or York Lake Beach in the 2002 season both lakes were assessed as support for *Primary* and *Secondary Contact Recreational* and *Aesthetic* uses.

The *Primary* and *Secondary Contact Recreational* and *Aesthetic* uses were assessed as support in two lakes: Otis Reservoir and York Lake representing a total of 1,018 acres (Table 4). The *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are not assessed in the remaining 16 lakes (1,117 acres) in the Farmington River Watershed because of a lack of recent bacteria, transparency and in-lake survey data.

SUMMARY

A total of 5 of the 18 lakes in the Farmington River Watershed assessed in this report were impaired for either the *Aquatic Life Use* and/or the *Fish Consumption Use* (Table 4). Causes of impairment included non-native plant infestation and mercury contamination. Otis Reservoir and Big Pond, totaling 1,314 acres, were impaired for the *Fish Consumption Use* due to mercury contamination. Benton, Noyes and Shaw Ponds, totaling 307 acres, were impaired for non-native plant infestation. One lake (Otis Reservoir), representing 989 acres supported the *Aquatic Life Use* and two lakes (Otis Reservoir and York Lake), totaling 1,018 acres supported the *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses. A total of 12 lakes (485 out of 2,135 acres) were not assessed for any uses.

Table 4. Farmington River Watershed Lake Use Summary

Lake, Location	WBID	Size (Acres)	Aquatic Life (Impairment Cause)	Fish Consumption (Impairment Cause)	Primary Contact (Impairment Cause)	Secondary Contact (Impairment Cause)	Aesthetics (Impairment Cause)
Benton Pond, Otis	MA31003	61	IMPAIRED (non-native plants)	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Myriophyllum spicatum (Eurasian water milfoil) was documented in Benton Pond during the 1996 synoptic survey (Appendix D). Anoxic conditions (DO <1 mg/L) were documented by DWM near the bottom of the deep hole in Benton Pond in August 1996 . In the sediments, four metals (As, Cu, Pb, and Zn) and TP fell between the lowest and severe effect levels and TKN exceeded the S-EL by a factor of three. Because of the presence of a non-native aquatic macrophyte the *Aquatic Life Use* is assessed as impaired. The non-native wetland plant, *Phragmites australis,* was also identified. Fish toxics monitoring was conducted by DWM in Benton Pond in February 1997 (Appendix F, Table 1). Too limited bacteria data were available so the *Primary* and *Secondary Contact Recreational* uses are not assessed. Based on the last evaluation of water quality conditions Benton Pond is listed in Category 4c of the 2002 Integrated List of Waters (MA DEP 2003a). This lake was assessed as impaired, but the impairment was not caused by a pollutant (exotic species).							
Big Pond, Otis	MA31004	325	NOT ASSESSED	IMPAIRED (mercury)	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Fish toxics monitoring was conducted by DWM in Big Pond in June 2001 (Appendix F, Table 2). MDPH issued a fish consumption advisory recommending "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body. The general public should not consume any largemouth bass from this water body. The general public should limit consumption of non-affected fish from this water body to two meals per month" because of elevated mercury (MDPH 2004). Atmospheric deposition is the suspected source of impairment. Based on the last evaluation of water quality conditions Big Pond is listed in Category 5 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake was assessed as impaired and requires a TMDL for metals and organic enrichment/low DO.							
Cranberry Pond, Tolland	MA31008	75	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Based on the last evaluation of water quality conditions Cranberry Pond is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake supported some designated uses (Secondary Contact Recreation and Aesthetics) and was not assessed for others (Aquatic Life, Primary Contact Recreation, and Fish Consumption).							
Dimmock Brook Pond, Otis	MA31010	15	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Based on the last evaluation of water quality conditions Dimmock Brook Pond is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). No uses were assessed in this lake.							
Hayden Pond, Otis	MA31016	28	NOT ASSESSED*	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Myriophyllum sp. (possibly *heterophyllum*) was observed in Hayden Pond during the 1996 synoptic survey (Appendix D). * Because of the possibility that this non-native aquatic plant may be present the *Aquatic Life Use* was identified with an alert status. The presence of this non-native aquatic plant needs to be confirmed. Based on the last evaluation of water quality conditions Hayden Pond is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). No uses were assessed in this lake.							

Table 4 continued. Farmington River Watershed Lake Use Summary

Lake, Location	WBID	Size (Acres)	Aquatic Life (Impairment Cause)	Fish Consumption (Impairment Cause)	Primary Contact (Impairment Cause)	Secondary Contact (Impairment Cause)	Aesthetics (Impairment Cause)
Long Bow Lake, Becket	MA31019	26	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
The non-native wetland plants *Lythrum salicaria* and *Phragmites australis* were identified during the synoptic survey in the summer of 1996 (Appendix D). Based on the last evaluation of water quality conditions, Long Bow Lake is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake supported some designated uses (Secondary Contact Recreation and Aesthetics) and was not assessed for others (Aquatic Life, Primary Contact Recreation, and Fish Consumption).							
Lower Spectacle Pond, Sandisfield	MA31020	70	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Based on the last evaluation of water quality conditions Lower Spectacle Pond is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake supported some designated uses (Secondary Contact Recreation and Aesthetics) and was not assessed for others (Aquatic Life, Primary Contact Recreation, and Fish Consumption).							
Noyes Pond, Tolland	MA31026	166	IMPAIRED (non-native plants)	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Myriophyllum heterophyllum (variable water milfoil) was found in Noyes Pond during the 1996 synoptic survey (Appendix D). Because of the presence of a non-native aquatic macrophyte the *Aquatic Life Use* is assessed as impaired. Based on the last evaluation of water quality conditions, Noyes Pond is listed in Category 4c of the 2002 Integrated List of Waters (MA DEP 2003a). This lake was assessed as impaired, but the impairment was not caused by a pollutant (exotic species).							
Otis Reservoir, Otis/Tolland/ Blandford	MA31027	989	SUPPORT	IMPAIRED (mercury)	SUPPORT	SUPPORT	SUPPORT
In-situ measurements of water quality (e.g., DO, pH) indicated generally good water quality conditions in Otis Reservoir and no non–native aquatic macrophytes in the summer of 2000 (ENSR 2001). Anoxic conditions (DO <1 mg/L), however, were documented by ENSR near the bottom of the reservoir in the summer of 2000 and so the *Aquatic Life Use* is identified with an Alert Status. Fish toxics monitoring was conducted by DWM in Otis Reservoir in February 1997 and again in June 2001 (Appendix F, Tables 1 and 2). MDPH issued a fish consumption advisory recommending "Children younger than 12 years, pregnant women, and nursing mothers should not eat any fish from this water body. The general public should limit consumption of all fish from this water body to two meals per month" because of mercury (MDPH 2004). Atmospheric deposition is the suspected source of impairment. Otis Reservoir Beach in the MA DCR Tolland State Forest has a public bathing beach. This beach was not posted during the 2001 or 2002 swimming season. Because the beach was open for both the 2001 and 2002 bathing seasons the *Recreational* and *Aesthetic* uses are assessed as support. Based on the last evaluation of water quality conditions Otis Reservoir is listed in Category 5 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake was assessed as impaired and requires a TMDL for metals.							
Royal Pond, Monterey/Otis	MA31034	7	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
The non-native wetland plant *Lythrum salicaria* was identified during the synoptic survey in the summer of 1996 (Appendix D).							

Table 4 continued. Farmington River Watershed Lake Use Summary

Lake, Location	WBID	Size (Acres)	Aquatic Life (Impairment Cause)	Fish Consumption (Impairment Cause)	Primary Contact (Impairment Cause)	Secondary Contact (Impairment Cause)	Aesthetics (Impairment Cause)
Shaw Pond, Becket	MA31036	80	IMPAIRED (non-native plants)	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Shaw Pond was treated in 1999 for a non-native aquatic macrophyte, *Myriophyllum spicatum* (Eurasian water milfoil) (MA DEP 1999b). Therefore the *Aquatic Life Use* is assessed as impaired. Anoxic conditions (DO <1 mg/L) were also documented by DWM near the bottom of Shaw Pond in August 1996, which is also of concern. The sediment concentrations of TKN and As exceeded the S-EL and Cu, Fe, Pb, Zn and TP were within the range between the L-EL and the S-EL. Fish toxics monitoring was conducted by DWM in Shaw Pond in February 1997 (Appendix F Table 1). Too limited bacteria data were available so the *Primary* and *Secondary Contact Recreational* uses are not assessed. The non-native wetland plant *Lythrum salicaria* was identified during the synoptic survey in the summer of 1996 (Appendix D). Based on the last evaluation of water quality conditions Shaw Pond is listed in Category 5 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake was assessed as impaired and requires a TMDL for organic enrichment/low DO.							
Silver Shield Pond, Otis	MA31054	10	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
The non-native wetland plant *Phragmites australis* was identified during the synoptic survey in the summer of 1996 (Appendix D). Based on the last evaluation of water quality conditions Silver Shield Pond is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake supported some designated uses (Secondary Contact Recreation and Aesthetics) and was not assessed for others (Aquatic Life, Primary Contact Recreation, and Fish Consumption).							
Upper Spectacle Pond, Otis/ Sandisfield	MA31044	53	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Based on the last evaluation of water quality conditions Upper Spectacle Pond is listed in Category 5 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake was assessed as impaired and requires a TMDL for organic enrichment/low DO and noxious aquatic plants.							
Ward Pond, Becket	MA31047	27	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
The non-native wetland plant *Lythrum salicaria* was identified during the synoptic survey in the summer of 1996 (Appendix D). Based on the last evaluation of water quality conditions Ward Pond is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). No uses were assessed in this lake.							
Watson Pond, Otis (also known as Creek Pond)	MA31009	52	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
The non-native wetland plant *Phragmites australis* was identified during the synoptic survey in the summer of 1996 (Appendix D). Based on the last evaluation of water quality conditions Watson Pond is listed in Category 3 of the 2002 Integrated List of Waters (MA DEP 2003a). No uses were assessed in this lake.							
West Lake, Sandisfield	MA31050	60	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Based on the last evaluation of water quality conditions West Lake is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake supported some designated uses (Secondary Contact Recreation and Aesthetics) and was not assessed for others (Aquatic Life, Primary Contact Recreation, and Fish Consumption).							

Table 4 continued. Farmington River Watershed Lake Use Summary

Lake, Location	WBID	Size (Acres)	Aquatic Life (Impairment Cause)	Fish Consumption (Impairment Cause)	Primary Contact (Impairment Cause)	Secondary Contact (Impairment Cause)	Aesthetics (Impairment Cause)
White Lily Pond, Otis	MA31051	62	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED	NOT ASSESSED
Based on the last evaluation of water quality conditions White Lily Pond is listed in Category 2 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake supported some designated uses (Secondary Contact Recreation and Aesthetics) and was not assessed for others (Aquatic Life, Primary Contact Recreation, and Fish Consumption).							
York Lake, New Marlborough	MA31052	29	NOT ASSESSED	NOT ASSESSED	SUPPORT	SUPPORT	SUPPORT
York Lake in the DCR Sandisfield State Forest has a public bathing beach. This beach was posted for a 2-day period in June 2001 because of elevated bacteria and no postings were recorded for the 2002 swimming season. Because the beach was open for the majority of the 2001 and 2002 bathing seasons the *Recreational* and *Aesthetic* uses are assessed as support. Based on the last evaluation of water quality conditions York Lake is listed in Category 5 of the 2002 Integrated List of Waters (MA DEP 2003a). This lake was assessed as impaired and requires a TMDL for organic enrichment/low DO.							

RECOMMENDATIONS – LAKES

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

- Implement recommendations identified in lake diagnostic/feasibility studies, including lake watershed surveys to identify sources of impairment.

- Continue to review data from "Beaches Bill" required water quality testing (bacteria sampling at all formal bathing beaches) to assess the status of the recreational uses.

- Quick action is necessary to manage non-native aquatic or wetland plant species that are isolated in one or a few location(s) in order to alleviate the need for costly and potentially fruitless efforts to do so in the future. Two courses of action should be pursued concurrently. More extensive surveys need to be conducted, particularly downstream from these recorded locations to determine the extent of the infestation. And, "spot" treatments (refer to the Final Generic Environmental Impact Report [GEIR] for Eutrophication and Aquatic Plant Management in Massachusetts [Mattson et *al*. 2004] for advantages and disadvantages of each) should be undertaken to control populations at these sites. These treatments include careful hand-pulling of individual plants in small areas. In larger areas other techniques, such as selective herbicide application, may be necessary. In either case the treatments should be undertaken prior to fruit formation and with a minimum of fragmentation of the individual plants. These actions will minimize the spreading of the populations. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson et *al*. 2004) should be consulted prior to the development of any lake management plan to control non-native aquatic or wetland plant species.

- Where non-native plant infestations are more widespread conduct additional monitoring to determine the extent of the problem. The Final GEIR for Eutrophication and Aquatic Plant Management in Massachusetts (Mattson et *al*. 2004) should be consulted prior to the development of any lake management plan to control non-native aquatic plant species. Plant control options can be selected from several techniques (e.g., bottom barriers, drawdown, herbicides, etc.) each of which has advantages and disadvantages that need to be addressed for the specific site. However, methods that result in fragmentation (such as cutting or raking) should not be used because of the propensity for some invasive species of these plants to reproduce and spread vegetatively (from cuttings).

- Continue to monitor for the presence of invasive non-native aquatic vegetation. Prevent spreading of invasive aquatic plants. Once the extent of the problem is determined and control practices are exercised, vigilant monitoring needs to be practiced to guard against infestations in unaffected areas and to ensure that managed areas stay in check. A key portion of the prevention program should be posting of boat access points with signs to educate and alert lake-users to the problem and responsibility of spreading these species.

- Develop TMDLs for lakes listed in Category 5 of the 2002 Integrated List of Waters (MA DEP 2003a).

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LIST OF APPENDICES WITH TABLES AND FIGURES

APPENDIX E - STATE AND FEDERAL WATER QUALITY GRANT AND LOAN PROJECTS IN THE FARMINGTON WATERSHED

There are no figures or tables in this Appendix

APPENDIX F - FARMINGTON RIVER WATERSHED FISH TOXICS MONITORING 1997 AND 2001

Table 1. MA DEP Farmington River Watershed fish contaminant monitoring data for Benton Pond, Otis, Otis Reservoir, Otis/Tolland, and Shaw Pond, Becket

Table 2. 2001 MA DEP Farmington River Watershed fish contaminant monitoring data excerpted from 2001 *Fish Toxics Monitoring Public Request* and *Year 2 Watershed Sur*veys

Table 3. 2001 Fish Toxics Analytical Methods and Mdls/Rdls excerpted from 2001 *Fish Toxics Monitoring Public Request* and *Year 2 Watershed Sur*veys

Figure 1. 1997 and 2001 MA DEP Fish Toxics Monitoring Lakes

APPENDIX G - 2001 DEP DWM FISHERIES MONITORING TECHNICAL MEMORANDUM

Table 1. 2001 Farmington Watershed Fish Population Station Locations

Table 2. Habitat assessment summary for fish population stations sampled during the 2001 Farmington river watershed survey

Table 3. Fish population data collected by DWM at eight biomonitoring stations in the Farmington River watershed

Figure 1. Massachusetts Surface-Water Runoff Conditions, August 2001

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