

SUDBURY RIVER WATERSHED

The Sudbury River originates in Cedar Swamp as the outlet of Cedar Swamp Pond. Cedar Swamp was the first Area of Critical Environmental Concern designated in Massachusetts (July 1975). The approximately 1650 acres are primarily vegetated wetlands, providing critical floodwater storage capacity for the Sudbury River basin. The area overlays the medium- and high-yield aquifers that supply two public wells for Westborough, as well as public drinking water reservoirs downstream in Framingham. State-listed rare species occur in the area, as well as the uncommon Atlantic White Cedar swamp for which the area is named. From its headwaters the Sudbury flows east. It is joined by Whitehall Brook, which is the outlet stream of Whitehall Reservoir, a public water supply for the Town of Hopkinton. The Sudbury River flows through Ashland into Framingham. Indian Brook flows through Hopkinton Reservoir, a water supply for Ashland, and into the Sudbury. In Framingham the river flows through Reservoir #1 and 2 (back up water supplies) and into the Saxonville Impoundment. The river continues in a northerly direction toward its confluence with the Assabet River. Hop Brook, Wash Brook, and Pantry Brook in the Town of Sudbury and Pine Brook in Wayland contribute freshwater to the Sudbury River system. The only direct wastewater discharge to the main stem Sudbury River is the Wayland Waste Water Management District. However, there are several wastewater and storm water discharges to the tributaries, including the Marlborough Easterly Waste Water Treatment Plant that discharges to Hop Brook.

The Wild and Scenic Rivers Act provides for three possible classifications of eligible river segments: wild, scenic, and recreational. Based on ecology, history, literature, and scenery 14.9 miles of the Sudbury River, from the Danforth Street bridge in Framingham to the Route 2 bridge in Concord, have been designated as scenic by the National Park Service. The remaining 1.7 miles of the Sudbury River (Rt. 2 to confluence with the Assabet River at Egg Rock in Concord) have been classified as recreational (NPS 1996).

ISSUES

The towns of Ashland, Framingham, and Natick discharge sewage to the MWRA sewer system. Approximately 65% of the Town of Ashland is sewered, while 45% uses on-site septic systems (ENSR 2004a). Wastewater (about 2.2 MGD) is pumped to the Arthur Street pump station in Framingham and then on to the MWRA Deer Island WWTP in the Boston Harbor Watershed. Approximately 85% of Ashland uses public water (Unger 2004). Framingham is approximately 89% sewered while Natick is 80-85% sewered.

The Town of Wayland, with the exception of the area east of the former Raytheon plant down to Route 20 and across Route 27, is served by on-site septic systems. The Wayland Business Center WWTP treats wastewater from some homes and small businesses and discharges it to the Sudbury River (Segment MA82A-04).

The City of Marlborough, as discussed in the Assabet River Watershed section, is approximately 92% sewered. Wastewater is discharged from the Westerly Treatment Plant to the Assabet River and the Easterly Plant discharges to the Hop Brook system (Segment MA82A-15).

The communities of Westborough, Hopkinton, Holliston, Southborough, Ashland, Sherborn, Framingham, Sudbury, Wayland, Weston, Lincoln, and Concord are all partially regulated Phase II storm water communities. Marlborough is an entirely regulated community. Each community was issued a storm water general permit from EPA and MA DEP in 2003/2004 and is authorized to discharge storm water from their municipal drainage system. Over the five-year permit term the communities will develop, implement, and enforce a storm water management program to reduce the discharge of pollutants from the storm sewer system to protect water quality (Domizio 2004).

There are two National Priorities List (Superfund) sites within the Sudbury River Watershed: the Nyanza Superfund in Ashland and the Natick Labs site in Natick.

In the Sudbury River Watershed, the towns of Hopkinton and Southborough have participated in the Comprehensive Community Septic Management Program (Kasper-Dunne 2004).

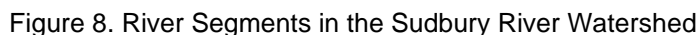
There are 120 21E Tier Classified Sites in the Sudbury River Watershed (Appendix J).

USGS is currently conducting a habitat project at selected sites in the Sudbury River Watershed. As part of this project temperature loggers were deployed at 11 sites (5 tributaries, 4 mainstem) from May through November 2004 and MDFW conducted fish population sampling at five sites. USGS plans to leave the temperature loggers in place for the entire 2005 season.

RECOMMENDATIONS

- Throughout the Sudbury River Watershed bacteria monitoring should be conducted to document the effectiveness of bacteria source reduction activities associated with the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Work with the Sudbury River Watershed Organization to collect quality-assured water quality data, to form stream teams throughout the watershed, and conduct shoreline surveys to assess the *Aesthetics Use*.
- When available, review the results from the USGS Habitat Project in the Sudbury River Watershed for pertinent information to assess the status of the *Aquatic Life Use*.

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SUDBURY RIVER (SEGMENT MA82A-01)

Description: From the source at the outlet of Cedar Swamp Pond, Westborough, to the Fruit Street Bridge, Hopkinton/Westborough

Segment Length: 1.9 miles

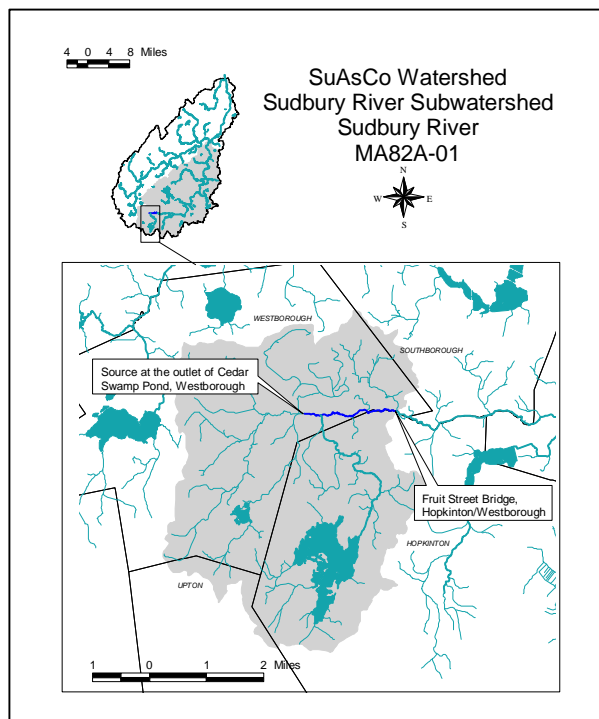
Classification: Class B, Warm Water Fishery, ORW

Land-use estimates (top 3, excluding water) for the 19.31mi² subwatershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 2.39 mi² and the percentage of the imperviousness is 12.4%.

Forest	48%
Residential	24%
Transportation...	5%
Industrial	5%

Based on the last evaluation of water quality conditions this segment of the Sudbury River is listed on the 2002 Integrated List of Waters in Category 3. This segment was not assessed for any of the designated uses (MA DEP 2003a).

This segment and tributaries to it are located in the Cedar Swamp Area of Critical Environmental Concern. A portion of this subwatershed is also located within the Miscoe, Warren, and Whitehall Waters ACEC.



MDFW has proposed that Jackstraw Brook, a feeder stream to Cedar Swamp Pond currently classified as an ORW, also be protected as cold water fishery habitat (Richards 2003b). Jackstraw Brook was sampled by MDFW on 21 July 2000 east of Upton Road in the Town of Westborough. Nineteen pumpkinseed, seven brook trout, six chain pickerel, and two banded sunfish were collected (Richards 2003a).

The USFWS collected ten similar sized yellow perch, white perch, brown bullhead, and black crappie from Cedar Swamp Pond in 1986 and/or 1987 (Eaton and Carr 1991). Wholebody composite samples were analyzed for heavy metals, PCBs and organochlorine pesticides. (It should be noted that in Eaton and Carr (1991) concentrations in whole fish are compared to the Food and Drug Administration's edible portion action levels.) Total PCBs, where detected, were well below the NAS/NAE guideline (Coles 1998) for the protection of fish eating wildlife of 500 ppb wet weight. Total DDT levels were also less than the 14.0 ppb wet weight guidelines. A sediment sample was also collected from this site in 1987 and analyzed for PCBs, PAHs, organochlorine pesticides, and heavy metals. PCBs were not detected, however, PAHs, arsenic, lead, cadmium, and chromium concentrations exceeded the lowest effect level (LE-L) guidelines in Persuad *et al.* (1993).

ENSR collected *in situ* water quality samples, nutrient samples, and bacteria samples from Piccadilly Brook, Jackstraw Brook, and Denny Brook (one station on each) in July and August 2003 (ENSR 2004a).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Westborough Water Department*	21432804	9P421432801	2328000-01S -01G -02G	1.92 (reg) <u>1.18(per)</u> 3.1*
Bay State Sterling**	21432803		Well #2 Well #3 Well #4	0.45

* Indicates a system wide withdrawal, all sources not necessarily within this subwatershed.

**The WMA permit for this facility was terminated in June 2003 (facility out of business).

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

Bay State Sterling Inc. (MA0000108) was permitted (14 July 1994) to discharge uncontaminated cooling waters via outfalls 001 (0.320 MGD), 002 (0.280 MGD), and 004 (0.009 MGD) to Rutters Brook. Rutters Brook is one of the streams that feeds into Cedar Swamp Pond, which forms the headwaters of the Sudbury River. The permit included temperature limits of 36°C, 24°C, and 35°C for outfalls 001, 002, and 004, respectively. This facility is no longer in business and EPA terminated the permit in March 2004. An on-site wastewater treatment plant, installed in 1974, treated waste and process waters at the facility using pH adjustment, solid separation, and sludge dewatering. The processed sludge was disposed of off site as non-hazardous waste and the treated wastewater was discharged to the Town of Westborough sewer system under an industrial wastewater discharge permit.

HAZARDOUS WASTE SITES AWAITING NPL DECISION

According to the EPA Fact Sheet for the Bay State Abrasives Landfill surface water samples collected from Rutters Brook, Cedar Swamp, and Cedar Swamp Pond in 1984 and 1989 indicated the presence of five VOCs and lead. The property is currently classified as a Tier 1C site and is in Phase IV of the five-phase Massachusetts Contingency Plan. Groundwater samples collected from 31 monitoring wells on the property in 1985 indicated the presence of chlorinated and non-chlorinated volatile organic compounds, phenols, petroleum hydrocarbons, and metals (including lead). Results of a groundwater monitoring program conducted on the property in 1991 by Dames & Moore indicated that contaminant concentrations had decreased over time to levels below State groundwater standards (EPA 2002D). Based on these results and the distance to the nearest drinking water supply well no impacts to nearby groundwater drinking water supply sources are known or suspected (EPA 2002D). Under a Covenant-Not-To-Sue agreement signed with the Attorney General's Office and MA DEP's Brownfields Unit in December 2004 Westborough CC LLC will be permitted to redevelop the site. Contaminated soil on the site will be capped. Several dilapidated buildings will be demolished and new buildings erected in their place without soil excavation. Plans include constructing a 250,000 square foot community retail center (including large and small retail stores, restaurants, public walkways and other open space opportunities such as a public park with an attractive communal environment) and 60,000 square feet of residential space (Keenan 2004, Menesale 2004).

LANDFILLS (APPENDIX K)

There are two landfills in this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

Approximately 200 feet of the Sudbury River, near Fruit Street in Hopkinton, was dry for 15 days in August and September 1999 (DFWELE 2002). The DFG suspects that the no flow event may be the result of numerous groundwater withdrawals in close proximity to the river coupled with drought conditions during the summer of 1999 (DFWELE 2002). The Town of Westborough has installed a monitoring well at Fruit Street to monitor water levels.

Biology

Eight species (127 fish total) were collected by MDFW as part of a fish population survey of the Sudbury River upstream of Fruit Street, Hopkinton/Southborough on 31 July 2001. Using barge electroshocking equipment 114 redbfin pickerel, three brown bullhead, three fallfish, two bluegill, two largemouth bass, one golden shiner, one pumpkinseed, and one yellow bullhead were collected (Richards 2003a). With the exception of fallfish all fish collected are considered macrohabitat generalists. In addition, all fish are classified as being moderately tolerant or tolerant to pollution. The dominance by macrohabitat generalists is likely a result of Cedar Swamp Pond and a large wetland located immediately upstream and possibly low-flow related events such as that noted above.

Chemistry – water

DWM conducted water quality monitoring of the Sudbury River at the Fruit Street Bridge, Hopkinton (Station SU01) in 2001. Parameters measured *in situ* included dissolved oxygen, percent saturation, temperature, pH, conductivity, and total dissolved solids. Grab samples were collected and analyzed for

hardness, alkalinity, turbidity, ammonia-nitrogen, total suspended solids, and total phosphorus (Appendix A).

ENSR also conducted *in situ* water quality sampling near Fruit Street in Hopkinton (Station SR22) in July and August 2002 and July, August, and September 2003. Parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected and analyzed for ammonia-nitrogen, total phosphorus and total suspended solids (ENSR 2004a).

DO

Dissolved oxygen concentrations measured by DWM downstream of the Fruit Street bridge (n=3) ranged from 2.8 to 5.0 mg/L (32-52 % saturation) with two of the three measurements less than 5.0 mg/L. DO concentrations measured by ENSR ranged from 0.5 to 5.3 mg/L with three of the four measurements less than 5.0 mg/L. Percent saturations ranged from 5.9 to 55%.

Temperature

Temperatures ranged between 18.7 and 21.2°C; ENSR's temperatures ranged between 17.1 and 22.6°C.

pH

pH ranged from 6.2 to 6.4 SU while pH measured by ENSR ranged between 6.3 and 6.7 with two of the four measurements less than 6.5 SU.

Conductivity

Conductivity at 25°C ranged between 397 and 500 µS/cm; ENSR measured conductivity between 336 and 1256 µS/cm (n=4).

Hardness

Hardness varied from 47 to 59 mg/L.

Alkalinity

Alkalinity ranged between 14 and 21 mg/L.

Turbidity

Turbidity ranged from 3.3 to 4.0 NTU.

Total Suspended Solids

TSS concentrations ranged between 2.2 and 3.6 mg/L during DWM surveys while ENSR measured found TSS concentrations between 6 and 11 mg/L (n=3)

Total phosphorus

Total phosphorus concentrations ranged between 0.033 and 0.076 with two of the three concentrations greater than 0.05 mg/L. ENSR measured total phosphorus concentrations ranging between 0.03 and 0.14 mg/L with one of the three samples greater than 0.05 mg/L.

Ammonia-nitrogen

The ammonia-nitrogen concentration of Sudbury River water near Fruit Street was <0.02 mg/L (n=3) during the DWM surveys. However, during the ENSR surveys concentrations of ammonia-nitrogen ranged between <0.03 and 0.13 (n=3).






The *Aquatic Life Use* is currently not assessed for this segment of the Sudbury River due to the lack of additional biological, habitat, and physico-chemical data. The limited water quality data and fish data suggest less than optimal conditions, but it is unclear if the conditions are the result of anthropogenic inputs or natural conditions (wetlands). This use is, therefore, identified with an Alert Status due to concerns regarding fish community structure, low DO, total phosphorus, and flow.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

DWM conducted fecal coliform and *E. coli* bacteria sampling on three occasions at Fruit Street, Hopkinton, in July and September 2001 (Appendix A). The dry weather fecal coliform bacteria counts were 75 and 380 cfu/100mL. ENSR also collected samples from the Sudbury River near Fruit Street and analyzed them for fecal coliform bacteria and *E. coli*. Fecal coliform bacteria counts ranged between <100 and 4000 cfu/100mL (2004a). These samples were collected during both wet and dry weather conditions.

Due to the limited bacteria data the *Recreational* uses are not assessed for this segment of the Sudbury River. However, due to elevated bacteria counts both uses are identified with an Alert Status.

Sudbury River (MA82A-01) Use Summary Table

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

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

RECOMMENDATIONS

- Work with interested parties to protect the core habitats and critical supporting watershed identified in the Natural Heritage *Living Waters* report (NHSEP 2003) including Whitehall Reservoir through land conservation measures and management practices.
- Review the water level data collected from the Westborough monitoring wells to better evaluate the impacts, if any, of the water withdrawals on instream flows and habitat.
- Conduct biological (benthic macroinvertebrate and fish population), habitat quality, and physico-chemical monitoring to assess the status of the *Aquatic Life Use*.
- MDFW has proposed that Jackstraw Brook, a feeder stream to Cedar Swamp Pond be protected as cold water fishery habitat. Additional monitoring of the fish population, DO, and temperature is needed to evaluate MDFW's proposal to list this stream as a cold water fishery in the next revision of the Surface Water Quality Standards.

WHITEHALL BROOK (SEGMENT MA 82A-11)

Description: From the outlet of Whitehall Reservoir, Hopkinton, to confluence with the Sudbury River, Westborough

Segment Length: 3.5 miles

Classification: Class B, ORW

Land-use estimates (top 3, excluding water) for the 7.60 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.37 mi² and the percentage of the imperviousness is 4.9%.

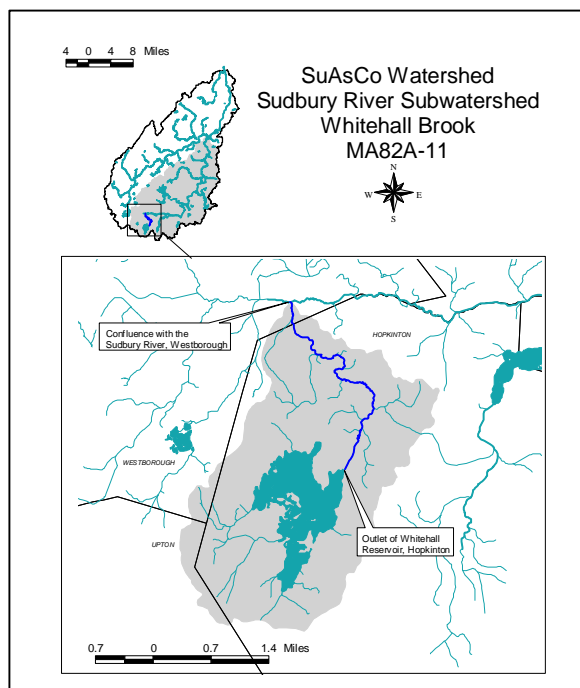
Forest 54%

Residential..... 24%

Agriculture 3%

Based on the last evaluation of water quality conditions Whitehall Brook is listed on the 2002 Integrated List of Waters in Category 2. This segment supported some designated uses (Aquatic Life) and was not assessed for others (MA DEP 2003a).

The use assessment for Whitehall Reservoir can be found in the lakes section of this report.



A portion of this subwatershed is located within the Miscoe, Warren, and Whitehall Waters ACEC.

WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Hopkinton Water Department	21413901	9P21413901	2139000-01G -02G -03G -04G -05G	0.56 (reg) <u>0.42 (perm)</u> 0.98

NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no regulated NPDES discharges to this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

The dam at Whitehall Reservoir was rebuilt in 2004 and includes a culvert-type spillway. Water levels in the Reservoir are controlled by installing flashboards. The Department of Conservation and Recreation, Office of Water Resources, specifies the level in the Reservoir (summer and winter) for flood control purposes. There is no low flow outlet or bypass structure (Cate 2005).

DWM conducted a habitat assessment of Whitehall Brook in 1996 at one station (SAC15) downstream from Fruit Street (Appendix H).

Biology

MDFW conducted fish population sampling at four stations in Whitehall Brook in Hopkinton in 2001 using backpack electroshocking equipment (Richards 2003a). It was noted that the water at all locations (downstream from Route 135 bridge, between Route 495 and the gravel pit, and near Fruit Street bridge (two sites)) was a dark tannin stained color and that there was a wide, deep, mucky channel between Route 495 and the gravel pit, which resulted in notably poor sampling efficiency. Only 37 fish were collected from all four stations combined. Fish included nineteen redbfin pickerel, seven bluegill, four pumpkinseed, one yellow bullhead, one black crappie, one banded sunfish, one American

eel, one brook trout, and one hybrid redbfin/chain pickerel. With the exception of the brook trout all species can be classified as macrohabitat generalists and are moderately tolerant or tolerant to pollution. The brook trout is considered a fluvial dependent species and is considered a pollution intolerant species. However, it is unclear whether this fish was "wild" or stocked by MDFW (Whitehall Brook is stocked annually).

While the data are too old for assessment purposes, it should be noted that DWM conducted benthic macroinvertebrate sampling in Whitehall Brook in 1996 at one station (SAC15) downstream from Fruit Street, Hopkinton (see Appendix H for more details).

Chemistry – water

DWM conducted water quality monitoring at one station (WH01) on Whitehall Brook, upstream from the Fruit Street crossing in Hopkinton in 2001 (Appendix A). Parameters measured included DO, temperature, pH, conductivity, and total dissolved solids. Grab samples were collected and analyzed for turbidity, hardness, alkalinity, ammonia-nitrogen, and total phosphorus.

ENSR conducted *in situ* water quality monitoring at one station on Whitehall Brook (T03- Fruit Street, Hopkinton) on five occasions in 2002/2003. Parameters measured included DO, temperature, pH, and conductivity. Grab samples were collected for ammonia-nitrogen and total phosphorus analysis three occasions (ENSR 2004a).

DO

Dissolved oxygen concentrations in Whitehall Brook, as measured by DWM during pre-dawn hours, ranged between 2.3 and 3.9 mg/L and percent saturations ranged between 25 and 40 % (n=3).

DO readings measured by ENSR ranged from 2.3 to 5.7 mg/L with three of the four readings less than 5.0 mg/L. Percent saturations ranged between 26.3 and 57.3%. It should be noted that these measurements were not collected during worst-case, pre-dawn conditions although they were collected during the early morning hours between 0605 and 0915h.

Temperature

Temperatures measured by DWM ranged between 17.7 and 20.0°C (n=3). Temperatures measured by ENSR ranged between 15.7 and 22.1°C (n=5).

pH

pH in stream during the DWM surveys ranged between 6.1 and 6.3 SU (n=3). pH measured by ENSR ranged between 6.3 and 7.2 SU and four of the five measurements were less than 6.5 SU.

Hardness

Hardness values measured by DWM were between 32 and 38 mg/L (n=3).

Alkalinity

Alkalinity in Whitehall Brook as measured by DWM ranged between 12 and 21 mg/L (n=3).

Conductivity

Specific conductance at 25°C as measured by DWM ranged between 203 and 306 µS/cm (n=3). Conductivities measured in Whitehall Brook by ENSR ranged between 166 and 273 µS/cm (n=5).

Total Suspended Solids

Total suspended solids concentrations ranged between 2.7 and 3.1 mg/L (n=3). Total suspended solids concentrations measured by ENSR ranged between 3 and 10 mg/L (n=3).

Turbidity

Turbidity in Whitehall Brook, as measured in samples collected by DWM, ranged between 1.9 and 5.3 NTU (n=3).

Total Phosphorus

Total phosphorus concentrations measured by DWM ranged between 0.045 and 0.11 (n=3). Total phosphorus concentrations reported by ENSR ranged between 0.02 and 0.04 mg/L (n=3).

Ammonia-nitrogen

Ammonia-nitrogen concentrations measured by DWM were all <0.02 mg/L (n=3). Ammonia-nitrogen concentrations in Whitehall Brook as measured by ENSR ranged between <0.03 and 0.1 mg/L (n=3).

Although limited water quality data and fish data suggest less than optimal conditions water quality was primarily performed in wetland dominated habitat and fish collections were noted as being inefficient. Therefore, the *Aquatic Life Use* is currently not assessed for Whitehall Brook. The use, however, is identified with an Alert Status.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

DWM collected fecal coliform and *E. coli* bacteria samples on three occasions in July and September 2001 at Station WH01 (Appendix A). Holding times were exceeded on one survey so those data were censored. The fecal coliform counts in July were 150 and 130 cfu/100 mL. These data were collected during dry weather conditions.






ENSR collected fecal coliform and *E. coli* bacteria samples from one station (T03- Fruit Street, Hopkinton) on four occasions; two surveys each in 2002 and 2003 during wet and dry weather conditions (ENSR 2004a). Fecal coliform bacteria counts ranged from 100 to 12,900 cfu/100 mL (collected during wet weather).

In 2002 and 2003 the Hopkinton Stream Survey Project conducted a shoreline survey of Whitehall Brook (Vos 2004). A final report of their findings is not yet available.

MDFW reported that the water in the brook between Route 495 and the gravel pits was a dark tannin stained color and that the sediments in the wide, deep channel were “mucky” (Richards 200a).

Because of the limited data set available the *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are not assessed for Whitehall Brook. The *Recreational* uses are identified with an Alert Status, however, due to elevated fecal coliform bacteria counts and the *Aesthetics Use* is identified with an Alert Status due to “mucky” sediments.

Whitehall Brook (MA82A-11) Use Summary Table

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

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

RECOMMENDATIONS

- Additional fish population, habitat quality and macroinvertebrate sampling should be conducted at multiple locations throughout Whitehall Brook to assess the status of the *Aquatic Life Use*.
- Documentation of general summertime flow conditions should be obtained.
- Water quality sampling, especially dissolved oxygen sampling, in the upper reaches of Whitehall Brook would be helpful in determining if the low DO concentrations documented during the 2001 DWM survey were natural conditions or anthropogenically induced.
- Additional bacteria monitoring should be conducted along this segment to evaluate the status of the *Primary* and *Secondary Contact Recreational* uses. If possible multiple locations should be sampled to bracket potential nonpoint sources of pollution including on-site septic systems, cropland, and horses (Vos 2004) to try to isolate the source(s) of elevated counts.

- Work with interested parties to protect the core habitats and critical supporting watershed areas identified in the Natural Heritage *Living Waters* report (NHESP 2003) including Whitehall Reservoir through land conservation measures and management practices.
- Review the results of the Hopkinton Shoreline Survey when available to identify non-point sources of pollution and assess the status of the *Aesthetics Use*.
- Work with the Department of Agricultural Resources and Natural Resource Conservation Service to educate area farmers about the importance of employing agricultural BMPs. If BMPs are not currently being utilized, work to assist farmers with the installation and maintenance of BMPs to protect riparian zones and prevent runoff from entering Whitehall Brook.
- Work with the MA DCR, Office of Water Resources, to evaluate outlet control practices at Whitehall Reservoir and to the extent possible, maintain a natural flow regime to Whitehall Brook.

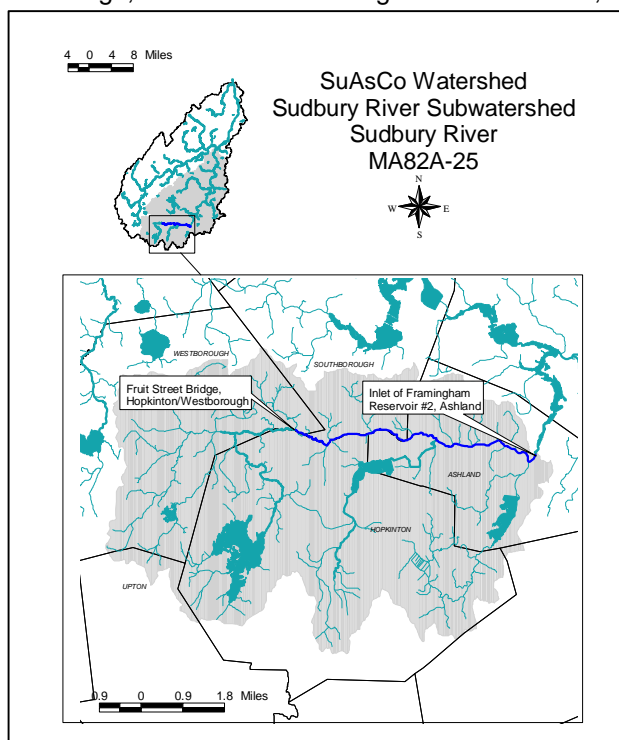
SUDBURY RIVER (SEGMENT MA82A-25)

Description: From the Fruit Street Bridge, Hopkinton/Westborough, to the inlet of Framingham Reservoir #2, Ashland (formerly part of segment MA82A-02)
Segment Length: 6.3 miles
Classification: Class B, Warm Water Fishery

Land-use estimates (top 3, excluding water) for the 43.8 mi² subwatershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 4.9mi² and the percentage of the imperviousness is 11.2%.

Forest 52%
Residential 26%
Open land 6%

Based on the last evaluation of water quality conditions this segment of the Sudbury River is listed on the 2002 Integrated List of Waters (as Segment MA 82A-02) in Category 5. This segment was assessed as impaired and requires a TMDL for metals (MA DEP 2003a).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Weston Nurseries of Hopkinton*		21413902	Rudy's Pond Busconi Pond Meadow Aux. Pond Meadow Pond Garden Center Pond Hill Pond Canal System Kidney Pond Irrigation Pond Stone Pond Tony's Bridge Canal Irrigation Canal/Pond Leaky Pond	0.78
Kidde-Fenwal Inc.		31401402	Well #1 Well #2	0.05
Mass Civil Defense Agency (MCDA)		31410002	01G 02G	0.29

* Indicates a system-wide withdrawal, all sources not necessarily within this subwatershed.

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLE E1-E4)

Trimount Bituminous (MA0033359) applied for an individual NPDES permit coverage to discharge to Cold Spring Brook. This facility is also known as Aggregate Industries Northeast Region. An individual permit was not needed and Aggregate Industries Northeast (MAR05C111) was issued a multi-sector general storm water permit by the EPA. It will expire in October 2005.

The Ashland Sand and Stone Company (MA0000132) is permitted (19 November 2003) to discharge 0.4 MGD of treated wastewater from sand and gravel washing via outfall 001 to Cold Spring Brook, a tributary to this segment. This permit will expire on 30 September 2008. The permit also includes limits on TSS (20 mg/L), temperature (23.3°C), and oil and grease (15 mg/L). The operation of this facility is

intermittent, averaging approximately 3 months per year, although during the non-operational periods leakage through the joints of the stone filters to an open trench to Cold Spring Brook through outfall 001 also occurs.

Kidde-Fenwal Incorporated (MAG250946) is permitted (17 January 2001) to discharge 0.052 MGD of NCCW to Cold Spring Brook, a tributary to this segment of the Sudbury River.

SUPERFUND SITES

In September 1983 the Nyanza Chemical Waste Dump, located on Megunko Road in Ashland along this segment of the Sudbury River, was placed on the National Priorities List. The site was formerly the location of the Nyanza Chemical Company, which operated a dye manufacturing facility at the property from 1965 to 1978. Groundwater, sediments, and surface water are contaminated with heavy metals (particularly mercury) and chlorinated organics. All cleanup activities were completed for groundwater contamination on site in 1992. Clean up of off-site groundwater contamination has been delayed due to the discovery of additional contaminated areas. Additional data collection and risk assessment activities continued through 2002. EPA completed the cleanup of mercury-contaminated sediments in on-site wetlands and drainageways in 2001. Data collection and risk assessment activities continued through 2003 to address contamination of the Sudbury River sediments and fish. MDPH is also conducting a health study, which has not yet been completed. Additional information is available in the Summary of Existing Conditions and Perceived Problems section of this report (EPA 1 December 2004b).

HAZARDOUS WASTE SITES AWAITING NPL DECISION

The former Timex Clock Company property is located at 200 Homer Avenue in Ashland. Timex and its predecessors manufactured motors, timers, and clocks. Trichloroethylene (TCE) was used as a degreasing agent prior to 1980, at which time it was replaced by methylene chloride. TCE was stored in an aboveground storage tank located in the northwestern portion of the property. Groundwater present in overburden beneath the property flows east toward Sudbury River. A total of 11 monitoring wells are located on the property and historical groundwater sampling indicates that the (VOC) contaminant plume is approximately 15 to 20 feet (ft) below the surface and migrating in an easterly direction toward the Sudbury River. In June 1983 surface water samples were collected from locations along the Sudbury River. The surface water sample analytical results indicated the presence of VOCs. Quarterly surface water sampling of the Sudbury River was conducted from February 1984 to October 1984. Quarterly surface water sampling analytical results indicated the presence of VOCs at concentrations significantly greater than background concentrations, including TCE at up to 11 parts per billion (ppb). On 16 May 1996 Stone and Webster collected surface water and sediment samples from the Sudbury River. No contaminants were detected in the surface water; semi-volatile organic compounds, pesticides, polychlorinated biphenyls, and metals were identified in sediment samples (EPA 15 July 2002d).

LANDFILLS (APPENDIX K)

There are four landfills in this subwatershed, all of which are closed or inactive.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

On 19 July 2001 DWM conducted biomonitoring upstream from Rt. 85 in Hopkinton (Station SRH (B0361)) along this segment of the Sudbury River. The sample reach was between the outlet of a small impoundment and Route 85. The river was about 3m wide and water depths were generally between 0.2 and 0.4m. There was sufficient gradient and good riffle habitat with large substrates (nearly all cobble and boulder). No signs of erosion were detected in the reach. Canopy cover was about 95%. Moss covered about 85% of the reach and no algae were observed. Station SRH received a total score of 179/200 (Appendix D).

Biology

This segment of the Sudbury River contains Estimated Habitat for Rare Wildlife (Ashland ConComm 2002).

On 19 July 2001 DWM conducted biomonitoring upstream from Rt. 85, Hopkinton (Station SRH (B0360)). The RBP III analysis indicated the community was *Slightly Impacted* when compared to the North Brook reference station (Appendix D). USGS also conducted biological monitoring (benthic, fish, algae) in this segment of the Sudbury River near Concord Street in Ashland in August 2000 as part of an urban gradient study. However, these data are not available at a sample site scale (Coles *et al.* 2004).

A fish population survey of this segment of the Sudbury River was conducted by MDFW between 31 July and 2 August 2001. A total of 263 fish (twelve species) were collected from four stations using backpack electroshocking equipment. Only four species were collected at the most upstream location. Redfin pickerel (n=34), a moderately tolerant macrohabitat generalist, heavily dominated the assemblage (>80%). One rainbow trout (most likely stocked) and three white sucker, both fluvial specialists/dependants, were also present. The three downstream locations contained fish communities that were similar to each other. Fish collected included 90 fallfish, 28 largemouth bass, 23 rock bass, 17 white sucker, 16 redbreast sunfish, 14 yellow bullhead, nine yellow perch, seven bluegill, six redfin pickerel, six pumpkinseed, and five chain pickerel (Richards 2003a). With the exception of fallfish and white sucker all fish collected are considered macrohabitat generalists. However, fallfish and white sucker comprised approximately 50% of the sample. All fish are classified as being moderately tolerant or tolerant to pollution.

Chemistry – water

DWM conducted water quality monitoring at two sites (see below) on this segment of the Sudbury River in 2001. Parameters measured *in situ* included dissolved oxygen, percent saturation, temperature, pH, conductivity, and total dissolved solids. Grab samples were collected and analyzed for hardness, alkalinity, turbidity, ammonia-nitrogen, total suspended solids, and total phosphorus (Appendix A).

SU02- at Cedar Street Bridge, Hopkinton/Southborough (locality of Southville)

SU03- at Route 85 (Cordaville Street/River Street), Hopkinton/Southborough

The USGS, as part of their mercury and urban gradient studies, collected DO, pH, conductivity, alkalinity, temperature, total phosphorus, ammonia-nitrogen, chlorophyll *a*, total and methyl mercury samples from the water column of the Sudbury River near Concord Street in Ashland on 5 April 2000 and 11 August 2000 (Socolow *et al.* 2001).

ENSR conducted *in situ* water quality sampling at seven stations along this segment of the Sudbury River sometime between July and August 2002 and July through September 2003 between 0600 and 1200h. Parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected and analyzed for ammonia-nitrogen, total phosphorus and total suspended solids (ENSR 2004a). Stations sampled included the following:

- SR21- Cedar Street Bridge, Hopkinton,
- SR20- Bridge on Cordaville Road, Ashland/Hopkinton,
- SR19- Howe Street, Ashland,
- SR18- Cordaville Road, Ashland,
- SR27- Myrtle Street, Ashland,
- SR17- Front Street, Ashland, and
- SR16- Rte 135, Ashland.

DO

Pre-dawn DO concentrations measured by DWM (n=6) ranged from 4.9 mg/L (54% saturation) to 8.2 mg/L (88% saturation) with only one measurement less than 5.0 mg/L. The lowest concentration in the river was at the Cedar Street Bridge.

DO concentrations measured by ENSR ranged between 4.7 to 8.2 mg/L (n=25) with only two readings less than 5.0 mg/L. Percent saturations ranged between 53.4 and 96.3% (n=25) with three less than 60%.

The DO concentrations recorded by USGS were 11.0 and 8.5 mg/L.

Temperature

Temperatures in the Sudbury River, as measured by DWM, ranged from 19.1 to 21.9°C (n=6) while temperatures measured by ENSR ranged between 17.3 and 28.1°C (n=25). Temperatures in this segment of the Sudbury River reported by USGS were 11.4 and 23.6°C.

pH

pH measured DWM ranged from 6.5 to 6.9 SU (n=6). pH measured by ENSR ranged between 6.6 and 7.3 SU (n=25). pH readings taken by USGS were 7.0 and 6.9 SU.

Hardness

Hardness of the Sudbury River ranged from 41 to 59 mg/L (n=6).

Alkalinity

Alkalinities reported by DWM ranged from 12 to 22 mg/L (n=6). Alkalinities as reported by USGS were 10 and 18 mg/L.

Conductivity

Conductivity at 25°C as measured by DWM ranged from 351 to 547 µS/cm (n=6) while conductivity measured by ENSR ranged between 320 and 697 µS/cm (n=25) and USGS measured conductivities of 326 and 370 µS/cm.

Total Suspended Solids

Total suspended solids concentrations reported by DWM ranged from <1.0 to 3.9 mg/L (n=6) and TSS concentrations measured by ENSR ranged between 1 and 36 with only one of the 18 samples having concentrations greater than 25 mg/L.

Turbidity

Turbidity in the Sudbury River ranged between 2.0 and 5.0 NTU (n=6).

Total phosphorus

Total phosphorus measured by DWM ranged between 0.034 and 0.082 mg/L with four of the six measurements greater than 0.05 mg/L. Total phosphorus concentrations measured by ENSR ranged between 0.02 and 0.12 mg/L. Six of the 18 samples had concentrations greater than 0.05 mg/L. The total phosphorus concentrations reported by USGS were 0.014 and 0.042 mg/L.

Ammonia-nitrogen

Ammonia-nitrogen concentrations reported by DWM were <0.02 mg/L (n=6) while ENSR reported ammonia-nitrogen concentrations ranging between <0.03 and 0.09 (n=18). The ammonia-nitrogen concentrations measured by USGS were <0.02 mg/L.

Mercury

The concentrations of total mercury reported by USGS were 3.48 and 5.25 ng/L (USGS 2003), both of which are below the EPA freshwater chronic criterion of 12 ng/L to protect aquatic life.

Chemistry-sediment

The sediments of the Sudbury River are contaminated with heavy metals and chlorinated organics from the Nyanza Superfund site. Cleanup activities were completed for groundwater contamination on site in 1992. Multiple studies (summarized below) of the river and sediments were conducted between 1993 and 1995. Clean up of off-site groundwater contamination has been delayed due the discovery of additional contaminated areas; additional data collection and risk assessment activities continued through 2002. EPA completed dredging/cleanup of the mercury contaminated sediments in wetlands and drainage ditches from the site in August 2001 (EPA 2004e). Data collection and risk assessment activities (data not yet available) continued in 2002 to address contamination of the Sudbury River sediments and fish.

Surficial sediment samples were collected from two locations along this segment of the Sudbury River: a reference reach of the Sudbury River in the vicinity of the Cedar Street bridge, Ashland/Southborough) (Station 2) and near the inlet to Framingham Reservoir #2 (Station 3) in June 1994 as part of the caged mussel study. Sediments from the river near Cedar Street had mean concentrations of three analytes (Pb, Cd, and TOC) that exceeded their L-EL but not S-ELs published in Persuad *et al.* (1993). Total Hg (0.11 ppm dry weight), Cr, and As were below their L-ELs (Beckvar *et al.* 2000). Sediments collected near the inlet to Framingham Reservoir #2 had mean concentrations of Pb, As, and Cd which exceeded their L-ELs. Total Hg (17.9 ppm dry weight), Cr, and TOC exceeded their S-ELs by factors of 8.95, 1.38, and 1.17, respectively.

Surficial sediment samples were collected from the Sudbury River from a reference reach (in the vicinity of the Cedar Street bridge, Ashland/Southborough) of the Sudbury River in July and September 1994 as part of the bioaccumulation study being conducted with mayfly nymphs. The mean total mercury concentrations in the sediment collected from the river in the vicinity of the Cedar Street bridge was 0.09 PPM and 0.2 ppm dry weight from samples collected in July and September 1994, respectively (Naimo *et al.* 2000). Both of these results were below the L-EL for total mercury.

It should also be noted that EPA collected sediment samples from the Sudbury River at Cedar Street in 1993 and 1994. These samples were analyzed for acid-volatile sulfide (AVS), simultaneously extracted (SEM) metals (As, Cd, Cr, Hg, Pb, Sb, Zn), and total recoverable mercury (Haines *et al.* 2003).

USGS collected sediment samples from this segment of the Sudbury River near Concord Street in Ashland in August 2000, as part of their mercury studies. The total mercury concentration was 0.458 ppm dry weight (USGS 16 October 2003), which exceeded the L-EL of 0.2 ppm (Persuad *et al.*, 1993).

Chemistry-tissue

A caged mussel (*Elliptio complanata*) study was conducted by Beckvar *et al.* (2000) from two locations along this segment of the Sudbury River- a reference reach of the Sudbury River in the vicinity of the Cedar Street bridge, Ashland/Southborough (Station 2), and near the inlet to Framingham Reservoir #2 (Station 3) in June 1994. Three 35 organism replicate samplers (total of 105 mussels) per station were deployed for a twelve-week period (Station 2). Survival of the mussels was 91% at Station #2 and 93% at Station #3. The total mercury concentrations in the mussel samples were 850 and 950 ppb **dry weight** at Stations #2 and #3, respectively (Beckvar *et al.* 2000). Although a direct comparison cannot be made (*dry weight* vs *wet weight*) it should be noted that the current Canadian Tissue Residue Guideline for consumers of aquatic biota for total mercury is 33 ppb **wet weight** (Environment Canada 2003).

A bioaccumulation study using burrowing mayfly nymphs (*Hexagenia* sp.) exposed to sediment collected from a reference reach (in the vicinity of the Cedar Street bridge, Ashland/Southborough) of the Sudbury River (21-day exposure) was conducted in July and September 1994 by Naimo *et al.* (2000). Survival of the mayfly nymphs was greater than 90%. The mean concentration of total mercury (gut contents not depurated) in the mayflies was 149 and 167 ppb dry weight for the July and September tests, respectively (Naimo *et al.* 2000).

Haines *et al.* (2003) collected fish, dragonfly larvae, crayfish, and prey fish from the Sudbury River near Cedar Street bridge, Ashland/Southborough, between May 1994 and 1995. Whole fish composite samples of black crappie (n=5 in May, n=8 in July, and n=9 in October 1994), bluegill (n=10 in all three sampling events), largemouth bass (n=7 in May, n=7 in July, and n=10 in October 1994) were collected and analyzed for total mercury. The mean concentration of total mercury in the whole fish composite samples (adjusted for size) were 130 ppb wet weight in black crappie, 110 ppb wet weight in bluegill, and 370 ppb wet weight in largemouth bass. The mean concentration of total mercury in dragonfly larvae (n=26) was 272 ppb dry weight, in crayfish (n=45) was 193 ppb dry weight, and in prey fish (n=38) was 322 ppb dry weight (Haines *et al.* 2003).

The *Aquatic Life Use* is assessed as support for this segment of the Sudbury River based primarily on the benthic macroinvertebrate, water quality and fish community data. The use is identified with an Alert Status, however, because of the slightly elevated total phosphorus concentrations. Additionally, the lower portion of this segment is identified with an Alert Status because of the mercury contamination from the Nyanza Superfund Site.

FISH CONSUMPTION

An edible fillet composite sample (scales off, skin on) of five pumpkinseed collected by USGS from the Sudbury River near Concord Street in Ashland in August 2000 was analyzed for total mercury. The concentration of total mercury in the edible fillet sample was 0.177 ppm wet weight (USGS 2003).

DWM conducted fish toxics monitoring in the Sudbury River in 1985, 1986, 1987, and 1988. Sampling in 1988 was conducted to confirm the mercury results of previous studies and to investigate possible bioaccumulation of PCBs as indicated by 1986 USFWS data (Maietta 1990). Sources of mercury included the Nyanza Superfund Site. Based on DWM data that found elevated concentrations of mercury in edible fish tissue MDPH issued a site-specific fish consumption advisory for the Sudbury River from Ashland to the confluence with the Assabet and Concord rivers, including Framingham Reservoirs #1 and 2 (MDPH advisory identifies them as Stern and Bracket Reservoirs). The advisory states:

1. The general public should not consume any fish from this waterbody.

The *Fish Consumption Use* is assessed as impaired for the lower 4.5 mile reach of this segment (downstream from the Ashland/Hopkinton boundary near Route 85) due to the site-specific advisory because of mercury contamination. The upper 1.8 mile reach is not assessed for this use.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

In July and September 2001 DWM conducted dry weather fecal coliform and *E. coli* bacteria sampling at three stations listed below.

SU02- Cedar Street, Hopkinton/Westborough

SU03- Route 85, Hopkinton, Southborough)

SU04A- at the Route 135 crossing upstream of the confluence of Cold Spring Brook, Ashland

Fecal coliform bacteria counts ranged between 35 and 660 cfu/100 mL (n=6). It should be noted that the two highest counts were from Station SU04A (Appendix A, Table A6).

ENSR (2004a) conducted fecal coliform and *E. coli* bacteria monitoring on four occasions at their water quality monitoring stations (described above in the *Aquatic Life Use* section) in July and August 2002 and July and September 2003. At the two most upstream stations sampled fecal coliform bacteria counts were fairly low, ranging from <100 to 300 cfu/100 mL. Fecal coliform bacteria counts collected from the river between Howe Street and Route 135 in Ashland ranged from <100 cfu/100mL to 3,100 cfu/100mL. Five of the 15 samples had counts greater than 400 cfu/100 mL and three samples exceeded 2000 cfu/100 mL. Elevated counts were recorded during both wet and dry weather conditions.

In 2004 DWM conducted a pilot source-tracking project (*E. coli* bacteria sampling) along this segment of the Sudbury River to identify potential sources of bacterial contamination. Five stations were sampled

on up to eight occasions between April and August. All but three counts met the current bathing beach standard (Connors 2004).






No objectionable conditions (e.g., odors, oils, turbidity) were noted on the field sheets during the DWM water quality sampling events (MA DEP 2001c). DWM biologists did note that the water was turbid (possibly associated with upstream construction activities or road runoff) upstream from Route 85 but no objectionable conditions were noted (MA DEP 2001a and Appendix D).

The Sudbury Watershed Monitoring and Protection Group (SWAMP) conducted a shoreline survey of this segment of the Sudbury River from the Fruit Street bridge, Hopkinton, to the "Chattanooga Mill Site" near Holly Lane, Ashland in October 1998. SWAMP indicated that there was generally no aesthetic quality degradation. There were a number of dams from former mills throughout this segment and there were several storm drains near the intersection of Wood Street and Cedar Street Extension. They were discharging clear liquid, but anecdotes indicated that they occasionally ran cloudy. Erosion and sedimentation were noted in the vicinity of Southville Road at the millpond and the Stockwell Development. No trash, debris, odors, or colored water were noted (SWAMP 1998).

The Ashland Conservation Commission, in conjunction with the University of Massachusetts Cooperative Extension Program and the Massachusetts Riverways Program, conducted shoreline surveys of the perennial and intermittent waterways in the town in the summer of 2002. In this segment of the Sudbury River the stream team found localized areas of trash and debris, particularly near road crossings. The "Mill Pond Raceway" canal bottom was covered with an orange precipitate. The remaining areas were described as being natural, wildlife habitat with good vegetation/canopy cover and high aesthetic quality (Ashland ConComm 2002).

Too limited fecal coliform bacteria data (only two dates in each of three years) are available to adequately assess the *Primary* and *Secondary Contact Recreational* uses so they are not assessed. The *Aesthetics Use* is assessed as support.

Sudbury River (MA82A-25) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		NOT ASSESSED upper 1.8 mile reach IMPAIRED lower 4.5 mile reach Causes: Mercury Sources: Nyanza Superfund Site (Suspected Sources: Atmospheric deposition)
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

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

RECOMMENDATIONS

- When complete review the results of the EPA Ecological Risk and Human Health Assessment for the Nyanza site for data to continue to assess the status of the *Aquatic Life Use*.
- Continuous *in-situ* dissolved oxygen and temperature monitoring and benthic macroinvertebrate sampling should be conducted which brackets potential sources (e.g. Nyanza site) to better evaluate the status of the *Aquatic Life Use*.
- Work with Sudbury River Watershed Organization to implement their action plan including development of a water quality monitoring program.

- MDPH should review all available data and revise the Fish Consumption Advisory as appropriate.
- Conduct additional bacteria sampling along this segment of the Sudbury River to assess the status of the *Primary* and *Secondary Contact Recreational* uses.

INDIAN BROOK (SEGMENT MA82A-23)

Description: Headwaters, outlet of Icehouse Pond, Hopkinton, to the inlet of Hopkinton Reservoir, Hopkinton (formerly part of Segment MA82A-12)

Segment Length: 2.3 miles

Classification: Class B

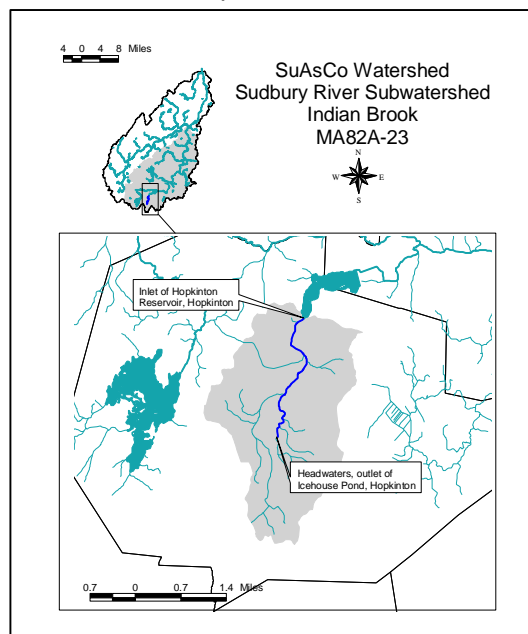
Land-use estimates (top 3, excluding water) for the 5.24 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.61 mi² and the percentage of the imperviousness is 11.7%.

Forest..... 70%

Residential 16%

Transportation.. 5%

Based on the last evaluation of water quality conditions Indian Brook (as part of Segment MA82A-12) is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired due to unknown causes (MA DEP 2003a). The data used to originally list Indian Brook in Category 5 were collected downstream from Hopkinton Reservoir.



In 2002 and 2003 Hopkinton Stream Survey Project volunteers conducted a shoreline survey of Indian Brook. A final report of their findings is not yet available (Riverways 2003).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Weston Nurseries of Hopkinton	21413902		Irrigation Pond Field 37N, 37S, 28, Island Pond	0.76*
Ashland Water and Sewer Department	31401401	9P231401402	3014000-04G -05G -07G -08G -09G	1.23 (reg) <u>0.45 (perm)</u> 1.68

* Indicates system-wide withdrawal - all sources not necessarily in this subwatershed.

NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no permitted surface water discharges to this subwatershed.

USE ASSESSMENT

Due to the lack of available data for this segment of Indian Brook all uses are currently not assessed.

Indian Brook (MA82A-23) Use Summary Table

Aquatic Life	Fish Consumption	Primary Contact	Secondary Contact	Aesthetics
NOT ASSESSED				

RECOMMENDATIONS

- Conduct water quality monitoring and biological monitoring in this segment of Indian Brook to assess the status of the *Aquatic Life Use*.
- Review the results of the Hopkinton Stream Survey Project shoreline survey to assess the status of the *Aesthetics Use* and to identify sources of non-point source pollution to the brook.

INDIAN BROOK (SEGMENT MA82A-24)

Description: Outlet of Hopkinton Reservoir, Ashland, to the confluence with the Sudbury River, Ashland (formerly part of Segment MA82A-12)

Segment Length: 1.7 miles

Classification: Class B

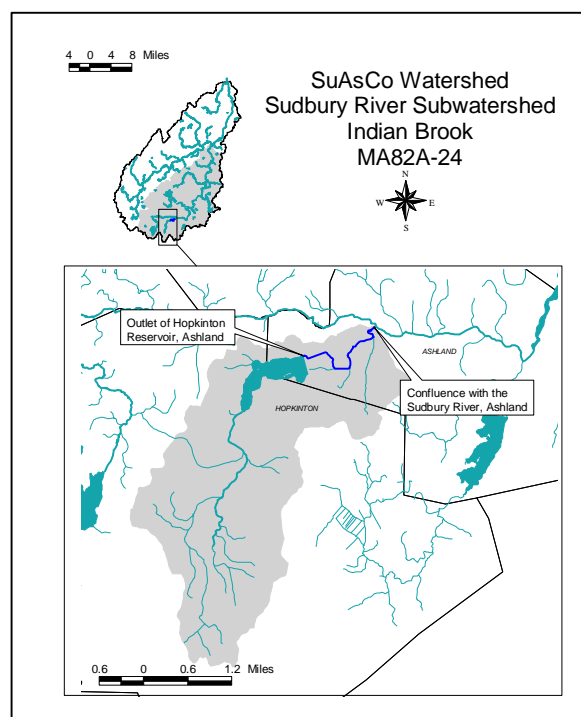
Land-use estimates (top 3, excluding water) for the 7.88 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.76 mi² and the percentage of the imperviousness is 9.7%.

Forest.....	66%
Residential	15%
Open land	7%

Based on the last evaluation of water quality conditions Indian Brook (as part of Segment MA82A-12) is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired due to unknown causes (MA DEP 2003a).

WMA WATER WITHDRAWAL SUMMARY AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available data there are no water withdrawals from this subwatershed or permitted surface water discharges to this subwatershed.



LANDFILLS (APPENDIX K)

The closed Ashland landfill is located within this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

The Department of Conservation and Recreation, Division of Forests and Parks, manages Hopkinton State Park. An impounded section of Indian Brook, just below the Hopkinton Reservoir Dam, is maintained as a bathing pond by MA DCR. Hopkinton Reservoir has two "outflows". There is a spillway located in the very northeastern-most corner of the reservoir. According to MA DCR 99% of the time there are no flows from the reservoir into this spillway. Water from the reservoir is conveyed into the bathing pond via a six-inch pipe (remnants of the former MWRA infrastructure). The bathing pond also has two "outflows". During the winter months water flows through the outflow pipe (located to the northwest of Howe Street) and the pond is basically run-of-river (i.e., no impoundment). During the summer months, especially during the bathing season, the outflow pipe is "plugged" and the pond is allowed to fill until the pond is full, after which water flows over the weir structure located at the northern-most lobe of the pond into Indian Brook (MA DCR 2004).

In July 2001 DWM conducted biomonitoring along one reach of Indian Brook, approximately 400 m downstream from Cross Street in Ashland. This reach had a steep gradient with a series of cascading riffles and small plunge pools. The stream was about 4m wide and water depths varied from 0.25 to 0.5m. Instream moss, covering roughly 50% of the reach, was the only vegetation. No algae were seen. This site received the highest score (185/200) of any of the sites in the 2001 survey (Appendix D). DWM also conducted a habitat quality evaluation in this reach of Indian Brook in 1996 (Appendix H).

Biology

On 5 July 2001 DWM conducted a biomonitoring survey along a reach in Indian Brook downstream from Cross Street, Ashland (Station IB (B0202)). When compared to the North Brook reference station the RBP III analysis indicated that the benthic community was *Slightly Impacted*. Prior sampling by DWM biologists in 1996 in this reach of Indian Brook (Station SAC14) can be found in Appendix H.

Unlike 1996 when filter-feeding organisms dominated the sample, the 2001 sample was found to have higher numbers of sensitive species, which was indicative of improved water quality conditions.

Chemistry-water

ENSR conducted *in situ* water quality monitoring at one station on Indian Brook (T04- Indian Brook Road, Ashland) on four occasions in 2002 and 2003. Parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected and analyzed for ammonia-nitrogen, total phosphorus, and TSS on two occasions (ENSR 2004a).

DO

DO in Indian Brook ranged between 7.3 and 8.5 mg/L (n=4). Percent saturation ranged between 79.3 and 95.2% (n=4). It should be noted that these data were collected between 0650 and 0915h, not during worse case pre-dawn conditions.

Temperature

Temperatures ranged from 17.1 to 20.9°C (n=4).

pH

pH values ranged between 6.5 and 7.0 SU (n=4).

Conductivity

Specific conductivity in Indian Brook ranged from 248 to 335 µS/cm (n=4).

Total Suspended Solids

TSS concentrations were <1 and 3 mg/L.

Total phosphorus

The total phosphorus concentrations in Indian Brook were <0.01 and 0.02 mg/L.

Ammonia-nitrogen

Ammonia-nitrogen concentrations were 0.05 and 0.08 mg/L.

The *Aquatic Life Use* is assessed as support based on the RBP III analysis coupled with supporting habitat and water quality data.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

DWM collected bacteria samples from Indian Brook at two locations in 2001. On July 10 at Station IB01, upstream from Cross Street bridge in Ashland, the count was 75 cfu/100 mL (wet weather). On 30 July at Station IB01A, downstream from Indian Brook Road in Ashland the count was 30 cfu/100 mL (dry weather). The results from the 11 September 2001 sampling at Station IB01A were censored due to the exceedances of hold times.

ENSR collected fecal coliform and *E. coli* bacteria samples from one station (T04- Indian Brook Road, Ashland) on three occasions; one in 2002 and two in 2003 (ENSR 2004a). Counts ranged between <100 and 200 cfu/100 mL (n=3). Samples were collected during both wet and dry weather conditions.






In July 2001 DWM biologists noted that the water in Indian Brook downstream from Cross Street in Ashland was clear with no objectionable odors, colors, or trash (MA DEP 2001a and Appendix D).

The Ashland Conservation Commission conducted a shoreline survey of Indian Brook from the outlet of Hopkinton Reservoir to Cross Street on 29 May 2002. The water color of Indian Brook was noted to be slightly brownish with no odors and with the exception of "some accumulation of dead leaves causing stream blockage... the area was very nice for outdoor recreation" (Ashland ConComm 2002).

In 2002 and 2003 Hopkinton Stream Survey Project volunteers conducted a shoreline survey of Indian Brook. A final report of their findings is not yet available (Riverways 2003).

While too limited fecal coliform bacteria data are available to assess either the *Primary* or *Secondary Contact Recreational* uses the *Aesthetics Use* is assessed as support based on observations by both DWM biologists and the Ashland Stream Team volunteers.

Indian Brook (MA82A-24) Use Summary Table

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

RECOMMENDATIONS

- Continue to conduct biological (benthic macroinvertebrate and fish population) and habitat quality monitoring in Indian Brook in order to evaluate the status of the *Aquatic Life Use* and to document any changes in water quality conditions.
- Additional bacteria monitoring should be conducted in Indian Brook to assess the status of the *Recreational* uses.
- Work with the Ashland Conservation Commission Stream Team to protect and maintain the high aesthetic quality of Indian Brook.
- Work with MA DCR to ensure minimum flows are maintained in Indian Brook during the filling of the swimming pond.

SUDBURY RIVER (SEGMENT MA82A-26)

Description: From the outlet of Framingham Reservoir #1, Framingham, to the inlet of Saxonville Pond, Framingham (formerly part of Segment MA82A-02)

Segment Length: 2.8 miles

Classification: Class B, Warm Water Fishery

Land-use estimates (top 3, excluding water) for the 82.1 mi² subwatershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 10.9mi² and the percentage of the imperviousness is 13.3%.

Forest 44%

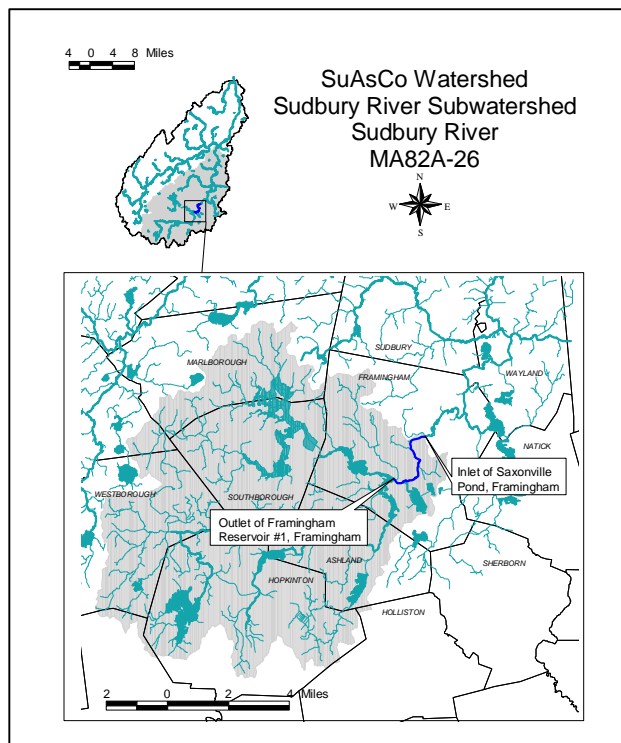
Residential 28%

Open land 7%

Based on the last evaluation of water quality conditions this segment of the Sudbury River is listed on the 2002 Integrated List of Waters (as part of Segment MA82A-02) in Category 5. This segment was assessed as impaired and requires a TMDL for metals (MA DEP 2003a).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

There are 12 Emergency water supply sources in this subwatershed.



NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLE E1-E4)

Murphy's Automotive (MA0030660) is permitted (7/18/1988) to discharge to Sucker Pond and is still listed on the EPA list of active dischargers as of August 2004.

Framingham District Court (MA0036145) was permitted to discharge to this segment of the Sudbury River. This discharge was from a Tier 2 21e site. Remediation has been completed and EPA terminated the permit in August 2003.

SUPERFUND SITES

In September 1983 the Nyanza Chemical Waste Dump was placed on the National Priorities List. Groundwater, sediments, and surface water are contaminated with heavy metals and chlorinated organics. Additional information is available in the previous segment and in the Summary of Existing Conditions and Perceiver Problems section.

LANDFILLS (APPENDIX K)

There are four landfills in this subwatershed, all of which are closed or inactive.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

On 19 July 2001 DWM conducted biomonitoring along this one reach of this segment of the Sudbury River downstream from Winter Street in Framingham (Station SRF (B0484)). The river was about 6 m wide with depths of 0.25 to 0.35 m in the riffles/runs and up to 0.5 m in the pools. No erosion or non-point source pollution was noted. The reach was 7% covered with a canopy. The instream vegetation was milfoil (*Myriophyllum* sp.) but that was present in no more than 5% of the sample reach. No algal growths were seen. A lack of stable fish cover, sediment deposition, and only two velocity/depth combinations resulted in a habitat score of 166/200 (Appendix D).

Biology

This segment of the Sudbury River contains Estimated Habitat for Rare Wildlife (Ashland ConComm 2002).

On 19 July 2001 DWM conducted biomonitoring at Station SRF (see description above) in Framingham. The RBP III analysis indicated this site was *Moderately Impacted* when compared to the North Brook reference station (Appendix D).

Chemistry – water

DWM conducted water quality monitoring at one site on this segment of the Sudbury River in 2001- Station SU04- Winter Street, Framingham. Parameters, measured *in situ*, included dissolved oxygen, percent saturation, temperature, pH, conductivity, and total dissolved solids. Grab samples were collected and analyzed for hardness, alkalinity, turbidity, ammonia-nitrogen, total suspended solids, and total phosphorus (Appendix A).

ENSR conducted *in situ* water quality sampling at five stations (see below) along this segment of the Sudbury River in July and August 2002 and July and August 2003. *In situ* parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected for nutrient analysis of ammonia-nitrogen and total phosphorus (ENSR 2004a).

SR25- Conrail Crossing, Framingham

SR24- Franklin Street, Framingham

SR14- Union Avenue, Framingham

SR23- Main Street, Framingham

SR13- Central Street, Framingham

DO

Pre-dawn dissolved oxygen concentrations measured by DWM ranged from 5.2 to 8.3 mg/L (n=3) and percent saturations ranged between 59 and 97% (only one of the three less than 60%). DO concentrations measured by ENSR ranged between 5.7 and 8.2 mg/L (n=14). Percent saturations ranged between 61.7 and 94.8% (n=14). ENSR data were not collected during worst-case, pre-dawn conditions.

Temperature

Temperatures in the Sudbury River, as measured by DWM, ranged from 22.4 to 23.8°C (n=3), while ENSR measured temperatures between 17.8 and 27.1°C (n=14).

pH

pH readings taken by DWM ranged from 6.8 to 7.0 SU (n=3). pH measured by ENSR ranged between 6.37 and 7.25 SU (n=14) with only one measurement less than 6.5 SU.

Hardness

Hardness ranged from 43 to 48 mg/L (n=3).

Alkalinity

Alkalinity ranged from 17 to 21 mg/L (n=3).

Conductivity

Conductivity at 25°C as measured by DWM ranged from 383 to 433 µS/cm (n=3). Conductivity as measured by ENSR ranged between 272 and 562 µS/cm (n=14).

Total Suspended Solids

TSS concentrations reported by DWM ranged from <1.0 to 2.4 mg/L (n=3) while TSS concentrations measured by ENSR ranged from <1 to 6 (n=11).

Turbidity

Turbidity in the Sudbury River ranged between 1.5 and 1.9 NTU (n=3).

Total phosphorus

DWM data reported the concentrations of total phosphorus in this segment of the Sudbury River between 0.029 and 0.036 mg/L. Total phosphorus concentrations measured by ENSR ranged between <0.01 and 0.04 mg/L (n=11).

Ammonia-nitrogen

Ammonia-nitrogen concentrations reported by DWM were <0.02 mg/L (n=3) and ENSR reported ammonia-nitrogen concentrations between <0.03 and 0.07 (n=11).

Chemistry-sediment

The sediments of the Sudbury River are contaminated with heavy metals and chlorinated organics from the former Nyanza Inc. EPA completed cleanup of the mercury contaminated sediments in wetlands and drainage ditches from the site in August 2001. Data collection and assessment will continue to address contamination of groundwater and the Sudbury River sediments (Sprague 2003).

Chemistry-tissue

EPA is continuing efforts to address contamination of fish from the Sudbury River due to the Nyanza Superfund Site.

The *Aquatic Life Use* is assessed as impaired for this segment of the Sudbury River based on the RBP III analysis that indicated a moderately impacted benthic community. Filter-feeders dominated the benthic sample, often associated with a lotic community downstream from a productive impoundment. Additionally, the mercury contamination from the Nyanza Superfund Site is also of concern.

FISH CONSUMPTION

DWM conducted fish toxics monitoring in the Sudbury River in 1985, 1986, 1987, and 1988. Sampling in 1988 was conducted to confirm the mercury results of previous studies and to investigate possible bioaccumulation of PCBs as indicated by 1986 USFWS data (Maietta 1990). Sources of mercury include the Nyanza Superfund Site. Based on DWM data that found elevated concentrations of mercury in fish tissue MDPH issued a fish consumption advisory for the Sudbury River from Ashland to the confluence with the Assabet and Concord rivers, including Framingham Reservoirs #1 and 2) (MDPH refers to them as Stern and Bracket Reservoirs). The advisory states:

1. The general public should not consume any fish from this waterbody.

The *Fish Consumption Use* is assessed as impaired for this segment of the Sudbury River due to the site-specific advisory because of mercury contamination.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

DWM conducted dry weather fecal coliform and *E. coli* bacteria sampling at Winter Street in Framingham (Station SU04) in July and September 2001. The valid fecal coliform bacteria count was 100 cfu/100 mL (Appendix A). Hold times were exceeded on the September survey; subsequently the results for that survey were censored.

ENSR (2004a) conducted fecal coliform and *E. coli* bacteria monitoring at their water quality monitoring stations (see locations in the *Aquatic Life* section) in July and August 2002 and July and September 2003. Fecal coliform bacteria counts ranged from <100 cfu/100mL to 4500 cfu/100mL with four of the 10 samples having counts exceeding 2,000 cfu/100mL. Elevated counts were recorded during both wet and dry weather conditions.

In 2004 DWM conducted a pilot source-tracking project in the Baiting Brook subwatershed, a tributary to this segment of the Sudbury River, to identify potential sources of bacterial contamination. The Town of Framingham, in their application for their NPDES Phase II storm water permit, identified 48 storm water outfalls in the Baiting Brook subwatershed. Up to 30 stations were sampled on up to 14 occasions between April and November throughout the watershed (including tributaries and storm






drains). The study identified wildlife, improper disposal of pet waste, and stormwater runoff as sources of bacterial contamination to Baiting Brook (Connors 2004).

DWM biologists noted no objectionable deposits, odors, or sheens in the Sudbury River downstream from Winter Street in Framingham, but the water was slightly turbid (Appendix D and MA DEP 2001a).

In 1997 the Framingham Advocates for the Sudbury River conducted a shoreline survey of the Sudbury River beginning at the Winter Street Dam. Trash, algae growth and sediment deposition were noted (Riverways 1999b).

The *Primary* and *Secondary Contact Recreational* uses are not assessed due to the limited fecal coliform bacteria dataset. However, the *Primary Contact Recreation Use* is identified with an Alert Status because of elevated fecal coliform bacteria counts. The *Aesthetics Use* is assessed as support based on the recent observations of DWM biologists. However, this use is identified with an Alert Status due to the objectionable conditions noted by the Framingham Advocates for the Sudbury River.

Sudbury River (MA82A-26) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Benthic macroinvertebrate assessment (Suspected Sources: Upstream Impoundment)
Fish Consumption		IMPAIRED Causes: Mercury Sources: Nyanza Superfund Site (Suspected Sources: Atmospheric deposition)
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT*

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

RECOMMENDATIONS

- Conduct additional biological monitoring along this segment of the Sudbury River to continue to assess the status of the *Aquatic Life Use*.
- Review the results of the ecological risk assessment for the Nyanza Superfund Site to better assess the *Aquatic Life Use*.
- Collect additional bacteria samples throughout this segment to attempt to isolate and eliminate sources of bacterial contamination.
- Work with the Framingham Advocates for the Sudbury to update their shoreline survey to better assess the status of the *Aesthetics Use*.

EAMES BROOK (SEGMENT MA82A-13)

Description: From the outlet of Farm Pond, Framingham, to the confluence with the Sudbury River, Framingham

Segment Length: 0.6 miles

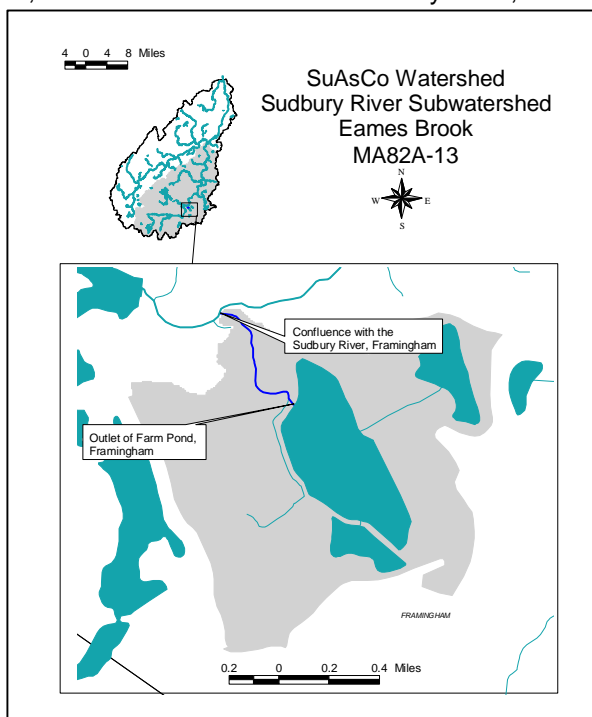
Classification: Class B

Land-use estimates (top 3, excluding water) for the 1.24 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.34 mi² and the percentage of the imperviousness is 27.4%.

Open land	25%
Residential	17%
Commercial	13%

Based on the last evaluation of water quality conditions Eames Brook is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired due to unknown causes, noxious aquatic plants, and exotic species (non-pollutant) and a TMDL is required (MA DEP 2003a).

The use assessment of Farm Pond is provided in the lakes section of this report.



WMA WATER WITHDRAWAL SUMMARY AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no regulated water withdrawals from or NPDES regulated discharges to this subwatershed.

LANDFILLS (APPENDIX K)

The Framingham Compost Site and former landfill is located within this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

DWM conducted a habitat assessment of Eames Brook in 1996 at one station downstream from the Framingham Reduction Plant, upstream from Dudley Road (Appendix H). DWM biologists noted that the sediments upstream from the benthic sampling location, as well as downstream from Dudley Road, were very mucky and released oils and petroleum odors when disturbed.

While there are no outlet control structures or dams to maintain water levels in Farm Pond there is a small concrete footbridge over the outlet.

Biology

DWM conducted benthic macroinvertebrate sampling in Eames Brook in 1996 at one station (SAC13A) downstream from the Framingham Reduction Plant and downstream from Dudley Road (Appendix H). The non-native aquatic macrophyte *Potamogeton crispus* was observed in the brook.

Chemistry-water

ENSR conducted *in situ* water quality monitoring at one station on Eames Brook (T01- Sherwin Terrace, Framingham) in 2002 and 2003. Parameters measured included DO, temperature, pH, and conductivity. Grab samples were collected for ammonia-nitrogen and total phosphorus analysis (ENSR 2004a). ENSR also collected samples from an unnamed tributary (locally known as Eames Brook) at one station (T18- Dudley Road, Framingham).

DO

The DO concentrations in Eames Brook at Sherwin Terrace ranged between 4.6 and 5.3 (n=4) with two of the four measurements less than 5.0 mg/L. Percent saturations ranging between 46.9 and 63.8% with only one measurement less than 60% saturation. It should be noted that these data were not collected during worst-case, pre-dawn conditions (i.e., between 0735 and 1305h).

Temperature

The water temperatures in Eames Brook ranged from 16.1 to 26.9 °C (n=4).

pH

The pH in Eames Brook ranged between 6.8 and 7.2 SU (n=4).

Conductivity

Conductivity ranged from 721 to 1010 µS/cm (n=4).

Total Suspended Solids

TSS concentrations in Eames Brook ranged between 8 and 10 (n=3).

Total Phosphorus

Total phosphorus concentrations ranged from <0.01 to 0.06 (only one of the three concentrations was greater than 0.05 mg/L).

Ammonia-nitrogen

The concentration of ammonia-nitrogen in Eames Brook ranged between 0.26 and 0.51 mg/L (n=3).

The *Aquatic Life Use* is currently not assessed for Eames Brook due to the lack of pre-dawn dissolved oxygen, habitat quality, and current biological data. This use is identified with an Alert Status due to occasional low dissolved oxygen concentrations, elevated conductivity, and sediment oils/odors. The extent of the non-native aquatic macrophyte infestation is currently unknown.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

DWM bacteria sampling on two occasions in July 2001 (dry weather conditions) in Eames Brook near Sherwin Terrace in Framingham (Station EP01) found fecal coliform bacteria counts of 140 and 240 cfu/100 mL (Appendix A).






ENSR collected fecal coliform and *E. coli* bacteria samples from the brook near Sherwin Terrace in Framingham (Station T01) on four occasions (July and August 2002 and July and September 2003) during wet and dry weather (ENSR 2004a). Fecal coliform bacteria counts ranged between 100 and 6700 cfu/100 mL with two of the four measurements greater than 2000 cfu/100 mL. The highest counts (<3,000 and 6,700 cfu/100mL) were recorded on 22 July 2002 (dry weather, drought year) and 16 September 2003 (wet weather).

The entire Eames Brook subwatershed is sewered. The Town of Framingham identified approximately 19 storm water outfalls in the Eames Brook subwatershed in their application for their NPDES Phase II storm water permit. In 2004 DWM conducted a pilot source-tracking project in the Eames Brook subwatershed to identify potential sources of bacterial contamination. Four stations were sampled on up to 11 occasions between April and November. A storm water outfall near Mt. Wayte Avenue was found to be contaminated with raw sewage (Connors 2004).

During surveys conducted by DWM in 1996 and 2004 Eames Brook was observed to have aesthetically objectionable conditions including excessive amounts of algae, sediment petroleum odors and oils, and instream trash and debris (Appendix H and Connors 2004).

The *Recreational* and *Aesthetics* uses are assessed as impaired for Eames Brook due to aesthetically objectionable conditions. Although too limited fecal coliform bacteria data are available elevated bacteria counts are also of concern.

Eames Brook (MA82A-13) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED*
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Trash and debris, excess algal growth, sediment odor (Suspected Causes: Fecal coliform bacteria) (Suspected Sources: Discharges from municipal separate storm sewers (MS4s), landfill, municipal urbanized high density areas)
Secondary Contact		
Aesthetics		IMPAIRED Causes: Trash and debris, excess algal growth, sediment odor (Suspected Sources: Discharges from municipal separate storm sewers (MS4s), landfill, municipal urbanized high density areas)

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

RECOMMENDATIONS

- Conduct additional water quality monitoring in Eames Brook (i.e., pre-dawn DO, benthic macroinvertebrate, habitat) to evaluate the status of the *Aquatic Life Use* and to bracket potential sources of pollution to the brook (e.g., landfill, compost facility, storm drains).
- Conduct sediment sampling in Eames Brook (see Appendix H).
- Evaluate the level of infestation of the non-native macrophyte *Potamogeton crispus* in Eames Brook.
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including treatment of storm water discharges, sewer infrastructure repairs and the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Work with the Town to employ best management practices at the landfill and compost facility. Yard waste and disposed items can easily tumble down the embankment negatively impacting water quality. Determine the effects, if any, of the unlined, uncapped landfill to the brook.
- Work with Keefe Technical High School and Barbieri Middle School to employ BMPs for their athletic fields including reducing fertilizer and pesticide use, which could contribute to instream nutrient concentrations and excessive algae.

SUDBURY RIVER (SEGMENT MA82A-03)

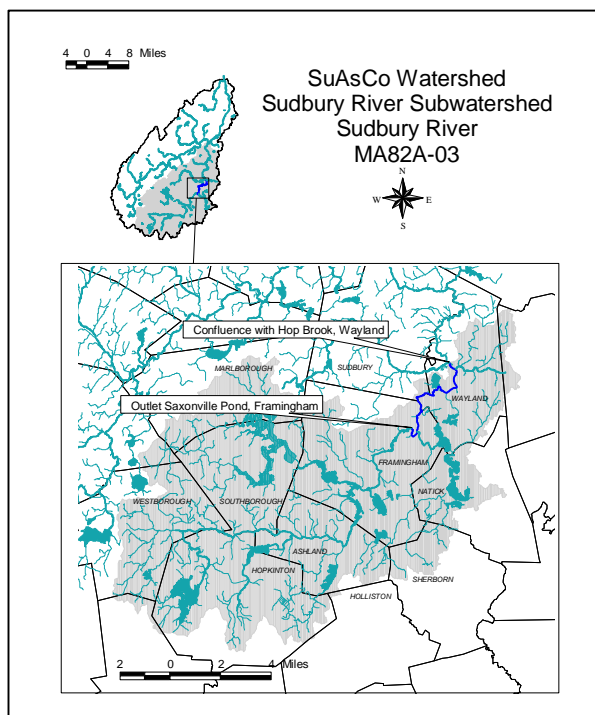
Description: Outlet Saxonville Pond, Framingham, to confluence with Hop Brook (the lower portion of Hop Brook was identified as Wash Brook on USGS quads prior to 1987), Wayland
Segment Length: 5.5 miles
Classification: Class B, Aquatic Life

Land-use estimates (top 3, excluding water) for the 116.4 mi² subwatershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 17.1 mi² and the percentage of the imperviousness is 14.7%.

Forest 39%
Residential 33%
Open land 7%

Based on the last evaluation of water quality conditions this segment of the Sudbury River is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for metals (MA DEP 2003a).

The Saxonville Local Flood Control Protection Project is located along the Sudbury River in the Saxonville section of Framingham and was completed in 1979 at a cost of \$4.75 million. The project extends from the Saxonville Dam to the Danforth Street Bridge and consists of 2,500 feet of earthfill dikes with stone slope protection, 1,340 feet of concrete floodwalls, a vehicular floodgate at Concord Street, and a pumping station. The project straightened a 1,000-foot section of the Sudbury River upstream from the Danforth Street Bridge. The Town of Framingham operates and maintains the project (ACOE 1995).



The USFWS collected ten similar-sized yellow perch, white perch, brown bullhead, and black crappie from one site along this segment of the Sudbury River in 1996 and three sites in 1987 (Eaton and Carr 1991). Wholebody composite samples were analyzed for heavy metals, PCBs and organochlorine pesticides. (It should be noted that in Eaton and Carr (1991) concentrations in whole fish are compared to the Food and Drug Administration's edible portion action levels.) Total PCBs, where detected, were well below the NAS/NAE guideline (Coles 1998) for the protection of fish eating wildlife of 500 ppb wet weight. Total DDT levels were also less than the 14.0 ppb wet weight guidelines. Two sediment samples were also collected from this segment in 1987 and analyzed for PCBs, PAHs, organochlorine pesticides, and heavy metals (Eaton and Carr 1991). PCBs, PAHs (1 sample closest to Nyanza site), arsenic, cadmium, and chromium concentrations exceeded the L-EL guidelines from Persuad *et al.* (1993). Lead and mercury (sample closest to Nyanza) concentrations exceeded both the L-EL and the S-EL.

WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Wayland Water Department	9P431431501	31431502	3315000-03G -04G -05G	1.66 (reg)

The Framingham Water Department wells 3100000-01G, -02G, and -03G have not been used since 1990. The Water Department relies on MWRA supply.

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

The Dennison Manufacturing Company's (MA0002844) NCCW discharge was terminated in 1996, and, subsequently, EPA terminated the NPDES permit in August 1999.

LANDFILLS (APPENDIX K)

There is one inactive, unlined, and uncapped landfill located within this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

Stream gaging data for the Sudbury River are available for the USGS gage 01098530 located downstream from the new Danforth Street Bridge, Saxonville, from 1979 to the present. The drainage area at this gage is 106 mi² and the average annual discharge over the period of record is 193 cfs (Socolow *et al.* 2004). According to USGS flows are regulated by upstream reservoirs and affected by diversions and spills; flows are diverted as needed for use of the Boston metropolitan district for drinking water supply; and part of the flow from Wachusett Reservoir is diverted into the Sudbury Reservoir en route to the Boston metropolitan district (Socolow *et al.* 2004).

Chemistry – water

As part of the SMART monitoring program, water quality sampling was conducted on five occasions between March and November of 2000 in the Sudbury River (Station SU07) just upstream/south of Danforth Street, Framingham (Appendix I). Parameters measured included temperature, DO, pH, specific conductivity, TSS, turbidity, hardness, alkalinity, total phosphorus, and ammonia-nitrogen.

DWM conducted water quality monitoring on 11 and 31 July and 11 September 2001 at two stations on this segment of the Sudbury River: SU07- Danforth Street, Framingham and SU09- at Pelham Island Road, Wayland (Appendix A).

ENSR conducted *in situ* water quality sampling along this segment of the Sudbury River in July and August 2002 and 2003 (see stations below). *In situ* parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected and analyzed of ammonia-nitrogen and total phosphorus (ENSR 2004a).

SR10- Concord Street, Framingham
SR09- Danforth Street, Framingham
SR08- Stonebridge Road, Wayland
SR07- Bridge on Pelham Island Road, Wayland

DO- Note: This segment is designated as "Aquatic Life", so Class C dissolved oxygen and temperature criteria apply.

DO measurements recorded by SMART ranged from 8.0 to 12.8 mg/L (n=5) with percent saturation ranging from 90 to 107%. It should be noted that these data do not represent the worse-case (pre-dawn) conditions. Pre-dawn DO concentrations measured by DWM ranged from 5.3 to 7.9 mg/L while percent saturation ranged from 58 to 92% (n=6) with only one measurement less than 60% saturation. ENSR measured DO concentrations in this segment of the Sudbury River between 3.1 and 9.3 mg/L with percent saturations between 34.4 and 113.2% (n=19). The low concentration was recorded at Station SR07 on 22 August 2003 and was the only reading less than 5 mg/L. It should be noted that these data were not collected during worst-case conditions.

Temperature

Temperatures measured by the SMART program ranged between 5.6 and 22.1°C (n=5). DWM measured temperatures in the Sudbury River between 19.7 and 23.4°C (n=6) and ENSR measured temperatures between 17.9 and 27.1°C (n=19).

pH

Instream pH as measured by SMART ranged between 6.8 and 7.1 SU (n=5). Similarly, DWM measured pH between 6.7 and 7.2 SU (n=6) and ENSR measured pH between 6.5 and 7.6 SU (n=19).

Alkalinity

The SMART program alkalinities were similar, ranging from 15 to 26 mg/L (n=5) while DWM measured alkalinities in this segment of the Sudbury River between 19 and 36 mg/L (n=5).

Hardness

Hardness data, as recorded by the SMART program ranged from 39 to 58 mg/L (n=5), while DWM recorded hardness values ranged between 50 and 82 mg/L (n=5).

Conductivity

Conductivity at 25° C as measured by the SMART program ranged from 313 to 422 μ S/cm (n=5) while DWM measured conductivities ranging from 416 to 625 μ S/cm (n=6). Conductivities measured by ENSR ranged between 394 and 542 μ S/cm (n=19).

Turbidity

Turbidity measured by the SMART program ranged from 0.6 to 2.1 NTU (n=5) while DWM measured turbidity ranging from 0.75 to 5.3 NTU (n=5).

Total Suspended Solids

During the SMART sampling suspended solids concentrations ranged between <1.0 and 2.2 mg/L (n=5). TSS concentrations during DWM sampling ranged between <1.0 and 9.6 mg/L (n=5) and TSS concentrations measured by ENSR ranged between < 1 and 29 mg/L with only one measurement greater than 25 mg/L.

Total Phosphorus

Total phosphorus concentrations in the Sudbury River south of Danforth Street, as measured by SMART, ranged between 0.017 and 0.04 mg/L (n=5). Total phosphorus concentrations reported by DWM ranged between 0.015 and 0.064 mg/L (n=5) with the two samples from Pelham Island Road in Wayland having concentrations greater than 0.05 mg/L. ENSR measured total phosphorus concentrations in this segment of the Sudbury River between <0.01 and 0.03 mg/L (n=12).

Ammonia-nitrogen

Ammonia-nitrogen concentrations reported by the SMART program and DWM were all <0.02 mg/L (which do not exceed the chronic criterion for ammonia-nitrogen). Data from ENSR indicate concentrations of ammonia-nitrogen between <0.03 and 0.06 mg/L (n=12).

Chemistry-sediment

USGS collected and analyzed sediment cores collected in the stream channel and at the bank at one site in the Sudbury River near the Wayland High School in Wayland (Station T1) in August and May 1995, respectively (Colman *et al.* 1999). The total mercury concentration in the channel core was approximately 0.5 ppm dry-weight at the top, increased with depth up to a maximum concentration of approximately 1.0 ppm dry-weight in the 4-6 cm section of the core and then steadily decreasing to very low concentrations to the bottom of the core. The total mercury concentration in the bank core was highest at the top (approximately 2.2 ppm dry-weight) and decreased steadily to very low concentrations at the bottom of the core (Colman *et al.* 1999).

The *Aquatic Life Use* is assessed as support for this segment of the Sudbury River based primarily on the water quality data. This use is identified with an Alert Status, however, because of the mercury contamination from the Nyanza Superfund Site.

FISH CONSUMPTION

DWM conducted fish toxics monitoring in the Sudbury River in 1985, 1986, 1987, and 1988. Sampling in 1988 was conducted to confirm the results of previous studies and to investigate possible bioaccumulation of PCBs as indicated by 1986 USFWS data (Maietta 1990). Sources of mercury include the Nyanza Superfund Site. Based on DWM data that found elevated concentrations of mercury in fish tissue MDPH issued a fish consumption advisory for the Sudbury River from Ashland to the confluence with the Assabet and Concord rivers, including Stern and Bracket Reservoirs in Framingham. The advisory states:

1. The general public should not consume any fish from this waterbody.

The *Fish Consumption Use* is assessed as impaired due to the MDPH site-specific advisory because of mercury contamination.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS






DWM collected fecal coliform and *E. coli* bacteria samples from two sites on this segment of the Sudbury River- upstream of Danforth Street in Framingham and at Pelham Island Road in Wayland in 2001 (Appendix A). Fecal coliform bacteria counts ranged between 40 and 140 cfu/100 mL (n=4).

ENSR (2004a) collected fecal coliform and *E. coli* bacteria samples from their water quality monitoring stations (see station location details in the *Aquatic Life Use* section) in July and August 2002 and July, August, and September 2003. Fecal coliform bacteria counts from all stations ranged between <100 cfu/100mL to 19,500 cfu/100mL (n=14). Elevated counts were recorded during both wet and dry weather conditions with the highest count being recorded during wet weather at Station SR08, Stonebridge Road, Wayland. Seven of the 14 counts were greater than 400 cfu/100mL and three were greater than 2000 cfu/100 mL.

The SMART monitoring crew noted trash and debris and decaying aquatic plant matter in the river near Danforth Street in Framingham (Station SU07). On one sampling event a scum on the water was noted (MA DEP 2001b).

Because of the limited fecal coliform bacteria dataset (too few samples collected in any given year) and lack of information as to the aesthetic quality of this segment of the Sudbury River, the *Primary* and *Secondary Contact Recreational* and *Aesthetic* uses are not assessed. The *Recreational* uses are identified with an Alert Status, however, because of the occasionally high bacteria counts.

Sudbury River (MA82A-03) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		IMPAIRED Causes: Mercury Sources: Nyanza Superfund Site (Suspected Sources: Atmospheric deposition)
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED

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

RECOMMENDATIONS

- Conduct biological monitoring in this segment of the Sudbury to better evaluate the status of the *Aquatic Life Use*.
- Work with the Sandy Burr Country Club to implement BMPs including limiting fertilizing use, which could contribute to instream nutrient concentrations and impact the aquatic life.
- Continue to conduct bacteria monitoring along this segment to assess the status of the *Primary* and *Secondary Contact Recreational* uses. Efforts should be aimed at identifying and eliminating potential sources of bacterial contamination.
- Work to promote stewardship along this segment and create a stream team to conduct shoreline surveys to assess the *Aesthetics Use*.

UNNAMED TRIBUTARY LOCALLY KNOWN AS COCHITUATE BROOK (MA82A-22)

Description: Unnamed tributary to the Sudbury River, locally known as Cochituate Brook, from the outlet of the north basin of Lake Cochituate, Framingham, to confluence with Sudbury River, Framingham

Segment Length: 1.3 miles

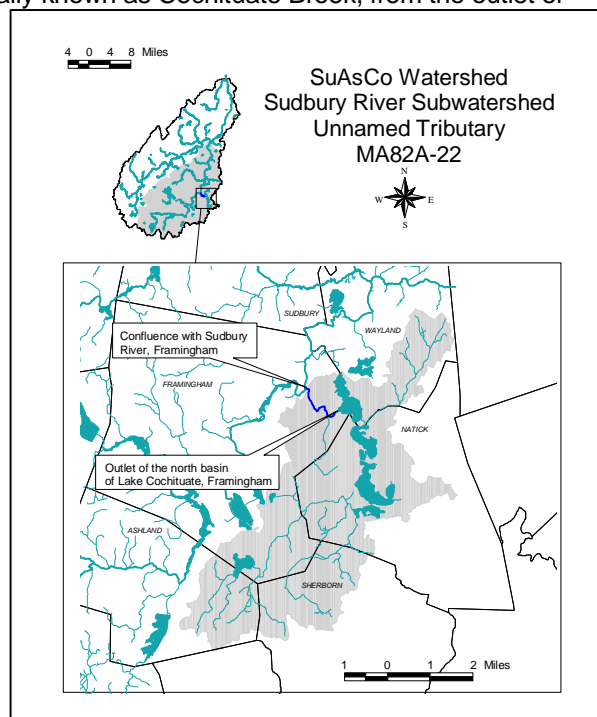
Classification: Class B

Land-use estimates (top 3, excluding water) for the 20.2 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 4.5 mi² and the percentage of the imperviousness is 22.3%.

Residential 40%

Forest..... 27%

Commercial..... 9%



WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Natick Water Department		3149801	3198000-01G -02G -07G -09G -13G -11G	4.1

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

US Army Natick R&D Labs (MA0001724) is permitted to discharge storm water to the south basin of Lake Cochituate, which is located within this subwatershed (see lakes section for additional information).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

DWM conducted a habitat assessment of this unnamed tributary in July 2001. The sample reach was about 150 m downstream from the outlet of Lake Cochituate. The width was roughly 5 m and the depths ranged from around 0.3 m to 0.5 m. Thin-film green algae were observed on rocks in about 10% of the reach. Gravel and sand accounted for 65% of the bottom composition in the reach. The habitat score was 175 out of 200 (Appendix D).

Biology

In July 2001 DWM conducted benthic macroinvertebrate sampling in this unnamed tributary approximately 150 meters downstream from the lake outlet in Framingham. However, because of the hyperdominance of Hydropsychid caddisflies two subsamples were picked (stations LCA and LCB). Compared to the North Brook reference station the RBP III analysis using LCA subsample (including the hydropsychids) indicated the benthos were *Moderately Impacted/Severely Impacted*. The LCB analysis (hydropsychids removed from the sample) still resulted in the benthos being classified as *Moderately Impacted*. Dominance by filter feeders and high HBI values obtained for this site are

characteristic of benthic communities in riffle habitats downstream from very enriched impoundments (Appendix D).

Chemistry – water

DWM conducted water quality monitoring in this unnamed tributary at two stations (CB01- Outlet Lake Cochituate, Framingham, and CB02- School Street/Route 126, Framingham) in 2001. Parameters measured included DO, temperature, pH, conductivity, and total dissolved solids. Grab samples were collected and analyzed for turbidity, hardness, alkalinity, ammonia-nitrogen, and total phosphorus (Appendix A).

DO

Dissolved oxygen concentrations in this unnamed tributary locally known as Cochituate Brook during pre-dawn hours ranged between 6.0 and 8.5 mg/L. Percent saturations ranged between 62 and 101% (n=6).

Temperature

In stream temperatures ranged between 18.1 and 24.8°C (n=6).

pH

pH ranged from 7.1 to 8.1 SU (n=6).

Hardness

Hardness values measured by DWM were between 49 and 109 mg/L (n=9).

Alkalinity

Alkalinity ranged between 23 and 55 mg/L (n=9).

Conductivity

Specific conductance at 25°C as measured by DWM ranged between 203 and 863 µS/cm (n=6) although it should be noted that conductivities were much higher in the brook near School Street during two of the three surveys.

Total Suspended Solids

TSS concentrations ranged between 1.0 and 3.0 mg/L (n=9).

Turbidity

Turbidity in this unnamed tributary, as measured in samples collected by DWM, ranged between 0.9 and 2.1 NTU (n=9).

Total Phosphorus

Total phosphorus concentrations measured by DWM ranged between 0.014 and 0.032 (n=9).

Ammonia-nitrogen

Ammonia-nitrogen concentrations were all <0.02 mg/L (n=9).

The *Aquatic Life Use* for this unnamed tributary, locally known as Cochituate Brook, is assessed as impaired based on the results of the RBP III analysis, which indicated a moderately/severely impacted benthic community. Although the water quality data were indicative of generally good conditions the benthic community was hyperdominated by filter feeders. This hyperdominance, coupled with high HBI values, is representative of impairment associated with increased organic loading, originating from Lake Cochituate.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS






DWM collected fecal coliform and *E. coli* bacteria samples from this unnamed tributary at the water quality stations at the outlet of Lake Cochituate and at School Street on three occasions in July and September 2001 (Appendix A). Holding times were exceeded on the September survey so the data

were censored. The fecal coliform counts in July ranged between 22 and 230 cfu/100 mL (n=6). These data were collected during dry weather conditions.

DWM biologists noted that the water in this unnamed tributary had a fish odor and was slightly turbid during the benthic survey in July 2001. No color, surface oils, or other objectionable conditions were reported (MA DEP 2001a).

Because of the limited data set available the *Primary* and *Secondary Contact Recreational* uses are not assessed for this unnamed tributary. The *Aesthetics Use* is assessed as support based on observations by DWM biologists.

Unnamed Tributary (MA82A-22) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Organic enrichment biological indicators Sources: Upstream impoundment (Suspected Sources: Municipal urbanized high density area, discharges from municipal separate storm sewers (MS4s))
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		SUPPORT

RECOMMENDATIONS

- Conduct additional water quality monitoring in this unnamed tributary (i.e., habitat quality evaluations and biological monitoring) to evaluate the status of the *Aquatic Life Use* and any changes associated with pollution reduction activities.
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- The Metropolitan Area Planning Council developed a Nonpoint Source Pollution Water Quality Management Plan for Lake Cochituate (July 2004) with funding from MA DEP through the 604(b)(3) grant program. While the recommendations from this plan are aimed at improving water quality in the Lake, it is important to note that the recommendations, particularly for managing stormwater and sedimentation, will also improve water quality in this unnamed tributary, locally known as Cochituate Brook. The MAPC and the towns in this subwatershed should work together to implement the recommendations from this 604(b)(3) project (possibly through the pursuit of 319 funding).

PINE BROOK (SEGMENT MA82A-14)

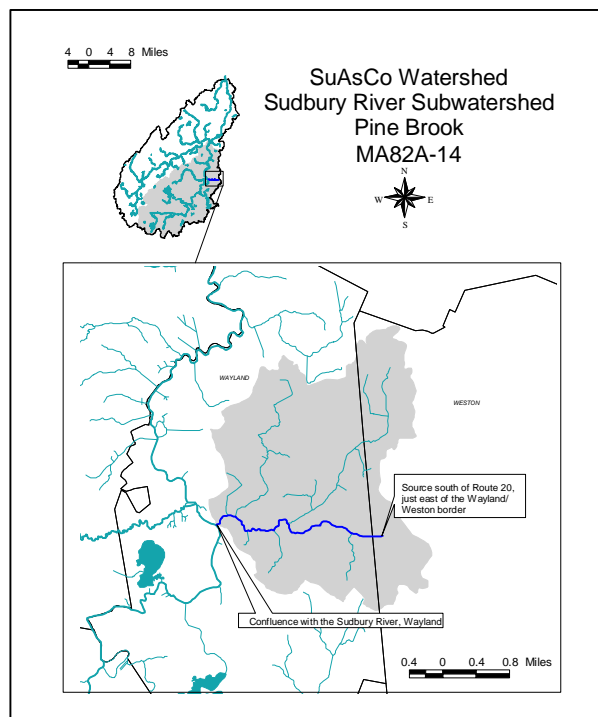
Description: From source south of Route 20, just east of the Wayland/Weston border, to the confluence with the Sudbury River, Wayland
Segment Length: 2.5 miles
Classification: Class B

Land-use estimates (top 3, excluding water) for the 5.7 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.55 mi² and the percentage of the imperviousness is 9.6%.

Residential	44%
Forest.....	40%
Wetlands.....	6%

Based on the last evaluation of water quality conditions Pine Brook is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired due to unknown causes and a TMDL is required (MA DEP 2003a).

MDFW has proposed that Hayward Brook, a tributary to Pine Brook, be protected as cold water fishery habitat (Richards 2003b). MDFW conducted fish population sampling in Hayward Brook on 13 July 2001 at one station upstream from Rich Valley Road, Wayland. Redfin pickerel (n=25) dominated the sample, but nine brook trout, three American eel, and two golden shiners were also collected (Richards 2003a).



WMA WATER WITHDRAWAL SUMMARY AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no water withdrawals from this subwatershed or regulated NPDES discharges to this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

A habitat quality evaluation was conducted by DWM biologists along a reach of Pine Brook downstream from Pine Brook Road in Wayland in July 2001. At the time of the sampling Pine Brook was only about 2 m wide and 0.25 to 0.3 m deep. The canopy was completely closed (100% canopy) over the brook. The habitat score of 165 out of 200 was affected most by lack of velocity-depth combinations and sediment deposition (affected approximately 30% of the streambed) (Appendix D). DWM also conducted a habitat evaluation downstream from Pine Brook Road as part of the 1996 benthic macroinvertebrate sampling (Appendix H).

Biology

On 5 July 2001 DWM conducted benthic macroinvertebrate monitoring in Pine Brook downstream from Pine Brook Road in Wayland (Station PB (B0466)). When compared to the North Brook regional reference site the RBP III analysis indicated that the benthic macroinvertebrate community was *Slightly Impacted*. Prior sampling by DWM biologists in 1996 in this reach of Pine Brook (Station SAC02) can be found in Appendix H.

MDFW conducted fish population sampling at one station in Pine Brook 300 feet above Old Connecticut Path in Wayland on 21 June 2001 using backpack electroshocking equipment (Richards 2003a). A total of three species were collected. The sample (n=99) was dominated by brook trout (multiple age classes). Largemouth bass and pumpkinseed made up the remainder of the sample. Brook trout are considered to be a fluvial dependent species which is intolerant to pollution. Their presence is indicative

of excellent water quality and lotic habitat. MDFW has proposed that Pine Brook be protected as cold water fishery habitat (Richards 2003b).

Chemistry – water

ENSR conducted *in situ* water quality monitoring at one station on Pine Brook (T07- Pine Brook Road, Wayland) on five occasions in 2002 and 2003. Parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected for ammonia-nitrogen, total phosphorus, and TSS on three occasions (ENSR 2004a).

DO

DO concentrations in Pine Brook ranged from 9.1 to 9.9 mg/L (n=5). Percent saturations ranged from 96.3 to 106.6 (n=5). It should be noted that these data were collected between 0834 and 1445h, not during worst-case, pre-dawn hours.

Temperature

Temperatures in Pine Brook ranged from 15.4 to 18.8°C (n=5).

pH

pH ranged from 6.5 to 7.5 SU with one of five less than 6.5 SU.

Conductivity

Specific conductance ranged from 196 to 289 µS/cm (n=5).

Total Suspended Solids

TSS concentrations ranged from 2 to 8 mg/L (n=3).

Total phosphorus

Total phosphorus concentrations in Pine Brook ranged from 0.01 to 0.05 mg/L (n=3).

Ammonia-nitrogen

Ammonia-nitrogen concentrations were all less than 0.03 mg/L (n=3).

The *Aquatic Life Use* is assessed as support based upon the presence of reproducing brook trout and the RBP III analysis, which indicated only a slightly impacted benthic community. This use is identified with an Alert Status, however, because the benthic community remains dominated by midges (Chironomidae) and other taxa (e.g., Simuliidae; Hydropsychidae) that thrive on organic particulates as a food resource. A similar benthic community was found in 1996. Furthermore, in 2001 the percent comparability (57%) to the reference station was at the low end of the “slightly impaired” category, suggesting that this stream still does not reach its full biological potential.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS






In 2001 DWM conducted three bacteria surveys at one station in Pine Brook, PI01A- downstream side of Pine Brook Road bridge in Wayland (Appendix A). Fecal coliform bacteria counts ranged from 5 to 190 cfu/100 mL (n=3).

ENSR collected fecal coliform and *E. coli* bacteria samples near Pine Brook Road, Wayland (Station T07), in July and August 2002, and July and September 2003 (ENSR 2004a). Fecal coliform bacteria counts ranged between <100 and 26,400 cfu/100 mL (n=4). Samples were collected during both wet and dry weather conditions. Two of the four samples had elevated counts greater than 400 cfu /100 mL while one sample had counts greater than 2,000 cfu/100mL. The elevated counts were collected during the July 2002 survey (dry, drought conditions) and the September 2003 survey (wet weather).

No odors, surface oils, turbidity, color or other objectionable conditions were noted by DWM biologists during the July 2001 survey in Pine Brook near Pine Brook Road in Wayland (MA DEP 2001a and Appendix D).

Because of the limited data set available the *Primary* and *Secondary Contact Recreational* uses are not assessed for Pine Brook. The *Recreational* uses are identified with an Alert Status, however, due to elevated fecal coliform bacteria counts. Based on observations by DWM biologists the *Aesthetics Use* is assessed as support for Pine Brook.

Pine Brook (MA82A-14) Use Summary Table

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

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

RECOMMENDATIONS

- MDFW has proposed that Pine Brook and Haywood Brook be protected as cold water fishery habitat. Additional monitoring of the fish population, DO, and temperature is needed to evaluate MDFW's proposal to list these brooks as cold water fisheries in the next revision of the Surface Water Quality Standards.
- Continue to conduct biological monitoring (habitat and benthic macroinvertebrate) in Pine Brook to evaluate the status of the *Aquatic Life Use*.
- Additional bacteria sampling should be conducted to identify and eliminate the source(s) of elevated counts. The 1996 benthic macroinvertebrate technical memorandum identified livestock pastures near the headwaters of Pine Brook with cows having direct access to the water. A shoreline survey should be conducted to determine if these pastures are still impacting the water quality of Pine Brook. If applicable, Department of Agricultural Resources and Natural Resource Conservation Service should work with the owners to educate them as to the importance of agricultural BMPs. Assistance should be given to install and maintain BMPs as necessary.
- Sandy Burr Country Club is located near the confluence of Pine Brook and the Sudbury River. Efforts should be made to educate and work with the Country Club to employ BMPs to reduce water use and nutrient inputs from fertilizers to both Pine Brook and the Sudbury River.

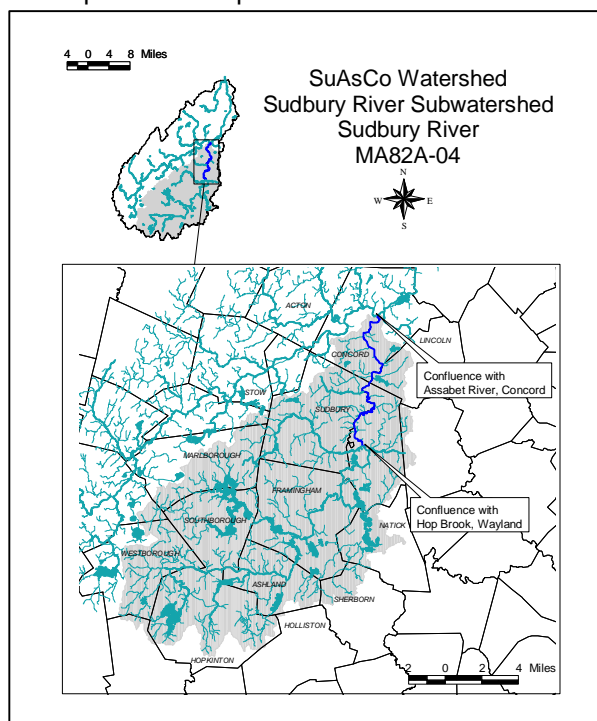
SUDBURY RIVER (SEGMENT MA82A-04)

Description: Confluence with Hop Brook, Wayland (the lower portion of Hop Brook was identified as Wash Brook on USGS quads prior to 1987), to confluence with Assabet River, Concord
Segment Length: 11.7 miles
Classification: Class B, Aquatic Life

Land-use estimates (top 3, excluding water) for the 162.5 mi² subwatershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 19.4 mi² and the percentage of the imperviousness is 11.9%.

Forest..... 40%
Residential 33%
Open Land 7%

Based on the last evaluation of water quality conditions, this segment of the Sudbury River is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for metals (MA DEP 2003a).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Concord Water Department	9P31406701	31406704	3067000-01G -03G -06G	2.1 (reg) <u>0.42 (perm)</u> 2.52
Lincoln Water Department		31415701	3157000-02G	0.28
Wayland Water Department	9P431431501	314315002	3315000-01G -02G -06G -07G -08G	1.66 (reg)
Nashawtuck Country Club Inc.		31406708	01G (Sudbury Road Well) 01S (Sudbury RD W/D)	0.1
Concord Country Club		31406702	01G (Well #1)	0.12
Verrill Farm*		31406707	02S (Wheeler Road (w/d) 04S (Rte 117 #1 w/d)	0.06 (184 days)

* This facility's withdrawals have been under the WMA threshold and they have initiated discussion with MA DEP to give up their registration (Peters 2004).

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

Wayland Wastewater Management District Commission (MA0039853) is permitted (October 1998) to discharge 0.065 MGD of treated sanitary wastewater from the Wayland Business Center LLC WWTP via outfall 001 to a wetland and then to this segment of the Sudbury River. The flow limit included a watershed-based trading program to reduce phosphorus loadings to the Sudbury and its tributaries. The program would involve reducing phosphorus from nonpoint sources, specifically by allowing tie-ins from failing septic systems. The permit expired in October 2003. EPA will reissue this permit in 2005. This plant was taken by eminent domain by the Town of Wayland on 26 October 1999. The existing permit includes limits for BOD (30 mg/L), TSS (30 mg/L), total phosphorus (0.5 mg/L) and fecal coliform bacteria (200 cfu/100mL). Wayland is required to conduct one acute whole effluent toxicity test per year. The

facility's whole effluent toxicity limit is $LC_{50} \geq 100\%$ effluent. The owners were also required to conduct an instream monitoring program at points upstream and downstream from the discharge, but these data were not available. The facility uses UV light for disinfection.

Raytheon Co. (Wayland) went out of business and EPA terminated the NPDES permit (MA0001511) in April 1997. The remediation efforts from hazardous waste and oil contamination at the facility are in Phase V (Operation, Maintenance, and/or Monitoring) of a five-phase cleanup.

LANDFILLS (APPENDIX K)

There are three landfills located within this subwatershed. Two, the Sudbury Transfer Station and the Wayland Sand Hill Landfill, are still active.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

As part of the development of the nutrient TMDL for the Concord River ENSR collected two stream flow measurements on this segment of the Sudbury River off Thoreau Street in Concord. Stream flow on 23 July 2001 was 51.9 cfs and on 11 September 2001 was 29.20 cfs (ENSR 2003).

The non-native aquatic macrophyte *Trapa natans* (water chestnut) was identified in this segment of the Sudbury River, but the extent of the infestation is not well documented (no macrophyte mapping or biovolume estimates). It is believed that water chestnuts were first documented in the Sudbury River near Route 27 in Wayland in the 1950s and a floating mat still persists today (Marden 2005). The infestation has spread downstream and water chestnuts were first documented in Fairhaven Bay in the early 1990s (Marden 2005). The Lincoln Conservation Department has been harvesting water chestnuts from Fairhaven Bay since 2000. The harvesting is accomplished by using the weed harvester from the Great Meadows National Wildlife Refuge. In 2000 ten to fifteen acres of the approximately 75-acre Bay were covered with water chestnuts. In recent years the extent of the acreage covered is decreasing, but along the shallow shore areas floating mats still persevere (Gumbart 2005 and Marden 2005). The Wayland Surface Water Quality Committee also reports that the river is "heavily infested" between Route 27 in Wayland and the Sherman Bridge in Sudbury/Wayland and there are "some long stretches where there's only a 6-8 foot wide channel in the river {and} one section...below the confluence of the old part of the river below the four arch bridge, and the channelized section below the Route 27 bridge" is also heavily infested (Largy 2004). The USFWS has also confirmed heavy infestation between the Route 27 bridge and the Sherman Bridge (Koch 2005). Heard Pond is also infested with water chestnuts and during extreme high waters is connected to the Sudbury River (Largy 2004).

Biology

MDFW conducted fish population sampling at two stations in this segment of the Sudbury using boat electroshocking equipment. The fish community was sampled near River Road in Wayland (Station 389) on 6 July 2001 and at Lowell Road (Station 532) near the confluence with the Assabet and Concord rivers on 5 July 2001 (Richards 2003a).

At the River Road station 14 species (436 fish total) were collected including 187 yellow perch, 69 bluegill, 41 largemouth bass, 37 golden shiner, 22 pumpkinseed, 18 white sucker, 12 brown bullhead, 11 black crappie, ten common carp, eight white perch, seven chain pickerel, six American eel, six redbfin pickerel, and two northern pike.

At Lowell Road 13 species were collected including (188 fish total) 72 yellow perch, 33 bluegill, 20 pumpkinseed, 16 common carp, 15 black crappie, 13 largemouth bass, five American eel, four white sucker, three chain pickerel, three white perch, two brown bullhead, one golden shiner, and one northern pike.

Although the total number of fish collected was high, macrohabitat generalists dominated both reaches sampled. Only one species, white sucker, is considered a fluvial specialist. All species present are considered moderately tolerant or tolerant to pollution. This segment of the Sudbury River is

predominately a slow-moving, meandering river with large areas of contiguous wetlands. Given the nature of this segment the dominance by a diverse mix of tolerant and moderately tolerant macrohabitat generalists is to be expected.

Toxicity

Effluent

Between October 1999 and October 2004 six whole effluent toxicity tests using the *C. dubia* and *P. promelas* were conducted on the Wayland Wastewater Management District effluent. With the exception of one test in October 1999 (LC_{50} = 35.40% effluent in *C. dubia* test) the effluent was not acutely toxic to the water flea (of the five valid tests) or the fathead minnow.

Ambient

Water was collected from the Sudbury River near the Route 20 bridge in Wayland for use as dilution water in the Wayland Wastewater Management District acute whole effluent toxicity tests. Survival of *C. dubia* was good (100%, 48 hour exposure) as was survival of *P. promelas* (>95%, 48 hour exposure).

Chemistry – water

Water was collected from the Sudbury River near the Route 20 bridge in Wayland for use as dilution water in the Wayland Wastewater Management District acute whole effluent toxicity tests. Data from these reports are maintained in the TOXTD database by DWM and are summarized below.

DWM conducted water quality monitoring in 2001 at four stations on this segment of the Sudbury River:

- SU11- Rte. 27 bridge in Wayland;
- SU12- Sherman Road bridge in Sudbury/Wayland;
- SU13- Rte. 117 bridge in Lincoln/Concord (only sampled on 10 July); and
- SU15- Nashawtuc Road bridge in Concord.

ENSR conducted *in situ* water quality sampling on this segment of the Sudbury River in July and August 2002 and July, August and September 2003 (see stations below). Parameters measured included temperature, pH, DO, and conductivity. Grab samples were also collected for nutrient analysis of ammonia-nitrogen and total phosphorus (ENSR 2004a).

- SR06- Bridge on Rte 20, Wayland
- SR05- Old Sudbury Road (Route 27 bridge), Wayland
- SR04- Sherman Bridge Road, Wayland
- SR03- Rte 117, Sudbury {Concord}
- SR02- Sudbury Road, Concord
- SR01- Bridge on Nashawtuc Road, Concord

ENSR also conducted water quality monitoring in this segment of the Sudbury River off Thoreau Street in Concord (Station SR) for the development of the Concord River nutrient TMDL. *In situ* samples were collected for DO, % saturation, temperature, pH, and conductivity. Grab samples were collected and analyzed for total phosphorus, ammonia-nitrogen, and TSS (ENSR 2003).

DO- Note: This segment is designated as "Class B, Aquatic Life", so Class C dissolved oxygen and temperature criteria apply. This designation is made only where background conditions prevent the attainment of a 'higher use' designation (MA DEP 1996).

DO concentrations (pre-dawn) measured by DWM ranged between 3.6 to 7.5 mg/L (n=9). Percent saturations ranged between 42 and 88% (n=9).

During the ENSR Sudbury study dissolved oxygen concentrations ranged between 2.3 and 11.1 mg/L with six of the 29 measurements less than 5.0 mg/L and two measurements less than 3.0 mg/L (note these were all on 22 August 2003). Percent saturations ranged from 29 to 145.2 % (n=29), although only two % saturations exceeded 110%. It should be noted that these data were collected between 0850 and 1740h. The lower DOs were measured in the morning while the highest DOs and saturation were in the later afternoon hours.

Dissolved oxygen concentrations reported by ENSR during the Concord TMDL study ranged from 2.2 to 8.8 mg/L, although only one measurement was less than 5.0 mg/L (n=8). Percent saturations ranged from 28.4 to 97.9% with only one measurement less than 60% saturation.

Temperature

Temperatures reported by DWM ranged between 21.7 and 25.2 °C (n=9). Temperatures measured by ENSR during the Sudbury survey ranged between 17.8 and 28.7°C (three of the 29 measurements exceeded 28.3°C). The highest temperatures were recorded in the river near Sudbury Road bridge (Station SR02). Temperatures reported by ENSR during the Concord TMDL survey ranged from 19.1 to 27.3°C (n=9).

pH

The pH of the Sudbury River near the Route 20 bridge (TOXTD database) ranged between 6.7 and 7.9 SU (n=6). pH values measured by DWM ranged from 6.5 to 7.2 SU (n=9). pH measured by ENSR during the Sudbury survey ranged between 6.1 and 7.6 SU (five of the 29 measurements were less than 6.5 SU) and the pH of the River measured by ENSR during the Concord TMDL study ranged from 6.5 to 7.7 SU (n=9).

Hardness

Hardness of the river near the Route 20 bridge (TOXTD database) ranged between 54 and 92 mg/l (n=6). Hardness measured by DWM in this segment of the Sudbury River ranged between 53 and 82 mg/L (n=8).

Alkalinity

Alkalinity of the river ranged between 14 and 58 (n=6 TOXTD database) while those measured by DWM ranged from 24 to 52 mg/L (n=8).

Conductivity

The conductivity of the river near the Route 20 bridge ranged between 360 and 490 µS/cm (n=6 TOXTD database). Specific conductance at 25°C as measured by DWM ranged between 385 and 522 µS/cm (n=9). Conductivity measured by ENSR as part of the Sudbury survey ranged between 386 and 500 µS/cm (n=29) with similar conductivities measured during the ENSR Concord TMDL study (range 358 to 412 µS/cm, n=8).

Total Suspended Solids

The total suspended solids concentrations of the river near the Route 20 bridge ranged from <5 to 40 mg/L with only one of the six measurements >25 mg/L (TOXTD database). Total suspended solids concentrations measured by DWM ranged between 6.0 and 11 mg/L (n=8). TSS concentrations measured during the ENSR Sudbury survey ranged between 2 and 21 mg/L (n=19) and between 1.5 and 12 mg/L during the Concord TMDL study (n=8).

Turbidity

Turbidity as reported by DWM ranged between 1.7 and 4.6 NTU (n=8).

Total Phosphorus

Total phosphorus concentrations measured by DWM ranged between 0.020 and 0.091 mg/L with seven of the nine samples having concentrations greater than 0.05 mg/L. Total phosphorus concentrations measured during the ENSR Sudbury survey ranged between 0.01 and 0.05 mg/L (n=19). Total phosphorus concentrations during the ENSR Concord TMDL survey ranged between <0.01 and 0.06 mg/L with two of the eight samples having concentrations greater than 0.05 mg/L.

Ammonia-nitrogen

No detectable concentrations of ammonia-nitrogen were reported in the samples of the river collected near the Route 20 bridge (n=6 TOXTD database). With the exception of the sample collected on 10 July at Station SU15 (0.08 mg/L), ammonia-nitrogen concentrations were less than 0.02 mg/L (n=9) during the DWM surveys. Ammonia-nitrogen concentrations in this segment of the Sudbury River during

the ENSR Sudbury survey ranged between <0.03 and 0.07 mg/L (n=19) and during the ENSR Concord TMDL survey concentrations ranged between <0.03 and 0.09 mg/L (n=8). All concentrations are below the EPA CCC for ammonia-nitrogen.

Total Residual Chlorine

With the exception of one measurement reported as <0.2 mg/L none of the other four TRC concentrations in the river near the Route 20 bridge exceeded 0.05 mg/L (n=5 TOXTD database).

Chemistry-sediment

USGS collected and analyzed sediment cores collected in the stream channel and at the bank at one site in the Sudbury River near Sherman Bridge Sudbury/Wayland (Station T2) in September and May 1995, respectively (Colman *et al.* 1999). The total mercury concentration in the channel core was highest (approximately 0.9 PPM dry-weight) at the top, and generally decreased to very low concentrations to the bottom of the core. The total mercury concentration in the bank core was highest at the top (approximately 3 PPM dry-weight) and decreased to low concentrations at the bottom of the core (Colman *et al.* 1999).

Surficial sediment samples were collected from three locations along this segment of the Sudbury River: near Sherman Street Bridge, Sudbury/Wayland (Station #6), from the Fairhaven Bay area in Concord/Lincoln (Station #7) and near the Thoreau Street Bridge, Concord (Station #8), in June 1994 as part of the caged mussel study. The mean concentrations of four analytes (total Hg – 0.5 ppm dry weight, Pb, As, and Cr) exceeded L-EL but not S-EL published in Persuad *et al.* 1993 at Station #6 while Cr was below the L-ELs and TOC was at the S-EL (Beckvar *et al.* 2000). The mean concentrations two analytes (As and TOC) exceeded their L-EL but not S-EL and the other analytes were below their L-ELs at Station #7 (total Hg was 0.07 ppm dry weight). At the most downstream sampling location the mean concentrations of all the analytes exceeded their L-ELs but were below the S-ELs (total Hg was 0.36 ppm dry weight) (Beckvar *et al.* 2000).

Surficial sediment samples were collected from the Sudbury River in the vicinity of the Route 27 bridge, Sudbury/Wayland, in July and September 1994 and from the Fairhaven Bay area in Concord/Lincoln in July and September 1994 and May and September 1995 as part of the bioaccumulation study being conducted with mayfly nymphs. The mean total mercury concentrations in the sediment collected from the river in the vicinity of the Route 27 bridge, Sudbury/Wayland, was 0.88 ppm and 1.92 ppm dry weight from samples collected in July and September 1994, respectively. The mean total mercury concentrations in the sediment collected from the Fairhaven Bay area ranged between 1.429 and 1.791 ppm dry weight (Naimo *et al.* 2000).

Chemistry-tissue

A caged mussel (*Elliptio complanata*) study was conducted from three locations along this segment of the Sudbury River- near Sherman Street Bridge, Sudbury/Wayland (Station #6), from the Fairhaven Bay area in Concord/Lincoln (Station #7) and near the Thoreau Street Bridge, Concord (Station #8), in June 1994. Three 35 organism replicate samplers (total of 105 mussels) per station were deployed for a twelve-week period at each location. Survival of the mussels was only 36% at Station #6 (caged mussels moved to a slightly different location from original deployment due to high mortality attributed to low dissolved oxygen conditions (Beckvar *et al.* 2000). Survival of caged minnows was 88 and 87% at Station #7 and #8, respectively. The mean total mercury concentrations in the mussel samples were 590, 400, and 340 ppb dry weight at stations #6, #7, and #8, respectively (Beckvar *et al.* 2000).

A bioaccumulation study using burrowing mayfly nymphs (*Hexagenia* sp.) exposed (21-day exposure) to sediment collected from the Sudbury River in the vicinity of the Route 27 bridge, Sudbury/Wayland, was conducted in July and September 1994. Sediments were also collected from the Fairhaven Bay section of the River in Concord/Lincoln in July and September 1994 and May and September 1995. Survival of the mayfly nymphs was greater than 90% in all tests conducted. The mean concentration of total mercury (gut contents not depurated) in the mayflies exposed to sediment collected near the Route 27 bridge was 759 and 762 ppb dry-weight for the July and September tests, respectively (Naimo *et al.* 2000). The mean concentration of total mercury in the mayflies exposed to Fairhaven Bay sediments ranged from 492 to 874 ppb dry-weight (Naimo *et al.* 2000).

Fish, dragonfly larvae, and prey fish were collected from the Sudbury River near Sherman bridge, Concord between May 1994 and 1995. Whole fish composite samples of black crappie (n=5 in May, n=5 in July, and n=6 in October 1994), bluegill (n=10 in all three sampling events), largemouth bass (n=10 in all three sampling events) were collected and analyzed for total mercury. The mean concentration of total mercury in the whole fish composite samples (adjusted for size) were 370 ppb wet weight in black crappie, 200 ppb wet weight in bluegill, and 690 ppb wet weight in largemouth bass. The mean concentration of total mercury in dragonfly larvae (n=19) was 313 ppb dry weight, and in prey fish (n=48) was 525 ppb dry weight (Haines *et al.* 2003).

The *Aquatic Life Use* for this segment of the Sudbury River is assessed as support based primarily on the fish community and the good survival of test organisms exposed to the river. This use is, however, identified with an Alert Status due to the identification of a non-native macrophyte (*Trapa natans*) in the river.

FISH CONSUMPTION

DWM conducted fish toxics monitoring in the Sudbury River in 1985, 1986, 1987, and 1988. Sampling in 1988 was conducted to confirm the results of previous studies and to investigate possible bioaccumulation of PCBs as indicated by 1986 USFWS data (Maietta 1990). Sources of mercury include the Nyanza Superfund Site. Based on DWM data that found elevated concentrations of mercury in fish tissue MDPH issued a fish consumption advisory for the Sudbury River from Ashland to the confluence with the Assabet and Concord rivers, including Stern and Bracket Reservoirs in Framingham. The advisory states:

1. The general public should not consume any fish from this waterbody.

The *Fish Consumption Use* is assessed as impaired due to MDPH site-specific fish consumption advisory because of mercury contamination.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS






DWM collected fecal coliform and *E. coli* bacteria samples at their three water quality stations on this segment of the Sudbury River during dry weather conditions in July and September 2001 (Appendix A). Fecal coliform counts ranged between 55 and 95 cfu/100 mL (n=6).

As part of the Sudbury River bacteria survey ENSR collected fecal coliform and *E. coli* bacteria samples from their six water quality stations on 22 July 2002, 30 August 2002, and 29 July 2003. Additionally, samples were collected from stations SR01, SR04, and SR06 only on 16 September 2003 (ENSR 2004a). Fecal coliform bacteria counts from all stations ranged between <100 cfu/100mL to 13,300 cfu/100mL (n=21). Elevated counts were recorded during both wet (16 September 2003) and dry (22 July 2002) weather conditions with the highest count being recorded during wet weather at Station SR01, bridge on Nashawtuc Road, Concord. Nine of the 21 counts were greater than 400 cfu/100mL while seven of them also exceeded 2000 cfu/100mL.

As part of the Concord River nutrient TMDL assessment study ENSR also collected *E. coli* and fecal coliform bacteria samples from the Sudbury River near Thoreau Street in Concord between June 2001 and September 2001 (ENSR 2003). Fecal coliform bacteria counts ranged between 20 and 160 colonies/100mL (n=5).

Because of the limited fecal coliform bacteria dataset (too few samples collected in any given year) and lack of information as to the aesthetic quality of this segment of the Sudbury River, the *Primary* and *Secondary Contact Recreational* and *Aesthetic* uses are not assessed. The *Recreational* uses are identified with an Alert Status, however, because of the occasionally high bacteria counts.

Sudbury River (MA82A-04) Use Summary Table

Designated Uses		Status
Aquatic Life		SUPPORT*
Fish Consumption		IMPAIRED Causes: Mercury Sources: Nyanza Superfund Site (Suspected Sources: Atmospheric deposition)
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED

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

RECOMMENDATIONS

- Conduct biological monitoring in this segment of the Sudbury to better evaluate the status of the *Aquatic Life Use*. Conduct an aquatic macrophyte weed mapping survey to document the extent of the water chestnut infestation throughout this segment of the river. Develop and implement a management strategy to reduce non-native plant infestation, if appropriate, and prevent the spread of non-natives downstream.
- Continue to review information developed as part of the Nyanza Superfund site investigations to evaluate restoration efforts when assessing the *Aquatic Life Use*.
- Continue to conduct bacteria monitoring along this segment to assess the status of the *Recreational Uses*. Efforts should be aimed at identifying and eliminating potential sources of bacterial contamination.
- Work to promote stewardship along this segment and create a stream team to conduct shoreline surveys to assess the status of the *Aesthetics Use*.

UNNAMED TRIBUTARY (SEGMENT MA82A-15)

Description: From the source northeast of Indian Head Hill (near Route 20), Marlborough, to the inlet of Hager Pond, Marlborough

Segment Length: 1.1 miles

Classification: Class B

Land-use estimates (top 3, excluding water) for the 1.00 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.14 mi² and the percentage of the imperviousness is 14.4%.

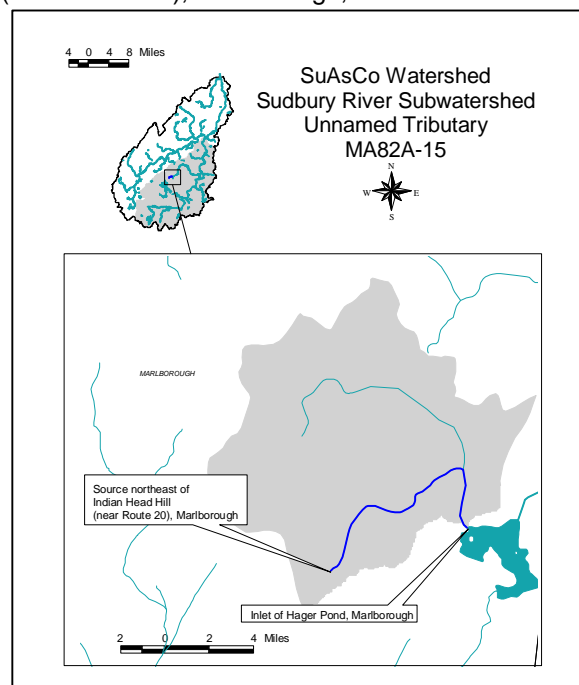
Forest 48%

Residential 26%

Commercial..... 10%

Based on the last evaluation of water quality conditions this unnamed tributary is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for nutrients, organic enrichment/low DO, suspended solids, and noxious aquatic plants (MA DEP 2003a).

The use assessment for Hager Pond is provided in the Lakes section of this report.



WMA WATER WITHDRAWAL SUMMARY

There are no registered or permitted WMA water withdrawals from this subwatershed.

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLE E1-E4)

The City of Marlborough is permitted (14 September 2004) to discharge 5.5 MGD of treated wastewater from the Marlborough Easterly Wastewater Treatment Facility (MA0100498) via outfall 001 to this unnamed tributary to Hop Brook. The permit contains seasonal limits for BOD, TSS, ammonia-nitrogen (0.5 mg/L average monthly limit imposed between 1 April and 30 November) and total phosphorus (0.1mg/L 60-day rolling average limit imposed between 1 April and 30 November). The permit limits for whole effluent toxicity testing are $LC_{50} \geq 100\%$ effluent and $C-NOEC \geq 99\%$ effluent (testing required on a quarterly basis). The facility utilizes flow paced chlorination/dechlorination on a year-round basis. Chlorine gas is added for disinfection and sodium dioxide gas is added for dechlorination. The TRC limit is 0.011 mg/L (average monthly). Additional details on permit limits and monitoring requirements can be found in the Sources of Information section of this report. The WWTF is a two stage aeration treatment plant with year-round nitrification. Alum is added at two locations for phosphorus removal and lime for pH adjustment. The pH of the effluent is typically around 7.0 SU. The facility is 30 years old and in need of an upgrade. Although the facility has generally been in compliance with their permit limits (their 1988 permit) infiltration/inflow in the sewer system is a problem (Webber 2004c).

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

ENSR measured flows at two stations on this unnamed tributary- upstream and downstream from the Marlborough Easterly WWTF- following USGS guidelines. Flows were measured during their dry weather surveys on 31 August and 12 October 1999 (it should be noted that 1999 was considered a drought year). Upstream from the WWTF flows were 0.03 and 0.21 cfs, while downstream from the discharge flows were 1.61 and 3.18 cfs in August and October, respectively (ENSR 2000). The upper 0.7 miles of this segment has very little water during low flow conditions. A 1984 USGS study determined that the discharge from the WWTF accounts for between 50 and 90% of the flow in Hop Brook (USGS 1984).

Chemistry – water

In August, September, and October 1999 ENSR collected water quality samples from two stations- upstream (Station 1) and downstream (Station 2) from the Marlborough Easterly WWTF- on this unnamed tributary. Analytes included total phosphorus, ammonia-nitrogen, and total suspended solids. Additionally, *in situ* measurements of DO, pH, temperature, and conductivity were made during “dry/baseflow” sampling rounds on 31 August, and 12 October (ENSR 2000).

DO

Dissolved oxygen concentrations in the brook upstream from the WWTF were 8.1 and 10.8 mg/L. Percent saturations recorded by ENSR upstream of the WWTF were 79.3 and 94.2%. Downstream from the discharge, DO concentrations were 7.7 and 8.7 mg/L and percent saturations were 82.6 and 87.8%. It should be noted that these measurements were not taken during worst-case, pre-dawn conditions.

Temperature

Temperatures upstream from the WWTF were 14.4 and 11.2 °C, while downstream from the discharge temperatures were 18.7 and 15.8 °C.

pH

pH values reported by ENSR for the upstream station were 8.4 and 8.1 SU. Downstream from the WWTF pH values were 7.8 and 7.1 SU.

Conductivity

Conductivities upstream from the WWTF were 627 and 323 µS/cm, while downstream from the discharge conductivities were 47 and 461 µS/cm.

Total Suspended Solids

TSS concentrations upstream from the Marlborough Easterly WWTF ranged from 1 to 1248 mg/L (n=6). All three of the wet weather samples were greater than 25 mg/L. TSS concentrations downstream from the plant ranged from 6 to 1220 mg/L also with all three wet weather samples greater than 25 mg/L.

Total Phosphorus






Total phosphorus concentrations reported by ENSR for their sampling station upstream from the WWTF ranged between 0.03 mg/L and 7.29 mg/L (n=6). It should be noted that the highest concentrations (0.53, 4.34, 7.29mg/L) were recorded during the three wet-weather sampling surveys. The dry weather survey results were all <0.05 mg/L at the upstream sampling location. Downstream from the discharge the total phosphorus concentrations ranged between 0.25 and 11.3 mg/L, again with the highest concentrations (all greater than 1 mg/L) occurring during the wet weather sampling events.

Ammonia-nitrogen

Ammonia-nitrogen concentrations upstream from the WWTF ranged between 0.02 and 0.15 mg/L (n=6). Downstream from the discharge concentrations ranged between 0.03 and 0.16 mg/L (n=6). These concentrations are below the CCC for ammonia-nitrogen.

The *Aquatic Life Use* for this unnamed tributary (locally known as Hop Brook) is assessed as impaired based primarily on the elevated concentrations of total phosphorus and suspended solids and best professional judgment. Although the Marlborough East WWTF discharge contributes total phosphorus to the brook storm water samples collected upstream from the discharge were extremely high.

Unnamed Tributary (MA82A-15) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Total phosphorus, total suspended solids Sources: Municipal point source discharge (Suspected Sources: Discharges from municipal separate storm sewers (MS4s), landfill, municipal urbanized high density areas)
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

- A nonpoint source pollution survey should be conducted in this subwatershed to identify potential sources to the unnamed tributary.
- Conduct additional water quality monitoring in this unnamed tributary (i.e., pre-dawn DO, benthic macroinvertebrates, habitat quality) to evaluate the status of the *Aquatic Life Use* and to bracket potential sources of pollution to the brook (e.g., municipal discharge, landfill, compost facility, storm drains).
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Work with the City of Marlborough to employ best management practices at the transfer station(s) and compost facility.
- Management options recommended in the ENSR reports (2000 and 2004b) to further the attainment of use goals for the Hop Brook subwatershed should be reviewed and implemented as deemed appropriate.
- The Marlborough Easterly WWTF should be upgraded as necessary to meet permit limits and protect water quality in the Hop Brook Subwatershed.

UNNAMED TRIBUTARY (SEGMENT MA82A-16)

Description: From the outlet of Hager Pond, Marlborough, to the inlet of Grist Millpond, Marlborough

Segment Length: 0.2 miles

Classification: Class B

Land-use estimates (top 3, excluding water) for the 1.9 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.26 mi² and the percentage of the imperviousness is 14.1%.

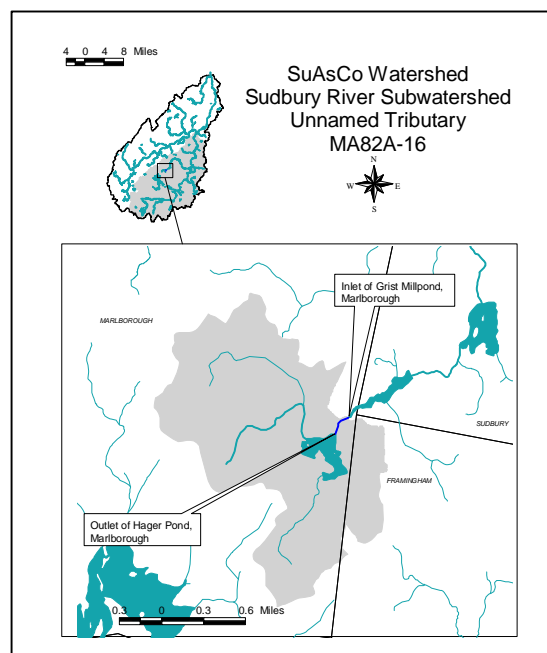
Forest 55%

Residential 22%

Commercial 10%

Based on the last evaluation of water quality conditions this unnamed tributary is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for nutrients, organic enrichment/low DO, suspended solids, and noxious aquatic plants (MA DEP 2003a).

The use assessments for Hager Pond and Grist Millpond are provided in the Lakes section of this report.



DWM staff participated in an informal sanitary survey along this unnamed tributary in preparation for re-issuing the NPDES permit for the Marlborough East WWTF (located upstream from this segment). Horses are stabled on three properties proximate to the stream, two of which abut the stream on either side. Direct animal access is not restricted from one property. The banks slope directly to the water and no controls to prevent direct pollutant runoff to the stream are known to exist (Firmin 2005).

WMA WATER WITHDRAWAL SUMMARY AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no registered or permitted WMA water withdrawals from this subwatershed or NPDES regulated discharges to this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

ENSR (2000) measured flow at the outlet of Hager Pond following USGS guidelines. Flows were measured during their dry weather surveys on 31 August and 12 October 1999 (a drought year) and were reported as 1.04 and 2.42 cfs, respectively.

Chemistry – water

In August, September, and October 1999 ENSR collected water quality samples from one station (Station 8 – outlet of Hager Pond inlet Grist Millpond) on this unnamed tributary. Analytes included total phosphorus, ammonia-nitrogen, and total suspended solids. Additionally, *in situ* measurements of DO, pH, temperature, and conductivity were collected during “dry/baseflow” sampling rounds on 31 August and 12 October (ENSR 2000).

DO

Dissolved oxygen concentrations were 10.7 and 10.8 mg/L. Percent saturations recorded by ENSR were 122.3 and 106.7%. It should be noted that these measurements were not taken during worse case pre-dawn conditions.

Temperature

Temperatures were 21.9 and 15°C.

pH

pH values reported by ENSR were 9.7 and 8.8 SU.

Conductivity

Conductivities were 542 and 421 $\mu\text{S}/\text{cm}$.

Total Suspended Solids

TSS concentrations ranged from 5 to 25 mg/L (n=5).

Total Phosphorus






Total phosphorus concentrations reported by ENSR ranged between 0.19 mg/L and 0.43 mg/L (n=5).

Ammonia-nitrogen

Ammonia-nitrogen concentrations ranged between 0.07 and 0.14 mg/L (n=5). These concentrations are below the CCC for ammonia-nitrogen.

The *Aquatic Life Use* for this unnamed tributary (locally known as Hop Brook) is assessed as impaired based primarily on the elevated concentrations of total phosphorus, evidence of organic enrichment resulting from the Hager Pond impoundment (supersaturation of dissolved oxygen and extremely high pH measurements in the morning --0800 to 0900 hours) and best professional judgment. While the Marlborough East WWTP discharges upstream from Hager Pond, other nonpoint sources of pollution (e.g., horse farms) also contribute total phosphorus to the system during storm events.

Unnamed Tributary (MA82A-16) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Total phosphorus, dissolved oxygen saturation, pH Sources: Municipal point source discharge, upstream impoundments (Suspected Sources: Discharges from municipal separate storm sewers (MS4s), landfill, municipal urbanized high density areas)
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

- Conduct additional water quality monitoring in this unnamed tributary (i.e., diurnal DO monitoring, and habitat quality evaluations) to evaluate the status of the *Aquatic Life Use* and any changes associated with pollution reduction activities.
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Management options recommended in the ENSR reports (2000 and 2004) to further the attainment of use goals for the Hop Brook subwatershed should be reviewed and implemented as deemed appropriate.

UNNAMED TRIBUTARY (SEGMENT MA82A-17)

Description: From the outlet of Grist Millpond, Sudbury, to the inlet of Carding Mill Pond, Sudbury

Segment Length: 0.5 miles

Classification: Class B

Land-use estimates (top 3, excluding water) for the 3.1 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.31 mi² and the percentage of the imperviousness is 9.8%.

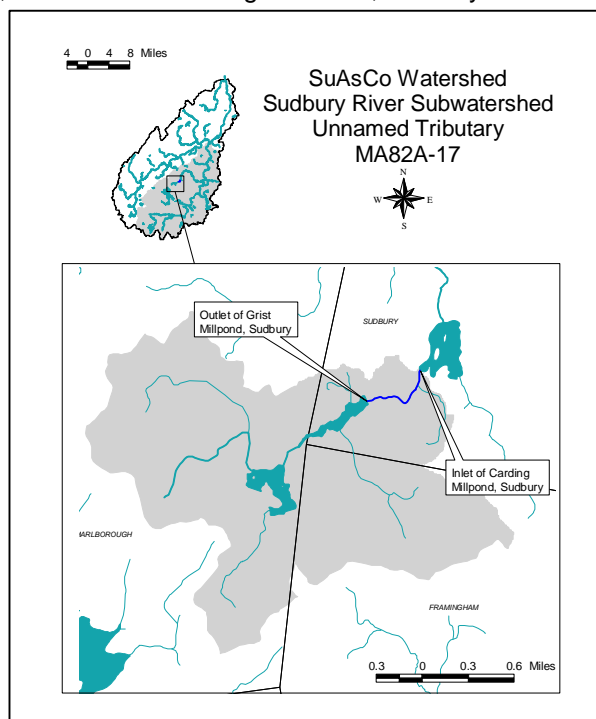
Forest 58%

Residential 23%

Commercial 6%

Based on the last evaluation of water quality conditions this unnamed tributary is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for nutrients, organic enrichment/low DO, suspended solids, and noxious aquatic plants (MA DEP 2003a).

The use assessments for Grist Millpond and Carding Mill Pond are provided in the Lake Assessment section of this report.



WMA WATER WITHDRAWAL SUMMARY AND NPDES WASTEWATER DISCHARGE SUMMARY

Based on the available information there are no registered or permitted WMA water withdrawals from this subwatershed or NPDES regulated discharges to this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

ENSR measured flows at one station (Station 14 - upstream of Carding Millpond) on this unnamed tributary using USGS guidelines. Flows were measured during their dry weather surveys on 31 August and 12 October 1999 (drought year). Flows were 2.7 cfs and 5.27 cfs (ENSR 2000).

Chemistry – water

In August, September, and October 1999 ENSR collected water quality samples from one station on this unnamed tributary. Analytes included total phosphorus, ammonia-nitrogen, and total suspended solids. Additionally, *in situ* measurements of DO, pH, temperature, and conductivity were collected during “dry/baseflow” sampling rounds on 31 August and 12 October (ENSR 2000).

DO

Dissolved oxygen concentrations were 3.3 and 9.6 mg/L. Percent saturations recorded by ENSR were 36.5% and 93.6%. It should be noted that these measurements were not taken during worst-case, pre-dawn conditions.

Temperature

Temperatures upstream were 21 and 14 °C.

pH

pH values reported by ENSR were 7.6 and 8.1 SU.

Conductivity

Conductivities were 574 and 399 µS/cm.

Total Suspended Solids

TSS concentrations ranged from 4 to 470 mg/L (n=6). All three of the wet weather samples were greater than 100 mg/L.

Total Phosphorus






Total phosphorus concentrations reported by ENSR ranged between 0.27 mg/L and 2.1 mg/L (n=6). It should be noted that the highest concentrations (1.31, 2.1, and 1.38 mg/L) were recorded during the three wet sampling events.

Ammonia-nitrogen

Ammonia-nitrogen concentrations ranged between 0.07 and 0.34 mg/L. These concentrations are below the CCC for ammonia-nitrogen.

The *Aquatic Life Use* for this unnamed tributary (locally known as Hop Brook) is assessed as impaired based primarily on the elevated concentrations of total phosphorus and suspended solids and best professional judgment. Although the Marlborough East WWTF discharge contributes total phosphorus to the brook other nonpoint sources of pollution also contribute total phosphorus to the system during storm events. Water quality in this segment is also affected by the impoundments (i.e., Hager Pond, Grist Millpond) where dense filamentous green algal mats were present.

Unnamed Tributary (MA82A-17) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Total phosphorus, dissolved oxygen saturation, pH Sources: Municipal point source discharge, upstream impoundments (Suspected Sources: Discharges from municipal separate storm sewers (MS4s), landfill, municipal urbanized high density areas)
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

- Conduct additional water quality monitoring in this unnamed tributary (i.e., diurnal DO monitoring, and habitat quality evaluations) to evaluate the status of the *Aquatic Life Use*, potential nonpoint sources of pollution, and any changes associated with pollution reduction activities.
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Management options recommended in the ENSR reports (2000 and 2004) to further the attainment of use goals for the Hop Brook subwatershed should be reviewed and implemented as deemed appropriate.

HOP BROOK (SEGMENT MA82A-05)

Description: Outlet of Carding Mill Pond, Sudbury, to confluence with Allowance Brook, Sudbury (Allowance Brook was identified as Landham Brook on USGS quads prior to 1987)

Segment Length: 6.7 miles

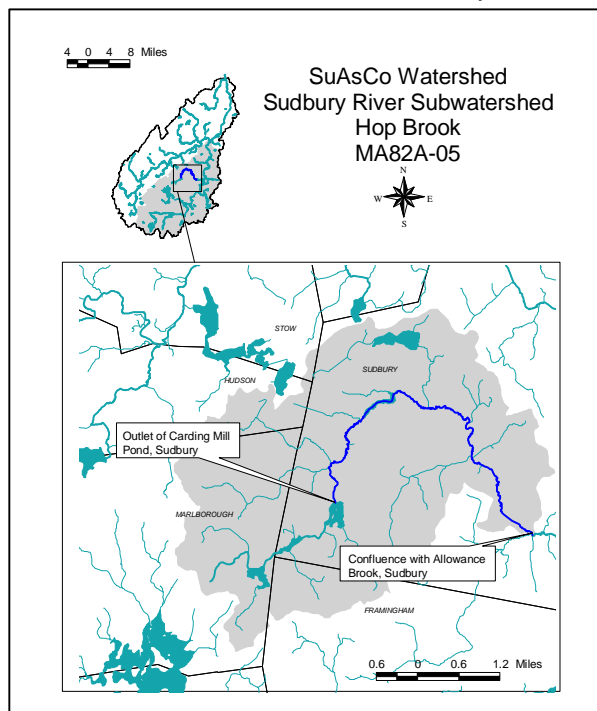
Classification: Class B, Warm Water Fishery

Land-use estimates (top 3, excluding water) for the 15.6 mi² subwatershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 1.2 mi² and the percentage of the imperviousness is 7.7%.

Forest..... 47%
Residential 39%
Open land 5%

Based on the last evaluation of water quality conditions Hop Brook is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for nutrients, organic enrichment/low DO, suspended solids, and noxious aquatic plants (MA DEP 2003a).

The use assessments for Carding Mill Pond and Stearns Mill Pond are provided in the Lake Assessment section of this report.



A Natural History of the Hop Brook (Novak undated) and *Brief Survey of Hop Brook's [and Sudbury's] Flora and Fauna From the Years of 1997-1999* (Cavallerano 1999b) provide details of the flora and fauna found in the Hop Brook watershed. There have also been numerous studies that examined the role of phosphorus in the Hop Brook watershed (e.g., Ashton 1998, Cavallerno 1999a and b, Cargill undated, and Schaider 1997).

WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Hudson Water Department	9P21414102	21414102	2141000-02G	2.0 (reg) <u>0.95 (perm)</u> 2.95
Sudbury Water Department	9P31428801	31428803	3288000-03G, -08G -10G	1.72 (reg) <u>0.36 (perm)</u> 2.08*
Cavicchio Greenhouse Inc.		31428802	Codger Ln Pond River	0.25

* Indicates a systemwide withdrawal- all sources not necessarily within this subwatershed

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

The Sudbury Water District (MAG640056) is permitted (6 August 2001) to discharge 0.018 MGD of effluent from the Sudbury Water Treatment Facility Well #8 off East Street to Hop Brook. This permit will expire in 2006.

USE ASSESSMENT

AQUATIC LIFE

Habitat and Flow

ENSR (2000) measured flows at two stations (Station 24- Stearns Millpond inlet and Station 28 outlet of Stearns Millpond) on Hop Brook following USGS guidelines. Flows were measured during their dry weather surveys on 31 August and 12 October 1999 (drought year). Flows ranged from 2.13 cfs to 8.38 cfs (n=4).

Chemistry – water

In August, September, and October 1999 ENSR collected water quality samples from two stations along this segment of Hop Brook (Station 24- Stearns Millpond inlet and Station 28 outlet of Stearns Millpond). Analytes included total phosphorus, ammonia-nitrogen, and total suspended solids. Additionally, *in situ* measurements of DO, pH, temperature, and conductivity were collected during “dry/baseflow” sampling rounds on 31 August and 12 October (ENSR 2000). ENSR also conducted *in situ* water quality monitoring in Hop Brook and collected grab samples for ammonia-nitrogen and total phosphorus at one station (T14- Peakham Road, Sudbury) on 29 July and 21 August 2003 as part of the Sudbury River Water Quality Study (ENSR 2004b).

DO

Dissolved oxygen concentrations during the 1999 ENSR survey ranged from 4.3 to 11 mg/L (n=4). Percent saturations recorded by ENSR were 44.9% and 107.1% (n=4). It should be noted that these measurements were not taken during worst-case, pre-dawn conditions.

During the 2003 ENSR survey, DO concentrations were 6.4 and 5.5 mg/L while percent saturations were 74.1 and 64.5%. Again these data were not collected during worse-case pre-dawn conditions.

Temperature

Temperatures during the 1999 survey ranged between 11.2 and 19.7°C (n=4). Temperatures during the 2003 survey were 22.4 and 23.1°C.

pH

pH values reported by ENSR for the 1999 survey ranged from 7.1 to 7.8 SU. pH values recorded during the 2003 survey were 6.9 and 7 SU.

Conductivity

Conductivity in this segment of Hop Brook in 1999 ranged between 273 and 535 µS/cm, while in 2003 conductivities were 420 and 356 µS/cm.

Total Suspended Solids

TSS concentrations during the 1999 survey ranged from 1 to 85 mg/L (n=8) with only one wet weather sample greater than 25 mg/L. During 2003, total suspended solids concentrations in Hop Brook were 5 and 1 mg/L.

Total Phosphorus

Total phosphorus concentrations measured by ENSR in the 1999 survey ranged between 0.05 mg/L and 0.54 mg/L (n=8). During the dry weather 2003 survey, concentrations of total phosphorus in Hop Brook were 0.02 mg/L (n=2).

Ammonia-nitrogen

Ammonia-nitrogen concentrations in 1999 ranged between 0.03 and 0.09 mg/L (n=8). In 2003, ammonia-nitrogen concentrations were <0.03 mg/L (n=2). These concentrations are all below the CCC for ammonia-nitrogen.






The *Aquatic Life Use* for this segment of Hop Brook is assessed as impaired based primarily on the elevated concentrations of total phosphorus and best professional judgment. Although the Marlborough East WWTF discharge contributes total phosphorus to the brook other nonpoint sources of pollution also contribute total phosphorus to the system during storm events. Water quality in this segment is also affected by the impoundments (i.e., Hager Pond, Grist Millpond, Carding Mill Pond) where dense filamentous green algal mats were present.

PRIMARY CONTACT AND SECONDARY CONTACT RECREATION

ENSR collected fecal coliform and *E. coli* bacteria samples at one station on Hop Brook (T14- Peakham Road, Sudbury) on 29 July 2003 (ENSR 2004). The fecal coliform bacteria count was 100 cfu/100 mL.

Due to the lack of additional bacteria data the recreational uses are currently not assessed for this segment of Hop Brook.

Hop Brook (MA82A-05) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Total phosphorus, dissolved oxygen saturation Sources: Municipal point source discharge, upstream impoundments (Suspected Sources: Discharges from municipal separate storm sewers (MS4s), landfill, municipal urbanized high density areas)
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED
Secondary Contact		NOT ASSESSED
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

- Conduct additional water quality monitoring in Hop Brook (i.e., diurnal DO monitoring, and habitat quality evaluations) to evaluate the status of the *Aquatic Life Use*, point and potential nonpoint sources of pollution, and any changes associated with pollution reduction activities.
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Management options recommended in the ENSR reports (2000 and 2004) to further the attainment of use goals for the Hop Brook subwatershed should be reviewed and implemented as deemed appropriate.
- Determine whether or not water withdrawals along this segment of Hop Brook are impacting stream flow and aquatic resources.

HOP BROOK (SEGMENT MA82A-06)

Description: From the confluence of Allowance Brook, Sudbury, to the confluence with the Sudbury River, Wayland

This segment was formerly identified as Wash Brook. Hop Brook appeared as Wash Brook and Allowance Brook was previously identified as Landham Brook on USGS quads prior to 1987.

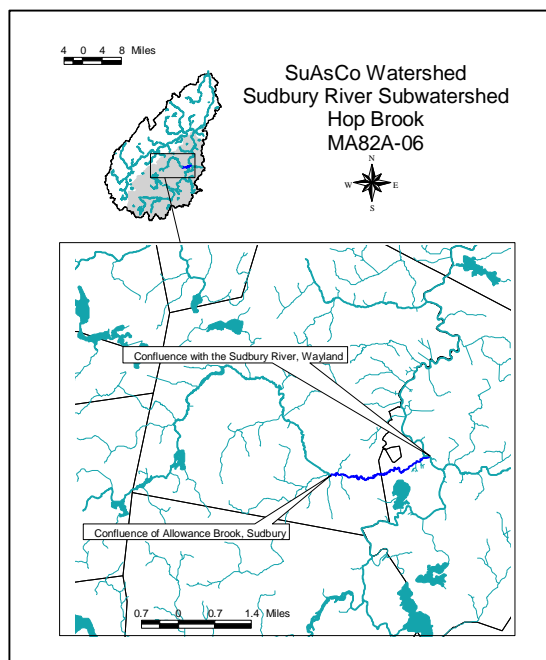
Segment Length: 3.0 miles

Classification: Class B, Warm Water Fishery

Land-use estimates for this subwatershed are currently not available.

Based on the last evaluation of water quality conditions Wash Brook is listed on the 2002 Integrated List of Waters in Category 5. This segment was assessed as impaired and requires a TMDL for nutrients, pathogens, suspended solids, and noxious aquatic plants (MA DEP 2003a).

MDFW has proposed that Hop Brook (SARIS # 8247925), a tributary to Landham Brook (Allowance Brook), be protected as cold water fishery habitat (Richards 2003b).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Sudbury Water Department	9P31428801	31428803	328800-02G, 04G, 06G, 07G, 09G	1.72 (reg) <u>0.36 (permitted)</u> 2.08

*Indicates system wide withdrawal- all sources not necessarily within this subwatershed

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

Raytheon Sudbury Facility (MA0034282) was permitted to discharge to Landham Brook, a tributary to this segment. The facility filed an application for the NCCW general permit but went to a closed loop system in 1998. The facility has since closed and ceased operation (Ahsan 2003) but still has coverage under the storm water multi-sector general permit (SW MSGP) as MAR05C078.

Coatings Engineering Corporation (MA0026743) is permitted to discharge to Landham Brook, a tributary to this segment. This facility is a hazardous waste site due to oil and hazardous material contamination and is in Phase V (Operation, Maintenance, and/or Monitoring) of the five-phase cleanup process.

The Sudbury Water District (MAG640054) is permitted (5 April 2001) to discharge 0.012 MGD of effluent from the proposed Raymond Road Water Treatment Facility to Landham Brook (a.k.a. Allowance Brook), a tributary to this segment. This permit will expire in 2006. Sudbury is required to notify EPA and MA DEP 90 days prior to commencement of discharge and conduct a complete toxicity test using *Ceriodaphnia dubia* during the first quarter of operation due to a low dilution factor (less than 10).

USE ASSESSMENT

AQUATIC LIFE

Chemistry – water

DWM conducted water quality monitoring in Hop Brook in 2001 at the Landham Road bridge in Sudbury (Station WB01). Measurements of dissolved oxygen, temperature, pH, and conductivity were taken *in situ*, while grab samples were collected and analyzed for total phosphorus, ammonia-nitrogen, alkalinity, hardness, and turbidity (Appendix A).

ENSR conducted *in situ* water quality monitoring in Hop Brook (Station T08) at the Landham Road Bridge in Sudbury (identified as Elm Street Bridge in ENSR report) in 2002 and 2003. Grab samples were also collected and analyzed for ammonia-nitrogen and total phosphorus on five occasions (ENSR 2004b).

DO

Dissolved oxygen concentrations measured by DWM during pre-dawn hours ranged between 3.2 and 4.7 mg/L (n=3). Percent saturations ranged between 35 and 49% (n=3). DO concentrations measured by ENSR ranged between 2.9 and 7.8 with two of the six measurements less than 5.0 mg/L. Percent saturations ranged between 32.8 and 90.2 % (n=6). It should be noted that these data were not collected during worst-case, pre-dawn conditions (0721 to 1430h).

Temperature

Temperatures measured by DWM ranged between 18.3 and 21.4°C (n=3). Temperatures measured by ENSR ranged between 16 and 23.9°C (n=6).

pH

pH measured during the DWM surveys ranged between 6.7 and 7.1 SU (n=3). pH measured by ENSR ranged between 6.7 and 7.1 SU (n=5).

Hardness

Hardness values measured by DWM were between 66 and 79 mg/L (n=6).

Alkalinity

Alkalinity measured by DWM ranged between 40 and 68 mg/L (n=6).

Conductivity

Specific conductance at 25°C as measured by DWM ranged between 386 and 507 µS/cm (n=3). ENSR measured conductivities in this segment between 410 and 475 µS/cm (n=5) although one higher measurement was also reported.

Total Suspended Solids

Total suspended solids concentrations ranged between 2.0 and 3.6 mg/L (n=6). TSS concentrations measured by ENSR ranged between 3 and 12 mg/L (n=5).

Turbidity

Turbidity measured in samples collected by DWM ranged between 0.8 and 2.5 NTU (n=6).

Total Phosphorus

Total phosphorus concentrations measured by DWM ranged between 0.13 and 0.16 (n=6). Total phosphorus concentrations during the ENSR survey ranged between 0.06 and 0.18 mg/L (n=5).

Ammonia-nitrogen

Ammonia-nitrogen concentrations measured by DWM were all <0.02 mg/L (n=6). ENSR measured concentrations of ammonia-nitrogen in this segment between <0.03 and 0.05 mg/L (n=5). These concentrations are all below the CCC for ammonia-nitrogen.

Chemistry-sediment

USGS collected and analyzed sediment cores collected from this segment of Hop Brook in May 1995. The total mercury concentration in the sediment showed a pattern of slight increase from the top of the

core to 10cm then a decrease with depth. The maximum concentration was 0.24 ppm dry-weight. (Colman *et al.* 1999).

The *Aquatic Life Use* for this segment of Hop Brook is assessed as impaired based primarily on the elevated concentrations of total phosphorus, low dissolved oxygen concentrations and best professional judgment. Although the Marlborough East WWTF discharge contributes total phosphorus to the brook other nonpoint sources of pollution also contribute total phosphorus to the system during storm events. Water quality in this segment is also affected by the impoundments (i.e., Hager Pond, Grist Millpond, Carding Mill Pond), where dense filamentous green algal mats are present. The influence of the wetland nature of this stream may also contribute to low dissolved oxygen/saturation levels.






PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

DWM collected fecal coliform and *E. coli* bacteria samples in Hop Brook at Landham Road in Sudbury in July and September 2001 (Appendix A). Fecal coliform counts ranged between 140 and 230 cfu/100 mL (n=4). These samples were collected during dry weather.

ENSR also collected fecal coliform and *E. coli* bacteria samples from Hop Brook at the Landham Street Bridge in Sudbury (T08 Hop Brook, Identified as Bridge on Elm Street, Sudbury) in July and August 2002, and July and September 2003 (ENSR 2004b). Fecal coliform bacteria counts ranged from 100 to 189,000 (n=4) with only one count greater than 2000 that was collected during wet weather on 16 September 2003.

Because of the limited data set available the *Primary* and *Secondary Contact Recreational* and *Aesthetics* uses are not assessed for this segment of Hop Brook. The *Recreational* uses are identified with an Alert Status, however, due to an elevated fecal coliform bacteria count during a wet weather event.

Hop Brook (MA82A-06) Use Summary Table

Designated Uses		Status
Aquatic Life		IMPAIRED Causes: Total phosphorus, low dissolved oxygen, dissolved oxygen saturation Sources: Municipal point source discharge, upstream impoundments (Suspected Sources: Discharges from municipal storm sewers (MS4s), landfill, municipal urbanized high density areas)
Fish Consumption		NOT ASSESSED
Primary Contact		NOT ASSESSED*
Secondary Contact		NOT ASSESSED*
Aesthetics		NOT ASSESSED

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

RECOMMENDATIONS

- Conduct additional water quality monitoring in Hop Brook (i.e., diurnal DO monitoring, and habitat quality evaluations) to evaluate the status of the *Aquatic Life Use*, potential nonpoint sources of pollution and any changes associated with pollution reduction activities.
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including treatment of storm water discharges and the Phase II community storm water management program and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Management options recommended in the ENSR reports (2000 and 2004) to further the attainment of use goals for the Hop Brook subwatershed should be reviewed and implemented as deemed appropriate.

- MDFW has proposed that Hop Brook (SARIS # 8247925), a tributary to Landham Brook (Allowance Brook), be protected as cold water fishery habitat. Additional monitoring of the fish population, DO, and temperature is needed to evaluate MDFW's proposal to list this tributary as a cold water fishery in the next revision of the Surface Water Quality Standards.

PANTRY BROOK (SEGMENT MA82A-19)

Description: From source west of Haynes Road, Sudbury, to the confluence with the Sudbury River, Sudbury

Segment Length: 3.2 miles

Classification: Class B

Land-use estimates (top 3, excluding water) for the 6.0 mi² watershed (map inset, gray shaded area) are presented below. An estimate of the impervious area within this subwatershed is 0.28 mi² and the percentage of the imperviousness is 4.7%.

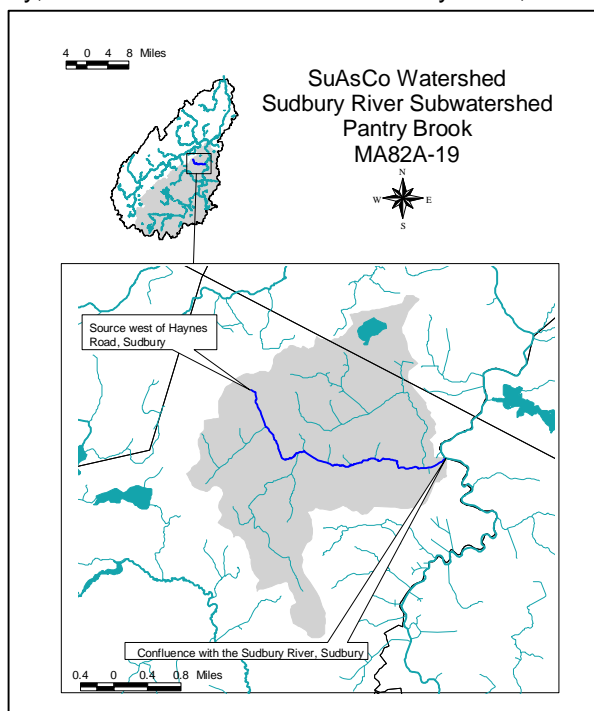
Forest 44%

Residential 31%

Agriculture..... 10%

Based on the last evaluation of water quality conditions Pantry Brook is listed on the 2002 Integrated List of Waters in Category 3. This was not assessed for any of the designated uses (MA DEP 2003a).

ENSR collected *in situ* water quality, nutrient, and bacteria samples from one station on Cold Brook, a tributary to Pantry Brook, in July, August, and September 2003 (ENSR 2004b).



WMA WATER WITHDRAWAL SUMMARY (APPENDIX E, TABLE E5)

Facility	WMA Permit Number	WMA Registration Number	Source (G = ground, S = surface)	Authorized Withdrawal (MGD)
Verrill Farm*		31406707	Concord Road (w/d) (s) Pantry Road (w/d) (s)	0.06 (184 days)**
Concord Water Department*	9P31406701	31406704	3067000-04G	2.1 (reg) <u>0.42 (perm)</u> 2.52
Sudbury Water Department*	9P31428801	31428803	3288000-05G	1.72 (reg) <u>0.36 (perm)</u> 2.08

*Indicates system-wide withdrawal, all sources not necessarily in this subwatershed.

** This facility's withdrawals have been under the WMA threshold and they have initiated discussion with DEP to give up their registration (Peters 2004).

NPDES WASTEWATER DISCHARGE SUMMARY (APPENDIX E, TABLES E1-E4)

The Sperry Research Center (MA0030155) was permitted (10 October 1986) to discharge via outfall 001 to Cold Brook Creek, a tributary to Pantry Brook. The permit expired 10 October 1991. According to MA DEP Northeast Regional Office staff the facility is closed and there is no longer a discharge (Ahsan 2003).

LANDFILLS (APPENDIX K)

The Sudbury Landfill is located within this subwatershed.

USE ASSESSMENT

AQUATIC LIFE

Biology

Although too old for assessment purposes it should also be noted that DWM sampled the benthic macroinvertebrate community in Pantry Brook in 1996 (Appendix H).

Chemistry-water

ENSR conducted *in situ* water quality monitoring at one station on Pantry Brook (T06- Pantry Brook, Pantry Road, Sudbury) on five occasions in 2002 and 2003. Measurements included temperature, pH, DO, and conductivity. Grab samples were also collected and analyzed for ammonia-nitrogen, TSS, and total phosphorus on three occasions (ENSR 2004b).

DO

DO concentrations ranged between 7.1 and 9.0 mg/L (n=5). Percent saturations ranged between 76 and 97% (n=5). It should be noted that these data were not collected during worst-case, pre-dawn conditions.

Temperature

Temperatures in Pantry Brook ranged from a low of 16.7°C in August 2002 to a high of 22.6°C in July 2002.

pH

pH values ranged between 5.5 and 7.7 SU with one of the five values less than 6.5 SU.

Conductivity

Specific conductance in Pantry Brook ranged between 212 and 421µS/cm (n=5).

Total Suspended Solids

TSS concentrations ranged between <1 and 16 mg/L (n=3).

Total phosphorus

Total phosphorus concentrations in Pantry Brook water ranged between 0.01 and 0.05 mg/L (n=3).

Ammonia-nitrogen

Ammonium-nitrogen concentrations ranged from <0.03 to 0.04 mg/L (n=3).

Too limited data are currently available to assess the status of the *Aquatic Life Use* for Pantry Brook.






PRIMARY CONTACT AND SECONDARY CONTACT RECREATION AND AESTHETICS

DWM conducted fecal coliform and *E. coli* bacteria monitoring on two occasions in July 2001 in Pantry Brook at Station PB01- upstream side of Pantry Road bridge- in Sudbury (Appendix A). Fecal coliform bacteria counts were 580 and 1600 cfu/100mL. These samples were collected during dry weather conditions.

ENSR also collected fecal coliform and *E. coli* bacteria samples from one station on Pantry Brook (T06- Pantry Road, Sudbury) in 2002 and 2003 (ENSR 2004b). Fecal coliform bacteria counts ranged from 100 to 50,000 cfu/100 mL with three of the four samples having counts greater than 400 cfu/100 mL and two of the four samples having counts greater than 2000 cfu/100 mL. ENSR conducted additional bacteria investigations in the Pantry Brook subwatershed in August and September 2004 to determine sources of elevated counts (Gendron and Hickey 2004). Samples were collected from two stations along Pantry Brook (Station B-07, Marlborough Road and T06 upstream Pantry Road station) during both wet and dry weather conditions. Fecal coliform bacteria counts at both locations ranged from 110 to >30,000 cfu/100 mL, with four of the eight measurements greater than 400 cfu/100mL and two of the eight measurements greater than 2000 cfu/100 mL.

Although limited data were collected in each of the sampling years (2001 through 2004) the *Primary* and *Secondary Contact Recreational* uses for Pantry Brook are assessed as impaired based primarily on elevated fecal coliform bacteria counts and best professional judgment. The potential sources of bacteria include on-site wastewater disposal systems as well as domestic waste from household pets and horses (farms abut the stream), wildlife, and manure piles used as fertilizer (Gendron and Hickey 2004). No data are available to assess the *Aesthetics Use*.

Pantry Brook (MA82A-19) Use Summary Table

Designated Uses		Status
Aquatic Life		NOT ASSESSED
Fish Consumption		NOT ASSESSED
Primary Contact		IMPAIRED Causes: Fecal coliform bacteria (Suspected Sources: On-site treatment systems, waste from pets, wildlife other than waterfowl)
Secondary Contact		
Aesthetics		NOT ASSESSED

RECOMMENDATIONS

- Conduct additional water quality monitoring in Pantry Brook (i.e., diurnal DO monitoring, habitat quality evaluations, biological monitoring) to evaluate the status of the *Aquatic Life Use*, potential nonpoint sources of pollution and any changes associated with pollution reduction activities.
- Conduct bacteria monitoring to evaluate the effectiveness of bacteria source reduction activities including septic system upgrades, implementation of BMPs by homeowners regarding pet waste disposal and horse farm manure storage/runoff, fertilizer storage/use, treatment of storm water discharges and the Phase II community storm water management program, and to assess the status of the *Primary* and *Secondary Contact Recreational* uses.
- Evaluate the need to conduct bacteria source identification studies (i.e., human vs. non-human contamination).