analyses indicated non/slight impairment (80% comparability) and non-impairment (90% comparability) respective to each reference station condition (Appendix B, Tables B6 and B7). Most metrics for the TM06 assemblage scored well relative to reference conditions; the exception being the community similarity metric—probably the result of differences in trophic structure. Hyperdominance of filter-feeding taxa at TM06 indicated a fine particulate organic matter (FPOM) based trophic guild that was dramatically different than at both reference stations, where a more periphyton-based (i.e., dominated by scrapers) assemblage predominated (Appendix B, Table B5). Falls Pond (North Basin), located upstream of station TM06, probably contributes significant amounts of the suspended FPOM food resource which appear to shape benthic community structure and function at TM06. Nonpoint source pollution in the form of runoff (possibly originating from the adjacent lawn and/or upstream road crossing) may contribute to a slightly degraded habitat relative to reference conditions at SM00 (Appendix B, Table BB9). Instream sediment deposition and embeddedness, which reduces macroinvertebrate microhabitat, may account for the slight reduction in taxa richness at TM06. As at TM05 (located just upstream of TM06), fish habitat appeared to be good to excellent; however, fish sampling resulted in the collection of only four fish (Appendix B, Table B10). One potential cause of the marginal fish community includes possible water quantity problems resulting from flow management (dam repair) at Falls Pond (North Basin) (Appendix B, Table B13). The filamentous green alga *Spirogyra* sp., whose presence is often associated with enriched conditions, was also very abundant (Appendix B, Table B11).

• Water Quality - TM04, TM06 - Fecal coliform sampling was conducted, however, the data set was too limited to assess either the primary or secondary contact recreational uses. Dissolved oxygen, pH, and temperature were within the criteria for class B warmwater fishery (Appendix B, Table B2).

• Sediment Quality – Survival of *C. tentans* (63%) exposed to sediment from Wetherells Pond Dam (WETH01) was significantly reduced compared to survival (94%) of the control sediment (Hellyer 1999a). Survival of *C. tentans* exposed to sediment from both Falls Pond (TENM01) and the Ten Mile River upstream of Cedar Street (NATP01) was 83% (no significant difference from the control). Due to problems meeting laboratory control criteria, the data from the *H. azteca* toxicity tests were not used in this assessment. The SEM/AVS ratio in the sediment from Wetherells Pond was 29 where significant sediment toxicity was detected. SEM/AVS ratios can be used to predict metal toxicity where no significant mortality occurs with a SEM/AVS ratio is < 1 and significant mortality occurs where a SEM/AVS ratio is > 1 (EPA 1991). The SEM/AVS ratio was less than 1 (0.24 and 0) at TENM01 and NATP01, respectively where no significant toxicity was detected. At all three stations the concentrations of Cd, PCB, DDT and TOC in the sediment samples exceeded L-EL guidance while Cu, Hg, and Ni exceeded S-EL guidance. Sediment from WETH01 and TENM01 contained concentrations of Cr and Pb that exceeded S-EL guidance whereas in sediment from NATP01 both metals only exceeded the L-EL guidance. Zinc was at the S-EL in sediment from WETH01 while exceeding the L-EL in both TENM01 and NATP01 samples.

SUMMARY

Designated Uses		Status
Aquatic Life		NON SUPPORT. The macroinvertebrate analysis, fish community sampling data, and the sediment quality data indicate this use is not supported for the entire 4.3 miles in this segment. Compromised habitat quality conditions, hydromodification, sediment contamination and other unknown causes/sources impair this use.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		PARTIAL SUPPORT. The entire 4.3 mile length of this segment partially supports this use based on visual observations of sediment deposition, nuisance aquatic vegetation and some turbidity as well as some instream anthropogenic debris.

RECOMMENDATIONS - Ten Mile River (Segment MA 52-02)

- Conduct 5-year review of the WMA registration for the North Attleborough Water Department. Minimize water withdrawals via conservation measures.

- Instream sediment deposition compromises habitat quality and biological potential at TM02 and TM06. Sources of sediment inputs (road crossings - in particular West Bacon Street, and parking lot runoff) should be investigated and remediated in order to minimize future impacts.

- Outreach to abutting landowners as to the need to establish/implement a riparian buffer zone, particularly along the TM04 and TM06 sampling reaches.

- Additional monitoring (particularly fecal coliform bacteria sampling) is necessary to evaluate the primary and secondary contact recreational use status.

- Determine whether or not the North Attleborough Water Department is in compliance with their registered withdrawal volume. It is presently unclear what is causing the lack of/reduced fish community in this segment. Auditing of dam operation at Falls Pond might shed light on the potential for low flow to be causing fisheries problems. Minimize water withdrawals via conservation measures.

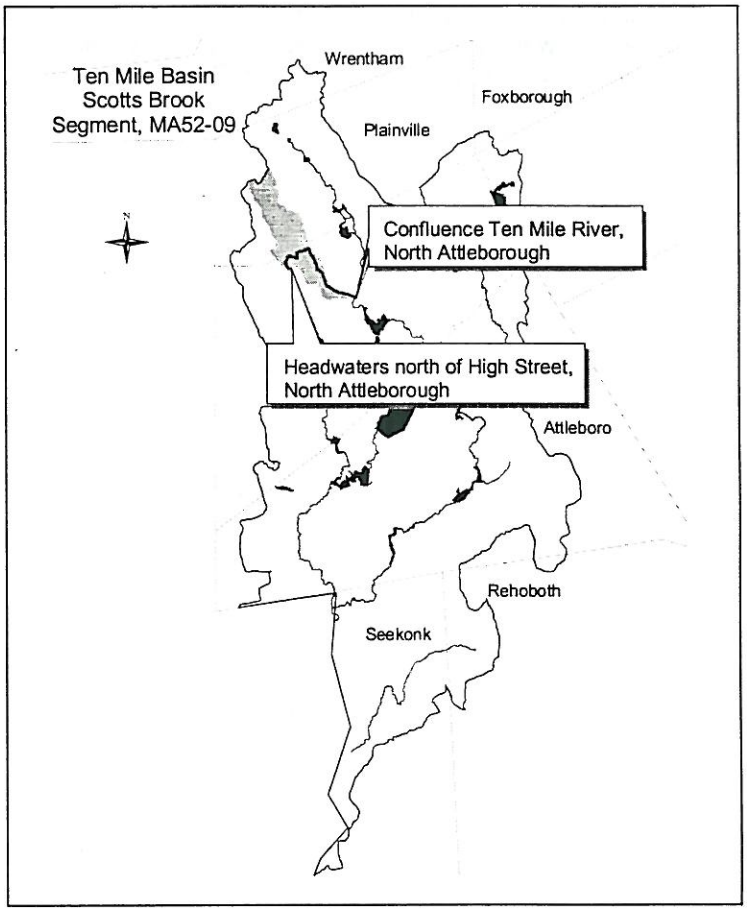
- Additional sediment sampling will be needed to determine the feasibility of restoring the impoundments via dredging.

SCOTTS BROOK (SEGMENT MA52-09)

Location: Headwaters north of High Street, North Attleborough to confluence with Ten Mile River, North Attleborough. Segment length: 2.2 miles. Classification: Class B.

SEGMENT DESCRIPTION

Scotts Brook originates in a golf course in Plainville. It flows south through a few small ponds, a forested/agricultural area, and then a heavy residential area before joining the Ten Mile River in the Town of North Attleborough.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	50%
Residential	20%
Open Land	19%

Land-use estimates in the 100' riparian zone from the streambanks:

Residential	42%
Forest	24%
Open Land	10%

WITHDRAWALS AND DISCHARGES

None known.

USE ASSESSMENT

In-situ measurements of dissolved oxygen, temperature and other variables were taken at one station in Scotts Brook (SB01 – upstream of the Broadway Bridge, North Attleborough) in August 1997(Appendix B, Table B1). Although additional sampling had been planned (July and September), too little flow was present in the brook.

- Water Quality – Most attempts to sample this stream were unsuccessful because of the lack of flow (Appendix B, Tables B2 and B3).

SUMMARY

Designated Uses		Status
Aquatic Life		NON SUPPORT. Lack of flow in Scotts Brook is responsible for this segment's non-support status.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		NOT ASSESSED.

RECOMMENDATIONS - Scotts Brook (Segment MA52-09)

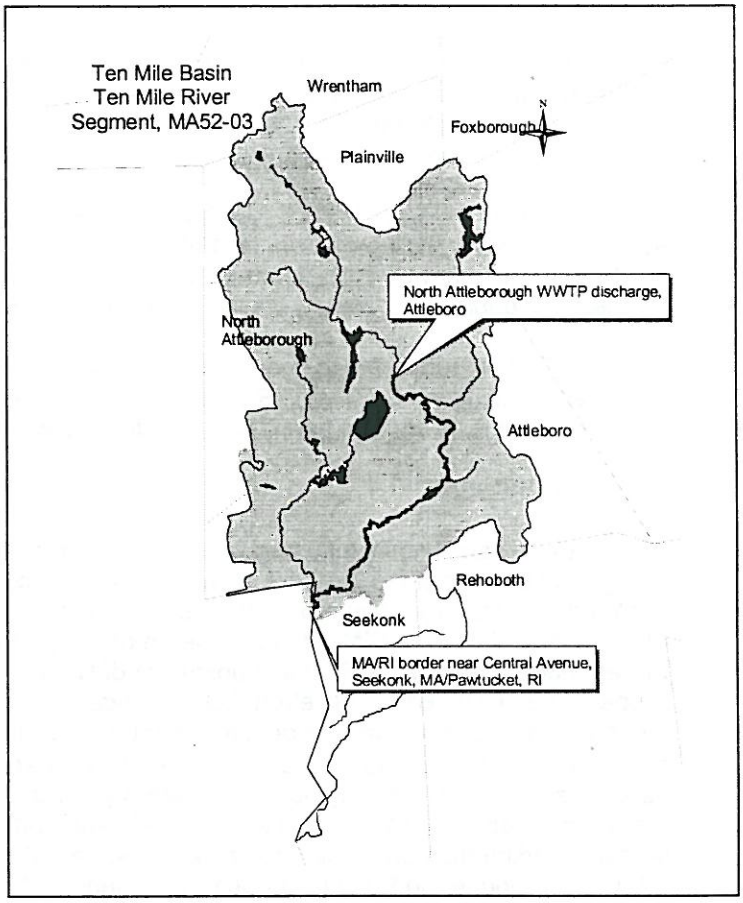
- The assessment of water quality conditions in this segment has been based entirely on limited data and best professional judgement. Additional monitoring would be useful to confirm this evaluation. Although the cause of low flow problems is unclear, a golf course and a number of small ponds located in the upper watershed may be contributing to low flow conditions in Scotts Brook. These merit further investigation by the Ten Mile River Basin team.

TEN MILE RIVER (SEGMENT MA 52-03)

Location: North Attleborough WWTP discharge, Attleboro to the MA/RI border near Central Avenue, Seekonk, MA/Pawtucket, RI. Segment length: 8.6 miles. Classification: Class B, Warm Water Fishery.

SEGMENT DESCRIPTION

This segment begins at the discharge of the North Attleborough WWTP discharge and extends downstream to the discharge of the Attleboro WWTP. Land use within the watershed of this segment is primarily residential, commercial and light industrial. The river passes through a number of small impoundments (Farmers Pond, Mechanics Pond, Dodgeville Pond, and Hebronville Pond) as it flows through this segment.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	39%
Residential	30%
Open Land	11%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	30%
Residential	16%
Wetlands	15%

WITHDRAWALS AND DISCHARGES

WMA:

1. Mantrose-Hauser Co., Inc. is permitted (9P242701602) to withdraw 0.46 MGD of water from three wells near their facility. Some of the water is used as process water which is discharged to the Attleboro WPCF. The remainder of the water is discharged (NPDES) as non-contact cooling water to the Ten Mile River.

NPDES:

1. MA0101036 North Attleborough WWTP - discharges 4.61 MGD of treated wastewater to the Ten Mile River. Whole effluent toxicity testing limits: $LC_{50} \geq 100\%$ effluent, CNOEC $\geq$ 94% effluent. Permit was renewed in September 1999 with same limits, however testing requires use of *C. dubia* only.

2. MA0004766 – L.G. Balfour Plant #1 permit file indicates NDPES file was closed November 1994 since the company no longer discharged their non-contact cooling water to the Ten Mile River.

3. MAG250967 – Automatic Machine Products Co. was issued a general non-contact cooling water discharge permit in January 1999. This permit authorized the discharge of 0.027 MGD (a well water withdrawal) up to 83°F to the Ten Mile River.

4. MA0000027 – Lambert Anodizing Co., Inc. permit file indicates the discharge was terminated. EPA terminated the NPDES permit in February 1991.

5. MA0005703 - Mantrose-Haeuser Co., Inc. (formerly owned by R.J.M. Chemicals, Inc.) - 1976 permit indicated the facility discharged non-contact cooling water via three outfalls to the Ten Mile River between Mechanics and Dodgeville ponds: Outfall #001 discharged 0.0075 MGD up to 72°F, #003

discharged 0.21 MGD up to 100°F, and #004 discharged 0.1 MGD up to 85°F. In 1982 the company filed a reapplication, however a new permit was never issued nor was the old permit ever terminated. In 1995 the facility requested and received coverage under a general non-contact cooling water (NCCW) permit MAG250958. This permit authorized the discharge of 0.65 MGD up to 83°F to the Ten Mile River. The facility still discharges to the Ten Mile River via the three outfalls (Young 2000).

6. MA0000159 - Attleboro Refining Company a member of Handy & Harman – discharges only non-contact cooling water on an infrequent basis (e.g. power outage, recirculation tower failure) to the storm drain system that discharges into the Ten Mile River. As of 1 January 1988, this company discontinued its process wastewater discharge to the Ten Mile River.

7. MA0100595 Attleboro WPCF - discharges 8.5 MGD of treated wastewater to the Ten Mile River. Whole effluent toxicity testing limits in the 1989 permit: ANOAEL $\geq$ 90% effluent, CNOEC $\geq$ 90% effluent. Permit was renewed in September 1999 with limits of $LC_{50} \geq$ 100% effluent and CNOEC $\geq$ 71% effluent using *C. dubia* only. Toxicity testing is now required 6X/year.

8. MA0035394 Mutual Oil Co, Inc. - According to the GIS overlay (EOEA 1999) the facility discharged to a small tributary of the Ten Mile River north of the Coles Brook subwatershed. Site remediation was terminated in 1997. The permit was deactivated by EPA in July 1999.

USE ASSESSMENT

Water quality sampling in July, August, and September 1997 was conducted by DWM at six locations along this segment of the Ten Mile River. Stations location were as follows: downstream from Route 95 (off Woodcock Lane), Attleboro (TM07), upstream of Olive Street, Attleboro (TM08A), upstream of Tiffany Street bridge, Attleboro (TM11), downstream of Bridge Street, Attleboro (TM12), downstream from Pond Street bridge, Seekonk (TM13) and upstream of Central Avenue bridge, Pawtucket Rhode Island (TM14) (Appendix B, Table B1). This effort included fecal coliform sampling (early morning survey) and *in-situ* measurements of dissolved oxygen, temperature and other variables (early morning and late afternoon surveys) using a Hydrolab®. Benthic macroinvertebrate sampling, qualitative periphyton sampling, habitat assessments and fish population sampling was also conducted by DWM biologists downstream of the North Attleborough WWTP (stationTM06A) and stations TM11 and TM14 in September 1997. EPA sampled sediments from behind three dams located within this segment in March 1998: Mechanics Pond (MECH01), Dodgeville Pond (DODG01), and Hebronville Pond (HEBR01)(Hellyer 1999b). Sediment samples were analyzed chemically for the following: metals, mercury, semivolatile organic compounds (SVOC), polychorinated biphenyls (PCB), pesticides, simultaneously extraced metals and acid volatile sulfide (AVS/SEM), grain size and total organic carbon (TOC). Sediment toxicity testing was also conducted by EPA using two freshwater macroinvertebrate species, *Chironomus tentans* and *Hyallela azteca*. Whole effluent toxicity testing data from the North Attleborough WWTP and the Attleboro WWPT (required by their NPDES permits) from December 1992 through March 1998 and March 1997 through December 1998, respectively was also reviewed (Dallaire 2000).

- Bioassessment/Habitat - TM06A - The benthic macroinvertebrate community analysis resulted in a total metric score of 20 (as compared to 40 and 42 at the regional reference sites SM00 and TM01, respectively) indicating moderate impairment (Appendix B, Tables B6 and B7). Loss of taxa--especially the pollution sensitive EPT taxa (mayflies, stoneflies, and caddisflies), a community dominated by the isopod *Caecidotea communis* (highly tolerant of organic pollution), and a generally dissimilar community compared to SM00 and TM01 contributed most to the impairment designation. Instream sediment deposition and lack of a well-vegetated riparian zone impacted habitat at this station, with these parameters scoring only 6 and 0, respectively (Appendix B, Table B9). Sediment runoff from nearby construction activity was observed during the time of sampling, with obvious sand inputs entering the stream mid-reach from the right bank (a sandy delta had formed instream at the point where the sediments entered the channel). Other potential NPS inputs (e.g., grass clippings and other yard waste) existed along the right bank and were associated with the adjacent lawns that extend to the river's edge. Nonpoint source related pollution effects are probably exacerbated by the lack of a riparian buffer along this bank. In addition to localized NPS pollution, North Attleborough's WWTP also discharges to this segment and impacts the benthic macroinvertebrate community.

When compared to the upstream reference station at TM06 (a site-specific control), the TM06A benthos assemblage received a total metric score of 22, representing 52% comparability to upstream reference conditions and placing the community in the slight/moderate category for biological condition (Appendix B, Table B8). Based on these upstream-downstream comparisons, the TM06A community was characterized by a loss of pollution sensitive taxa and a high degree of dissimilarity to the TM06 community. In addition, trophic structure appears to have shifted dramatically downstream from the WWTP. While the TM06 benthic community was dominated by filter-feeding forms (indicative of an abundant FPOM food resource), gathering collectors (most notably *Caecidotea communis*) predominated at TM06A (Appendix B, Table B5). The conspicuous absence of filter-feeders—normally expected in a stream reach with such an abundance of dissolved organic matter (DOM) and subjected to good current velocity—suggests the possibility of toxic effects at TM06A. By readily adsorbing to DOM forming FPOM during processes such as flocculation, toxicants become available to filter-feeders via the FPOM food resource (Plafkin et al. 1989). As a result, densities of filter-feeders decline when exposed to toxic stressors. A shift in the algal community between TM06 and TM06A (i.e., upstream and downstream of the North Attleborough WWTP discharge) was also observed (Appendix B, Table B11). Although fish habitat was adequate, no fish were collected or observed in the 100 meter sampling reach (Appendix B, Table B10), further corroborating the possibility of a toxicant in this portion of the river. While it is difficult to "tease out" habitat effects from water quality effects at TM06A, organic pollutant loadings and possible toxicants appear to be shaping benthic community structure and function in this section of the Ten Mile River. The North Attleborough WWTP discharge probably contributes most to the observed impairment of the aquatic community.

Station TM11 - The benthic macroinvertebrate community analysis resulted in total metric scores of 26 and 30 (as compared to 42 and 40 at the regional reference sites SM00 and TM01 respectively), indicating slight impairment to the benthic community (Appendix B; Table B6 and B7). Low taxa richness and a generally dissimilar community relative to reference conditions are most responsible for metric score reductions and resulting impairment (Appendix B; Table B6 and B7). In addition, a lack of diverse (depth and velocity) riffle habitat, coupled with instream sedimentation and a reduced riparian vegetative zone, impacted habitat at this station. Nonpoint source inputs originating from the adjacent cemetery (streambank erosion), the Tiffany Street road crossing, and a large sand/gravel operation upstream, probably contribute most to habitat degradation. Fish sampling resulted in the collection of 59 fish representing nine species (Appendix B, Table B10). There were a number of pond species, which is not surprising, given the location of this reach just downstream of Hebronville Pond. Fish habitat was rated fair with the majority of instream fish cover in the form of deep pools and aquatic macrophytes. Stream species present included: creek chubsucker (*Erimyzon oblongus*), white sucker (*Catostomus commersoni*), redfin pickerel (*Esox americanus americanus*), and yellow bullhead (*Ictalurus natalis*).

Although taxa richness was slightly less than at TM06A, there are indications that water quality conditions in this reach of the Ten Mile River (downstream from Dodgeville Pond) are slightly better compared to upstream conditions (TM06A). As evidenced by the biotic and EPT indices, taxa more tolerant of organic pollution have become displaced by more pollution sensitive forms (Appendix B, Table B6). Overall balance of the benthic community has improved considerably at TM11, with the dominant taxon comprising 23% of the assemblage as opposed to 43% at TM06A. Improvements in trophic composition were documented as well, with the reappearance of scrapers (*Stenelmis* sp) and filter-feeders (e.g., Pisidiidae, Hydropsychidae, Philopotamidae) indicating the presence of additional food resources (periphyton, FPOM) compared to conditions upstream where deposited organic matter supported a gathering collector-dominated trophic guild (Appendix B; Table B5).

Station TM14 - Benthic macroinvertebrate community analysis resulted in total metric scores of 28 and 30 (as compared to 40 and 42 at regional reference sites SM00 and TM01, respectively), indicating slight impairment to the benthic community (Appendix B; Tables B6 and B7). An assemblage dominated by caddisflies, slightly reduced species richness, and a generally dissimilar community compared to SM00 and TM01 are most responsible for metric score reductions and resulting impairment to the invertebrate community at this station. Sediment deposition and slightly embedded substrates within the sampling reach, probably resulting from sand inputs from an upstream road crossing and storm drain, are the primary forms of impairment

to instream habitat at this station (Appendix B; Table B9). Despite the slight degradation of these habitat parameters, the high overall habitat evaluation relative to both reference stations infers that water quality is more limiting to biological potential than habitat effects at TM14. Attleboro's WPCF also discharges to this segment and may be responsible for water quality degradation and the resulting effects on the benthic macroinvertebrate community at TM14. Discharge effects, or other sources of organic enrichment associated with the urban nature of this reach (i.e., urban runoff), is reflected in the preponderance of filter-feeding caddisflies in the macroinvertebrate assemblage and the dense filamentous algal cover throughout the sampling reach (Appendix B; Table B11). In addition, the impounded nature of the river between the Attleboro WPCF and TM14 probably contributes high levels of FPOM to this portion of the river. Considerable turbidity was observed at this station as well.

• Water Quality - Although the data set was too limited to assess either the primary or secondary contact recreational uses, the fecal coliform densities did not exceed 400 cfu/100 ml. at any of the stations (TM07, TM08A, TM11, TM12, TM13, TM14) sampled within this segment of the Ten Mile River (Appendix B, Table B3). Instream DO and % saturation was slightly below Class B standards during the early morning sampling runs at stations TM07 and TM08A on each sampling date. Diurnal changes were much greater, however, at TM07 (Δ4.4 mg/L) than at TM08A (Δ1.2 mg/L) on 1 July 1997 (Appendix B, Table B2). Measurements of DO in the Ten Mile River downstream of Dodgeville Pond (stations TM11 and TM12) met Class B Standards (Table 3), then dropped below standards near Pond Street bridge in Seekonk (TM13) where large diurnal fluctuations (Δ2.0 to 3.7 mg/L DO) were present (Appendix B, Table B2). Large diunal fluctuations (Δ2.9 to 3.8 mg/L DO) were also documented in the Ten Mile River near Central Ave in Pawtucket, RI (station TM14), however DO remained above 5.0 mg/L and 60% saturation. Temperature and pH met Class B Standards for a warmwater fishery at all stations. While the aesthetic quality of the impoundments in this segment of the Ten Mile River are compromised by symptoms of enrichment (Farmers, Mechanics, Dodgeville and Hebronville ponds), the aesthetics of the free flowing river reaches are generally good. Overall, the aesthetics use is assessed as partial support for this segment.

• North Attleborough WWTP

1. Effluent toxicity testing: Between December 1992 and March 1998, whole effluent toxicity was detected sporadically (both acute and chronic) in the North Attleborough WWTP effluent (Dallaire 2000). The effluent was acutely toxic (LC_{50}= 94%) to *Ceriodaphnia dubia* on two occasions and was chronically toxic (CNOEC = 25 and 50% effluent) in three of the 15 test events. The effluent was also chronically toxic (CNOEC = 50%) to *Pimephales promelas* on one occasion. *C. dubia* has been the more sensitive test organism.

2. Effluent quality: The North Attleborough WWTP routinely reported violations of their NPDES permit limits between 1995 and 1996. According to the DEP Southeast Regional Office (SERO) the facility has generally been in compliance with their NPDES permit limits in the last three years (Burns 2000). Various reports required through an EPA administrative order (i.e., I/I report, industrial local limit report, etc.) have been submitted to DEP and are currently under review. The Administrative Order was terminated on the effective date of the new permit (Couto 2000). Improvements in sludge handling and disposal (now contracted to a company for removal vs. being landfilled on site with limited capacity in past years) has resulted in improving compliance with the NPDES permit limits (Horton 2000). The facility also implemented dechlorination in the summer of 1993.

• Attleboro WPCF

1. Effluent toxicity testing: Between March 1997 and December 1998 whole effluent toxicity from the Attleboro WPCF was detected sporadically (both acute and/or chronic toxicity to *C. dubia*) (Dallaire 2000). The no observed acute effect level (NOAEL) of the whole exceeded the permit limit of 90% effluent in one of the six test events (NOAEL= 50%) and the chronic no observed effect concentration (CNOEC) limit of 90% effluent in two of six test events (CNOEC = 25 and 50% effluent).

2. Effluent quality: According to the DEP SERO, the facility has been doing well for the last couple of years with very little problems (Burns 2000). The only recent enforcement action was related to the closure of their existing sludge landfill cell and the startup of new cell.

• Sediment quality - Survival of *C. tentans* (78%) exposed to sediment from behind the Mechanics Pond Dam (MECH01) was not significantly reduced compared to survival (94%) in the control sediment (Hellyer 1999a). Survival of *C. tentans* (50%) exposed to sediment from Dodgeville Pond (DODG01), however was significantly lower than that of the control. Survival of *C. tentans* exposed to the sediment from behind the Hebronville Dam (HEBR01) was not significantly lower than the control. Due to problems meeting laboratory control criteria, the results of the *H. azteca* toxicity tests were not used in the assessment. The SEM/AVS ratio was less than 1 (0.24) for the sediment from Mechanics Pond. The ratio was above 1 (2.4) in samples from both Dodgeville Pond and Hebronville Dam. SEM/AVS ratios can be used to predict metal toxicity where no significant mortality occurs with a SEM/AVS ratio is < 1 and significant mortality occurs where a SEM/AVS ratio is > 1 (EPA 1991). Significant sediment toxicity (expressed as mortality) was only detected from sediment collected in Dodgeville Pond. The concentration of Cd, Cr, Cu, Pb, Hg, and Ni exceeded the S-EL guidance in the sediments at all three locations (Persaud *et al.* 1993). The concentration of Zn and TOC exceeded L-EL guidance in the sediment from Mechanics Pond and S-EL guidance in the sediment from both Dodgeville Pond and the Hebronville Dam. Concentrations of total DDT and PCB exceeded the L-EL guidance at all three locations.

SUMMARY

Designated Uses		Status
Aquatic Life		NON SUPPORT. The upper 4.1 miles do not support the aquatic life use based on the macroinvertebrate analysis, fish community sampling data and the sediment quality data. PARTIAL SUPPORT. The lower 4.5 miles of the segment partially support the aquatic life (some improvements over the upper reach of the segment). Causes of impairment include toxicity, organic enrichment/low DO and heavy metal contamination. Sources include the North Attleborough WWTP discharge and sediment contamination. Other causes and sources are unknown.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		PARTIAL SUPPORT. This use is assessed as partial support for the entire 8.6 miles of this segment based on the excessive growth of aquatic vegetation particularly in the impoundments.

RECOMMENDATIONS - Ten Mile River (Segment MA 52-03)

- Additional monitoring (particularly fecal coliform bacteria sampling) is necessary to evaluate the status of both the primary and secondary contact recreational uses.
- Nonpoint source pollution (sediment inputs, grass clippings and other yard waste) effects are exacerbated by the limited (or lack of) riparian zone, particularly in the reach adjacent to Freeman Street. Outreach to abutting landowners as to the need to establish/implement a riparian buffer zone is recommended
- Instream sediment deposition compromises habitat quality in the vicinity of the North Attleborough WWTP. Sources of sediment inputs (road runoff - in particular Cedar and Freeman streets) should be investigated and remediated in order to minimize future impacts.

RECOMMENDATIONS (CONTINUED)- Ten Mile River (Segment MA 52-03)

- An upstream/downstream evaluation of the North Attleborough WWTP discharge revealed impacts to the benthic macroinvertebrate community. While fish populations upstream of the discharge were considered impacted, the reach sampled downstream of the discharge was *devoid* of fish at the time of sampling. Whole effluent toxicity testing results indicate sporadic acute and chronic toxicity to *C. dubia*. The North Attleborough WWTP should be required to continue toxicity testing using *C. dubia* as well as initiate a toxicity identification and reduction evaluation (TIE/TRE).

- More intensive (diurnal) dissolved oxygen monitoring in the upper 4.3 miles of this segment is needed to delineate spatial extent of Class B water quality standards violations. Additional DO monitoring in the river downstream of Hebronville Pond is also recommended.

- Minimize erosion along the streambank immediately downstream from Tiffany Street (along the cemetery property). Improvements to the riparian zone (i.e., restoration of vegetative buffer) in the vicinity of the cemetery are recommended as well.

- Investigate compliance with storm water performance standards for the large sand/gravel mining operation immediately upstream of Tiffany Street. Sediment inputs from the facility to the Ten Mile River should also be investigated.

- To isolate potential impacts of the Attleboro WPCF discharge biomonitoring stations should be established immediately upstream and downstream of the discharge. Use of artificial substrates for macroinvertebrate sampling may be required due to habitat constraints.

- Road runoff originating from Central Ave. or adjacent parking lots may contribute to the sediment deposition observed throughout the sampling reach in the Ten Mile River as it leaves the state of Massachusetts (TM14 sampling reach). Site investigations are recommended to determine specific sources of sediment inputs and to determine if BMPs are needed.

- Measures to minimize nonpoint source nutrient inputs are critical to prevent further degradation and to reduce enriched conditions within the impounded sections of this segment.

- Additional sediment sampling will be required prior to any decisions for restoration of impoundments via dredging.

- Conduct 5-year review of the WMA permit conditions for the Mantrose-Haeuser Co., Inc. Permit requires 89% return of water to the Ten Mile River which may not being met. If necessary, the facility should meter the NCCW discharges.

- Once the new general NCCW permit is available, the NPDES permits MAG250958 for Mantrose-Haeuser Co., Inc. needs to be reissued.

- The NCCW discharges to this segment of the Ten Mile River should be screened for acute toxicity. These tests should be required of the facilities as part of their NCCW permit reissuance.

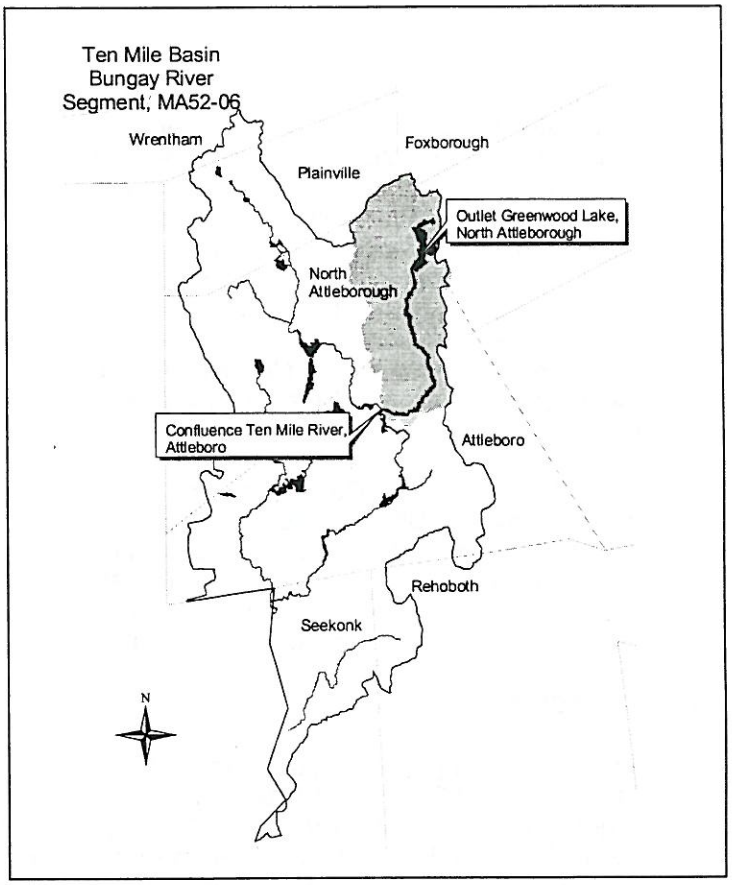
BUNGAY RIVER (SEGMENT MA 52- 06)

Location: Outlet of Greenwood Lake, North Attleborough to confluence with Ten Mile River, Attleboro.
Segment length: 4.0 miles. Classification: Class B, Warm Water Fishery.

SEGMENT DESCRIPTION

The Bungay River originates as the outlet from Greenwood Lake and flows south through an extensive wetland before joining the Ten Mile River in a highly developed portion of the Town of Attleboro.

Surface water features in the upper watershed of the Bungay River includes Witch Pond, Witch Pond Swamp and Greenwood Lake. These waterbodies are physically located in a combination of Foxborough, Mansfield and North Attleborough.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	38%
Residential	33%
Open Land	9%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	72%
Wetlands	11%
Open Land	7%

WITHDRAWALS AND DISCHARGES

WMA:

1. The Mansfield Water Department is registered (42716701) to withdraw 0.59 MGD of water from four wells located in the upper Bungay River watershed. DEP has approved a Wellhead Protection Area (Zone II) for these wells which indicates that groundwater underlying part of the Wading River watershed in the Taunton River Basin is also part of the contributing area. Furthermore, the Department of Fisheries, Wildlife and Environmental Law Enforcement (DFWELE) Natural Heritage and Endangered Species Program (NHESP) 1997-1998 has designated that a portion of this upper watershed that exists in the Zone II for the Mansfield Water Department contains Estimated Habitat of Rare Wildlife (EOEA 1999). The Mansfield Water Department is also seeking approval for an additional well in this area.

2. The Foxboro Water Department (9P242709901) is in the process of seeking approval for two new wells in the Witch Pond Swamp area (the approved capacity of these two sources is 1.15 MGD).

3. Boro Sand & Stone in North Attleborough is registered (42721102) to withdraw 0.04 MGD of water from one source.

4. The United States Fish and Wildlife Service's North Attleborough National Fish Hatchery is registered (42721101) to withdraw 1.71 MGD of water (system-wide total) from their four sources: the Bungay River and three wells (#2,#3, and #4).

5. The North Attleborough Water Department is registered (42721103) to withdraw from two wells along this segment of the Bungay River near the Angle Tree Stone Rod and Gun Club in North Attleborough. The North Attleborough Water Department is registered to withdraw a system wide total (from seven wells) of 2.1 MGD.

NPDES:

1. MA0005398 – The North Attleborough National Fish Hatchery discharges fish pond and raceway wastewater to the Bungay Mile River (there is no flow limit in the permit that was issued in 1979). Personnel from the hatchery have reported that there is no consistent discharge out of Greenwood Lake thus the effluent may at times dominate the flow in the Bungay River. The hatchery has a number of options regarding the location of their discharge. Field investigations indicated that one discharge pipe currently drains directly into the Bungay River (Maietta 1998). There also are a number of old fish rearing ponds not being used for fish production into which effluent from the hatchery could be diverted. On the day of the site visit such a diversion was taking place. The impression from the site visit was that the effluent in the ponds was essentially draining into the ground. No direct discharge was observed to the Bungay River from the ponds. Modifications of treatment procedures relating to biocide applications are also possible which may decrease concentrations of biocides in the hatchery discharge. Until the NPDES permit is reissued, it is unclear which options will be pursued by the USFWS.

2. MA0003701 - Fortifiber Corporation was issued their permit in 1975. A draft permit was being developed by EPA/DEP in 1986. The draft permit indicates the facility discharges steam condensate, boiler blow down, cooling tower blowdown, and non-contact cooling water into the Bungay River. This facility appears as a minor discharge on the GIS point coverage. Although the facility was once supplied by both city water and a well, the well has not been used for many years and the company currently relies solely on city water (Miller 2000).

USE ASSESSMENT

Water quality sampling (July, August, and September 1997) was conducted by DWM in the Bungay River downstream of West St., North Attleborough (upstream of the North Attleborough National Fish Hatchery discharge) and upstream of Holden St., Attleboro (stations BG01 and BG02, respectively) (Appendix B, Table B1). This effort included fecal coliform sampling and *in-situ* measurements of dissolved oxygen and other variables using a Hydrolab®. On one occasion (September 1997), *in-situ* measurements of the North Attleborough National Fish Hatchery discharge were taken with the Hydrolab® (station MA0005398).

- Water Quality - Although the data set was too limited to assess either the primary or secondary contact recreational uses, the fecal coliform sampling results did not exceed 260 cfu/100 ml. (Appendix B, Table B3). Levels of dissolved oxygen and percent saturation were slightly below Class B Standards (Table 3) in the Bungay River near West St., North Attleborough (station BG01) during the early morning sampling run on each date surveyed (Appendix B, Table B2). Instream dissolved oxygen concentrations in the Bungay River near Holden St, Attleboro (station BG02) met standards but extreme diurnal changes (Δ6.1 mg/L on 10 July) and saturation levels (as high as 137%) indicate nutrient enrichment. It should be noted, however, that historical data from the Bungay River documented extremely low oxygen levels during surveys conducted in June, July and August 1984 where instream DO rarely exceeded 1.0 mg/L (MA DEQE 1985). With the exception of one slightly low pH measurement, water quality standards were met for pH and temperature. The aesthetic quality of the Bungay River was excellent except for the last 0.3 miles. Instream turbidity and objectionable deposits of excrement impaired the aesthetic use in the lower 0.3 mile reach of the Bungay River resulting from the large number of waterfowl staging within a small impoundment.

SUMMARY

Designated Uses		Status
Aquatic Life		NOT ASSESSED.
Fish Consumption		NOT ASSESSED.
Primary Contact		NOT ASSESSED.
Secondary Contact		NOT ASSESSED.
Aesthetics		SUPPORT. The aesthetic quality of the upper 3.7 miles of this river is considered excellent. NON SUPPORT. The lower 0.3 miles do not support the aesthetic use as a result of the large waterfowl population in a small impounded area.

RECOMMENDATIONS - Bungay River (Segment MA 52- 06)

- Proposals by the towns of Mansfield and Foxborough have been received by DEP for one and two new wells, respectively in the upper Bungay River Watershed (Witch Pond Swamp area). Careful consideration must be given to both identify and assess the water uses/needs for flow since the withdrawals transport water out of the Ten Mile River Basin, Bungay River subwatershed.

- Conduct 5-year review of the WMA registrations for the following: North Attleborough Water Department, Boro Sand & Stone in North Attleborough and the United States Fish and Wildlife Service's North Attleborough National Fish Hatchery. Minimize water withdrawals via conservation measures.

- EPA/DEP need to reissue the Fortifiber Corporation NPDES permit. Particular attention should be given to heat, metals and other contaminants as well as toxicity. Hours of operation/discharge should also be considered in the development of the permit limits.

- The effects, if any, of the North Attleborough National Fish Hatchery water withdrawals and wastewater discharge practices on the Bungay River warrant further investigation. At a minimum, the NPDES permit needs to be reissued with appropriate permit limits for conventional and toxic pollutants. Specific recommendations were made in a memorandum for the record written in response to a request from the U.S. Fish and Wildlife Service requesting clearance for the use and discharge of formalin at their North Attleborough National Fish Hatchery (Szal 1993). Formalin is one of the most commonly used antifungal agents for the therapeutic treatment of fish eggs in hatcheries. Szal's recommendations include the following:

    1. The North Attleborough National Fish Hatchery should be investigated by EPA and DEP personnel and issued an NPDES permit. As the facility discharges in excess of 1.0 MGD and releases toxicants, it should be given a "major" status.

    2. Formalin levels in the effluent should not exceed 2 mg/L for a 15-min, release; formalin concentrations for longer duration releases should not exceed 1 mg/L.

    3. The hatchery should provide the Department with a list of the toxicants used, their application rates and copies of the Freedom of Information Summaries for each toxicant.

RECOMMENDATIONS (CONTINUED) - Bungay River (Segment MA 52- 06)

- Conduct a shoreline survey/field reconnaissance along the Bungay River. Identify any point or nonpoint source discharges that may be affecting instream water quality in the river. An intensive instream survey of dissolved oxygen (increased spatial and temporal coverage) is necessary to evaluate the effects of the NPDES discharges or other potential sources (bracketing any identified in the shoreline survey) of nutrient enrichment to the Bungay River. The need for nutrient sampling, fish population and/or benthic macroinvertebrate sampling should also be considered in a future sampling plan for the Bungay River.

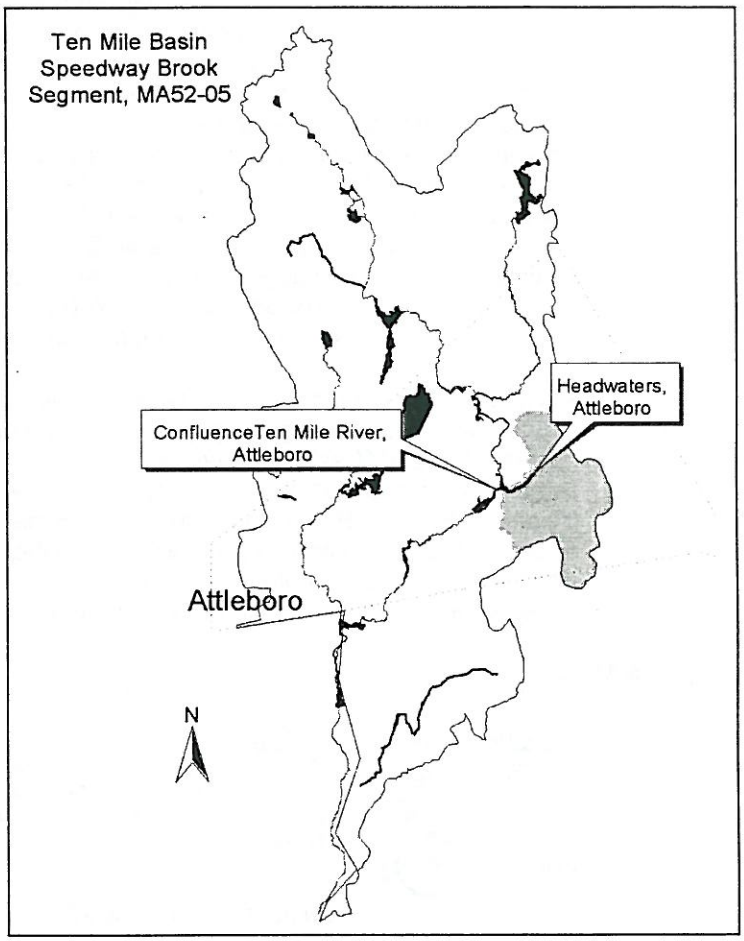
- Education regarding the detrimental effects (nutrient enrichment, bacterial contamination) of feeding wild and domestic waterfowl should be employed in an attempt to reduce the numbers of waterfowl staging in the small impoundment of the Bungay River downstream of Route 152 in Attleboro.

SPEEDWAY BROOK (SEGMENT MA52- 05)

Location: Headwaters, Attleboro to confluence with Ten Mile River, Attleboro.
Segment length: 0.9 miles. Classification: Class B, Warm Water Fishery.

SEGMENT DESCRIPTION

Speedway Brook (locally known as Thatcher Brook) originates from underground at Maple Street in Attleboro and flows southwest to its confluence with the Ten Mile River in Attleboro. The watershed is heavily developed with residences.



Land-use estimates for the subwatershed (map inset, gray shaded area):

Forest	52%
Residential	25%
Open Land	11%

Land-use estimates in the 100' riparian zone from the streambanks:

Forest	66%
Residential	24%
Wetlands	7%

WITHDRAWALS AND DISCHARGES

WMA:

1. Texas Instruments is permitted (9P42701601) to withdraw a total of 0.23 MGD of water from two wells.

NPDES:

1. MA0023426 - Bristol Nursing Home is authorized to discharge 0.005 MGD of treated domestic sanitary wastewater to an unnamed tributary of Speedway Brook. Permit was issued in September 1994. Permit reapplication was submitted in September 1999.

2. MA0001791 Texas Instruments, Inc. (TI) – A new permit is being developed by EPA/DEP for this facility (2000). Currently, two outfalls from TI discharge to the upper watershed of Speedway (Thatcher) Brook. Outfall #001 discharges stormwater runnoff. Outfall #002 stormwater runnoff up to 0.25 MGD of treated (air stripped) groundwater from the TI site to remove volatile organics (trichloroethylene, chloroform, and 1,2, transdichloroethylene). (The company can monitor the treated groundwater quality at sampling location outfall 002A.) (It should also be mentioned that TI also has outfalls that discharge into the Taunton River Basin not discussed in this report.)

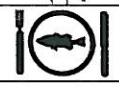
USE ASSESSMENT

Water quality sampling (July, August, and September 1997) was conducted by DWM at one location upstream of Rte. 152 in Attleboro in Speedway Brook (station SW01) (Appendix B, Table B1). This effort included fecal coliform sampling and *in-situ* measurements of dissolved oxygen and other variables using a Hydrolab®. Benthic macroinvertebrate sampling, qualitative periphyton sampling, and habitat assessments were also conducted by DWM biologists downstream from Dexter St., Attleboro (station SW01M) in September 1997.

• Bioassessment/Habitat – The SW01M benthic macroinvertebrate assemblage received total metric scores of 14 and 20 (as compared to 40 and 42 at the regional reference sites SM00 and TM0, respectively), indicating moderate impairment to the aquatic community (Appendix B, Tables B6 and B7). A community dominated (57%) by hydropsychid caddisflies, reduced species richness, an absence of scrapers, and a generally dissimilar community compared to SM00 and TM01 contributed most to the impairment designation (Appendix B; Table B6 and B7). The low scoring (score=0) scraper/filterer metric and percent dominant taxon metric are particularly indicative of trophic composition skewed toward a FPOM-based feeding guild, indicative of effects from organic enrichment. Heavy deposits of fine organic materials on most instream substrates further corroborate the effects of enrichment in this stream reach. Other degraded habitat parameters included limited riffle habitat, severe sediment deposition, channelization, and a very narrow riparian zone along one bank (Appendix B, Table B9. The filamentous green alga *Spirogyra* sp. was also very abundant, further suggesting that organic/nutrient loadings shape biological community structure in this portion of Speedway Brook (Appendix B, Table B11). Based on these data the aquatic life use is assessed as non-support, the result of both water quality and habitat degradation.

• Water Quality – Although the data set was very limited, the fecal coliform densities were elevated in Speedway Brook during dry weather sampling conditions in July 1997 (Appendix B, Table B3). Instream DO and % saturation was slightly below Class B standards during the early morning sampling runs at SW01 on each sampling date, although diurnal changes were not evident (Appendix B, Table B2). Temperature and pH met Class B Standards for a warmwater fishery. Based on these data and coupled with the aesthetic degradation observed (e.g., heavy deposits of sand, silt, and organic material, moderate levels of turbidity), the primary and secondary contact recreational uses and the aesthetics use are assessed as non-support.

SUMMARY

Designated Uses		Status
Aquatic Life		NON SUPPORT. The entire 0.9 miles of this segment do not support this use based on the moderately impaired benthic macroinvertebrate community. Causes of impairment include organic enrichment/low DO, habitat alteration, and siltation.
Fish Consumption		NOT ASSESSED.
Primary Contact		NON SUPPORT. The entire 0.9 miles do not support this use because of elevated levels of fecal coliform bacteria.
Secondary Contact		NON SUPPORT. The entire 0.9 miles do not support this use because of aesthetic degradation.
Aesthetics		NON SUPPORT. The entire 0.9 miles do not support this use because of moderate turbidity, sediment deposition, and channelization.

RECOMMENDATIONS - Speedway Brook (Segment MA52- 05)

- There appears to be a continuing source of fecal coliform bacteria to this segment. Although obvious improvements have been made over the last 15 years (MA DEQE 1985), as evidenced by the visual appearance of the brook as well as water quality data, additional work is needed to document the source of bacterial contamination.

- Best management practices (minimize sedimentation, education, protection/restoration of riparian zone) to minimize nonpoint source pollution should be employed in an effort to improve habitat quality in Speedway Brook.