

REPORT

Freshwater Mussels of the Eightmile River Wild & Scenic Watershed

prepared for

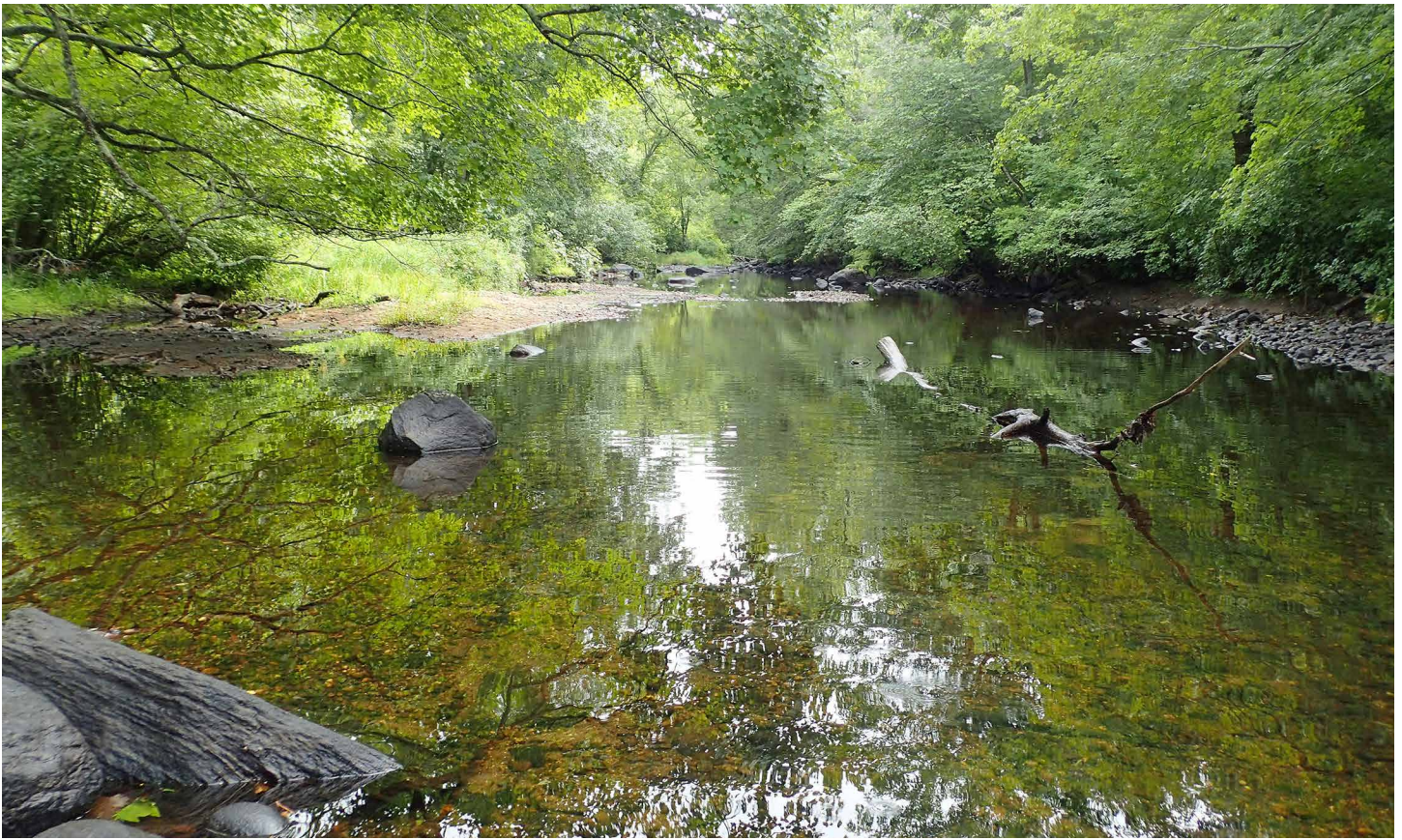
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Eightmile River in Lyme, Connecticut.

INTRODUCTION

Together, the Eightmile River and East Branch Eightmile River support nearly all of the 12 native mussel species known to occur in Connecticut (Table 1; Nedeau 2008). Only three tributaries in the entire Connecticut River watershed support higher mussel diversity. The Eightmile River is among very few rivers in Connecticut inhabited by the state-endangered brook floater (*Alasmidonta varicosa*), which is one of the most endangered aquatic animals in Connecticut. Other state-listed and uncommon mussel species have also been observed in the Eightmile River watershed, including eastern pondmussel (*Sagittunio nasutus*), eastern pearlshell (*Margaritifera margaritifera*), alewife floater (*Utterbackiana implicata*), and creeper (*Strophitus undulatus*). The tidewater mucket (*Atlanticoncha ochracea*) also occurs in Hamburg Cove. This exceptional diversity is attributed to the broad range of habitats in the watershed, from tidal waters near the Connecticut River to high-quality headwater streams, and the diverse fish assemblages in these areas.

Prior to 2022, live brook floater had not been observed in the Eightmile River since 2008 (Biodiversity 2008). During that survey, Ethan Nedeau observed eight brook

floaters: two were at the downstream end of the large deep pool at the town park and the other six were found between Macintosh Road and the town park. This was the first time brook floater had been observed in the Eightmile River since 1995, when a single live animal was found. The 2008 report described the brook floater population in the Eightmile River as “highly insular and existing at low densities, and also occurring in an area of the river that is targeted by fishermen. Mortality from trampling is a concern.” Brook floater had never been found in the East Branch or other tributaries in the Eightmile River watershed.

There had been very few mussel surveys in the Eightmile River or its tributaries in the 15 years prior to 2022. Over the years, the presence of state-listed mussels in the Eightmile River had provided an opportunity for the Connecticut Department of Energy and Environmental Protection (CTDEEP) to carefully review proposed projects in the river, along its banks, and in its tributaries. Scant surveys were not comprehensive but were instead highly targeted and in response to proposed infrastructure or development projects or dam removals. These site-specific surveys provided very little insight on the status of mussel populations in the whole river. Therefore, there was a need to reassess the mussel community and habitat, pro-

Table 1. Freshwater mussels in the Eightmile River watershed in Connecticut.

Common Name	Latin Name	Abbreviation	State Status	Notes
Triangle Floater	<i>Alasmidonta undulata</i>	AlUn		
Brook Floater	<i>Alasmidonta varicosa</i>	AlVa	Endangered	
Alewife Floater	<i>Utterbackiana implicata</i>	Utlm	Special Concern	Recent genus name change from <i>Anodonta</i> ; proposed Special Concern in 2020
Eastern Elliptio	<i>Elliptio complanata</i>	ElCo		
Eastern Lampmussel	<i>Lampsilis radiata</i>	LaRa		
Tidewater Mucket	<i>Atlanticoncha ochracea</i>	AtOc	Special Concern	Recent proposed genus name change from <i>Leptodea</i>
Eastern Pondmussel	<i>Sagittunio nasutus</i>	SaNa	Special Concern	Recent name change from <i>Ligumia nasuta</i>
Eastern Pearlshell	<i>Margaritifera margaritifera</i>	MaMa	Special Concern	
Eastern Floater	<i>Pyganodon cataracta</i>	PyCa		
Creeper	<i>Strophitus undulatus</i>	StUn	Threatened	Proposed Threatened in 2020

vide updated mapping of species and habitats, and identify threats and conservation opportunities. An updated comprehensive survey would allow for comparisons and coarse-level trend analyses, which are important for understanding the viability of the Eightmile River's mussel community, especially the endangered brook floater.

STUDY AREA AND SURVEY SITES

The mussel survey focused on 25.3 stream miles within the *Eightmile River Wild & Scenic Watershed* (Figures 1-3, Table 2) with 41 survey sites allocated among the designated segments: Eightmile River, East Branch Eightmile River, Falls Brook, Beaver Brook, and Harris Brook. Survey sites were selected based on historic data (especially where brook floater or other state-listed species were found in the past), habitat quality, potential for rare species, and access. We attempted to access remote areas of target reaches to find the best and least disturbed habitats. A primary constraint was land ownership and permission, and a secondary constraint was being able to reach remote areas efficiently without using an inordinate amount of our allotted time and budget.

- **Eightmile River (ER):** The *Wild & Scenic* portion includes a 10.8-mile segment, starting at the confluence with Lake Hayward Brook to the confluence with the Connecticut River at the mouth of Hamburg Cove (Figure 1). 24 sites were surveyed from Joshuatown Road to Devils Hopyard State Park (Figures 2 and 3, Table 2). Hamburg Cove was omitted.
- **East Branch (EB):** The *Wild & Scenic* portion includes an 8.0-mile segment of the East Branch starting at Witch Meadow Road to the confluence with the Eightmile River (Figure 1). 13 sites were surveyed (Figure 3, Table 2), but the upper three sites were dry or mostly dry and surveys were very brief.
- **Harris Brook (HB):** The *Wild & Scenic* portion includes a 3.9-mile segment starting with the confluence of an

unnamed stream lying 0.74 miles due east of the intersection of Hartford Road (CT Route 85) and Round Hill Road to the confluence with the East Branch (Figure 1). It was difficult to access most of this reach, and two sites were surveyed (Figure 3, Table 2).

- **Beaver Brook (BB):** The *Wild & Scenic* portion includes a 1.9-mile segment starting at the confluence of Cedar Pond Brook to the confluence with the Eightmile River (Figure 1). It was difficult to access most of this reach, and one site was surveyed (Figure 2, Table 2).
- **Falls Brook (FB):** The *Wild & Scenic* portion includes a 0.7-mile segment from the confluence of Tisdale Brook to the confluence with the Eightmile River at Hamburg Cove (Figure 1). One site near the lower end of that reach was surveyed by kayaking upstream from Hamburg Cove (Figure 2, Table 2).

SURVEY METHODS

Biologists conduct timed qualitative surveys by snorkeling. Survey duration ranged from 0.5 to 3.5 hours, but with less time at three of the sites in the East Branch that



Snorkeling in the Eightmile River.

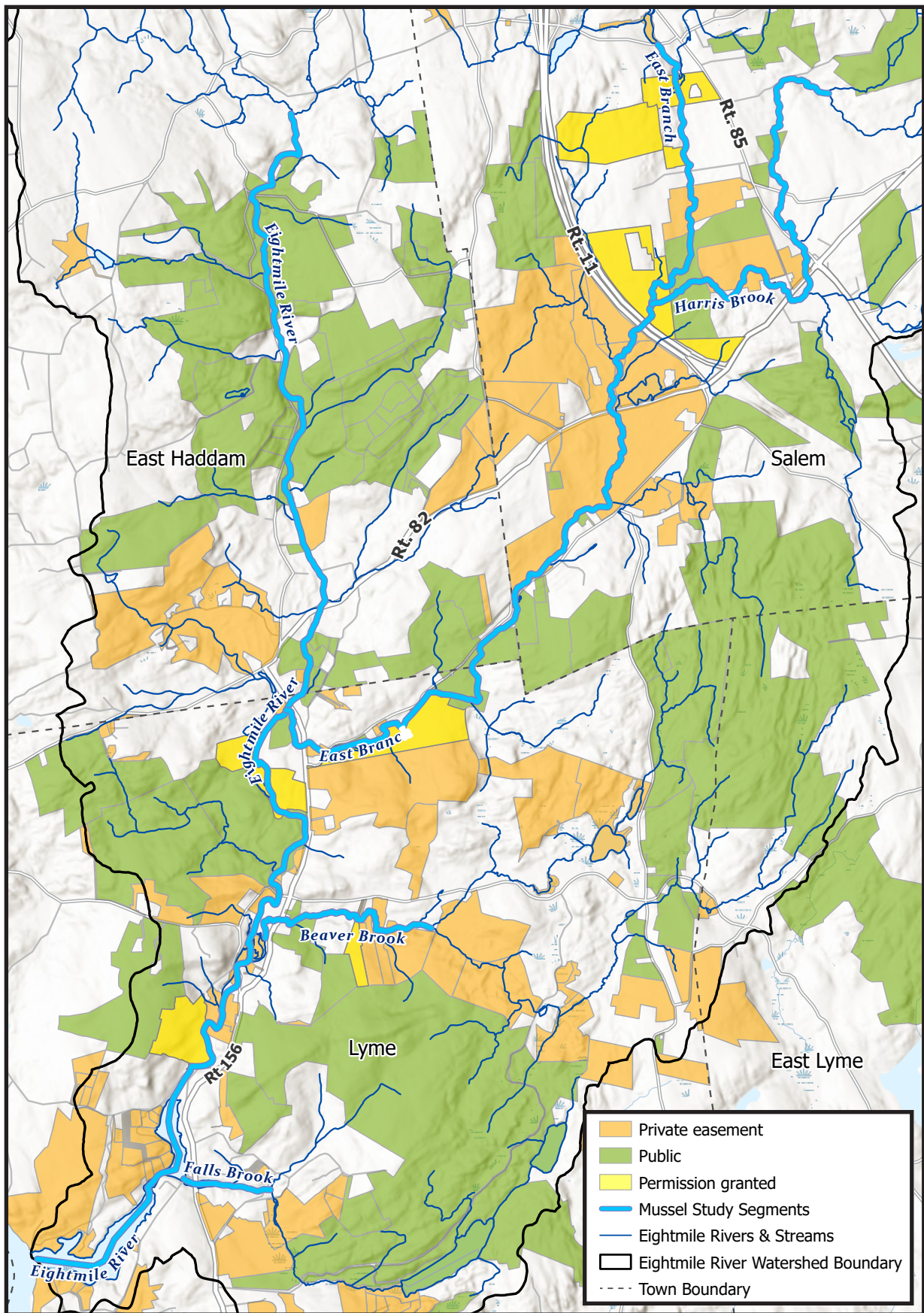


Figure 1. Freshwater mussel study area in the Eightmile River Wild & Scenic Watershed, highlighting targeted river segments in the Eightmile River, East Branch Eightmile River, Falls Brook, Beaver Brook, and Harris Brook.

Table 2. Freshwater mussel survey sites in the Eightmile River Wild & Scenic Watershed, including the Eightmile River (ER), East Branch Eightmile River (EB), Falls Brook (FB), Beaver Brook (BB), and Harris Brook (HB). See Figures 2 and 3 for mapped locations.

Site	Waterbody	Town	Date	Downstream		Upstream		Survey
				Latitude	Longitude	Latitude	Longitude	Duration (hr)
ER-1	Eightmile River	Lyme	8/19/22	41.39458	-72.35012	41.39562	-72.34796	1.5
ER-2	Eightmile River	Lyme	8/31/22	41.39872	-72.34711	41.40098	-72.34636	2.0
ER-3	Eightmile River	Lyme	8/17/22	41.41051	-72.34116	41.41173	-72.33954	1.5
ER-4	Eightmile River	Lyme	8/17/22	41.41139	-72.33891	41.41263	-72.33856	2.2
ER-5	Eightmile River	Lyme	8/16/22	41.41323	-72.33890	41.41384	-72.33964	2.7
ER-6	Eightmile River	Lyme	8/16/22	41.41425	-72.33927	41.41473	-72.33836	3.2
ER-7	Eightmile River	Lyme	8/16/22	41.41537	-72.33792	41.41697	-72.33707	3.5
ER-8	Eightmile River	Lyme	8/17/22	41.41693	-72.33699	41.41741	-72.33597	1.0
ER-9	Eightmile River	Lyme	8/17/22	41.41780	-72.33517	41.41807	-72.33491	1.0
ER-10	Eightmile River	Lyme	8/17/22	41.41993	-72.33496	41.42045	-72.33651	1.5
ER-11	Eightmile River	Lyme	8/17/22	41.42075	-72.33767	41.42222	-72.33925	1.8
ER-12	Eightmile River	Lyme	8/31/22	41.42468	-72.34003	41.42545	-72.34011	1.0
ER-13	Eightmile River	Lyme	8/31/22	41.42572	-72.34129	41.42676	-72.34160	1.5
ER-14	Eightmile River	Lyme	8/18/22	41.42957	-72.33943	41.43046	-72.33853	2.2
ER-15	Eightmile River	Lyme	8/18/22	41.43149	-72.33723	41.43224	-72.33655	2.0
ER-16	Eightmile River	East Haddam	8/18/22	41.43450	-72.33454	41.43568	-72.33409	3.1
ER-17	Eightmile River	East Haddam	8/18/22	41.44140	-72.33268	41.44196	-72.33230	1.2
ER-18	Eightmile River	East Haddam	8/18/22	41.44276	-72.33201	41.44401	-72.33199	2.0
ER-19	Eightmile River	East Haddam	8/19/22	41.45160	-72.33630	41.45238	-72.33655	1.5
ER-20	Eightmile River	East Haddam	8/19/22	41.45756	-72.33702	41.45899	-72.33605	1.7
ER-21	Eightmile River	East Haddam	8/19/22	41.46317	-72.33660	41.46357	-72.33725	1.3
ER-22	Eightmile River	East Haddam	8/19/22	41.46673	-72.33746	41.46729	-72.33712	1.0
ER-23	Eightmile River	East Haddam	8/19/22	41.47208	-72.33871	41.47274	-72.33909	1.6
ER-24	Eightmile River	East Haddam	8/19/22	41.48499	-72.33896	-	-	0.5
EB-1	East Branch Eightmile	Lyme	8/18/22	41.43129	-72.33713	41.42923	-72.33657	1.0
EB-2	East Branch Eightmile	Lyme	8/17/22	41.42780	-72.32768	41.42787	-72.32594	1.0
EB-3	East Branch Eightmile	Lyme	8/18/22	41.43270	-72.31821	41.43295	-72.31716	2.0
EB-4	East Branch Eightmile	Lyme	8/18/22	41.43273	-72.31585	41.43275	-72.31473	2.5
EB-5	East Branch Eightmile	East Haddam	8/17/22	41.43659	-72.31105	41.44190	-72.30621	1.5
EB-6	East Branch Eightmile	Salem	8/17/22	41.44228	-72.30623	41.44384	-72.30534	1.0
EB-7	East Branch Eightmile	Salem	8/17/22	41.45074	-72.29790	41.45116	-72.29788	1.0
EB-8	East Branch Eightmile	Salem	8/17/22	41.46176	-72.29297	-	-	0.2
EB-9	East Branch Eightmile	Salem	8/17/22	41.47077	-72.28820	41.47158	-72.28735	1.0
EB-10	East Branch Eightmile	Salem	8/17/22	41.47438	-72.28707	-	-	0.5
EB-11	East Branch Eightmile	Salem	8/17/22	41.47723	-72.28225	-	-	0.2
EB-12	East Branch Eightmile	Salem	8/18/22	41.48618	-72.28244	-	-	0.2
EB-13	East Branch Eightmile	Salem	8/18/22	41.49921	-72.28631	-	-	0.2
HB-1	Harris Brook	Salem	8/17/22	41.47282	-72.28576	41.47330	-72.28454	0.8
HB-2	Harris Brook	Salem	8/18/22	41.48797	-72.27029	-	-	0.8
BB-1	Beaver Brook	Lyme	8/19/22	41.40968	-72.32751	-	-	0.8
FB-1	Falls Brook	Lyme	8/19/22	41.38245	-72.34615	41.38220	-72.34224	1.0

were mostly dry at the time of the survey. Survey time varied depending on mussel densities and habitat suitability. Biologists recorded precise counts of uncommon mussel species and the relative abundance of species that were too numerous to efficiently count. Biologists planned to record the shell length, shell condition, location (using GPS), habitat (depth, substrate) of all or a subset of state-listed mussels. This proved to be too time consuming for the state-listed eastern pearlshell because it was so abundant where it was found, so biologists instead recorded

shell length and condition for a small subsample of the eastern pearlshell that were found. Representative mussels were photographed. Habitat was characterized (Table 3) and photographed (Appendix 1) at each site.

SURVEY DATES AND CONDITIONS

The surveys were conducted from August 16-19 and August 31, 2022. Weather was sunny, warm, and dry on all five days. Flows were very low after an exceptionally

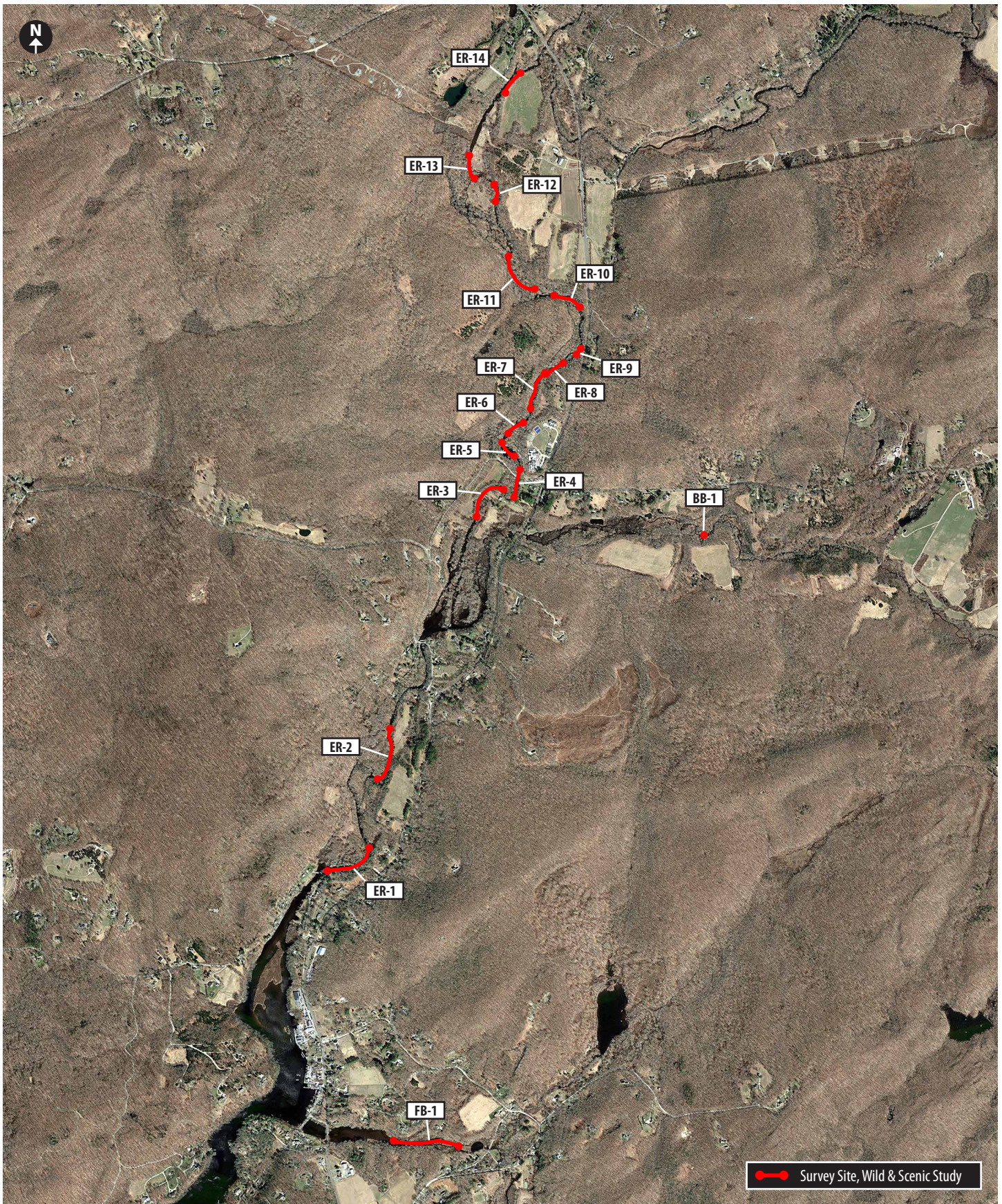


Figure 2. Freshwater mussel survey sites in the Eightmile River (Sites ER-1 to ER-14), Falls Brook (FB-1) and Beaver Brook (BB-1). See Table 2 for location data.

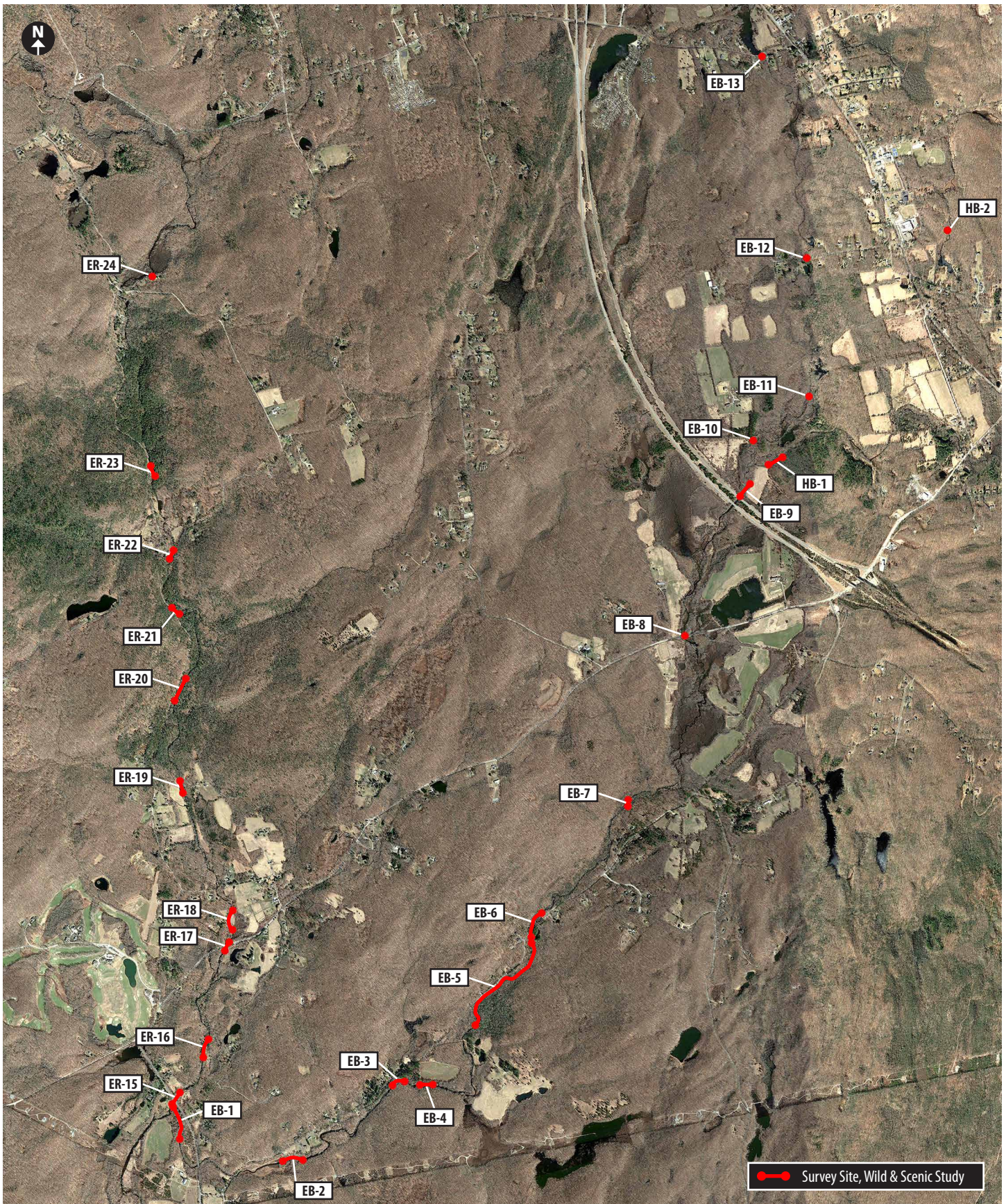


Figure 3. Freshwater mussel survey sites in the Eightmile River (Sites ER-15 to ER-24), East Branch Eightmile River (EB-1 to EB-13), and Harris Brook (HB-1 and HB-2). See Table 2 for location data.

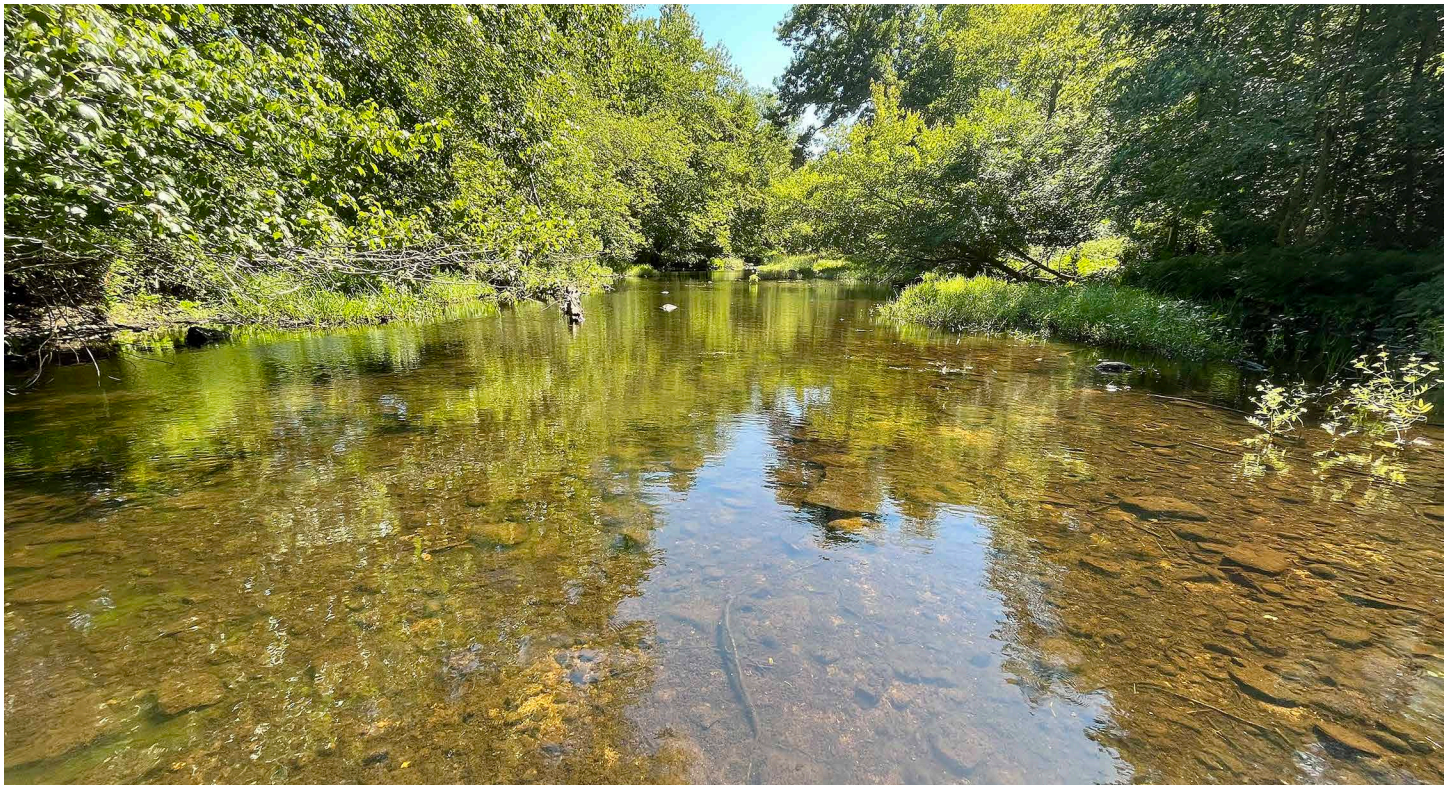
Table 3. Habitat summary for each of the survey sites in the Eightmile River Wild & Scenic Watershed.

Site	Habitat(s)	Flow Velocity ¹	Water Depth (ft)		Cover ²			Substrate ³				
			Mean	Max	Veg	Algae	Wood	Si	S	G	C	B/BR
ER-1	Riffle, run, pool (tidal)	L-M	2.0	8.0	L	L	L	X	X	X	XX	X
ER-2	Riffle, run, pool	L-M	1.0	4.0	L	M-H	M	X	X	XX	XX	X
ER-3	Run, pool	L	3.0	5.5	0	M	M	X	XX	XX	XX	
ER-4	Riffle, run, pool	L-M	2.2	4.5	L	M	L	X	XX	XX	XX	
ER-5	Pool	L	2.0	5.0	L	L	L	X	XX	XX	X	X
ER-6	Riffle, run, pool	L-M	1.0	3.0	0	L	L		X	XX	XX	X
ER-7	Riffle, run, pool	L-M	2.0	4.0	0	L	L		X	XX	XX	X
ER-8	Run, pool	L	0.7	1.5	L	L	L	X	XX	XX	XX	X
ER-9	Pool	L	0.8	4.2	L	L	L	X	XX	X	X	X
ER-10	Riffle, run, pool	L-M	0.5	1.2	L	L	L	X	X	XX	XX	
ER-11	Riffle, run	L-M	0.8	2.0	L	L	L	X	X	XX	XX	X
ER-12	Run, pool	L	1.5	2.0	L	L	M-H	X	X	XX	XX	X
ER-13	Pool	L	1.5	4.0	L	L	M-H	X	X	XX	XX	X
ER-14	Riffle, run	L-M	1.8	5.0	0	M	L	X	XX	XX	XX	X
ER-15	Riffle, run, pool	L	1.8	4.0	L	L	M	X	XX	XX	XX	X
ER-16	Riffle, run, pool	L	0.4	1.2	L	M	M	X	XX	X	XX	XX
ER-17	Pool	L	2.5	4.0	L	L	L	XX	XX	X	X	
ER-18	Riffle, run, pool	L-M	0.7	3.0	L	L	L	X	XX	XX	XX	
ER-19	Riffle, run, pool	L-M	0.3	2.0	0	0	0	X	X	X	XX	XX
ER-20	Pool, riffle	L-M	0.3	0.5	0	0	L	X	X	X	XX	XX
ER-21	Riffle, run, pool	L-M	0.9	2.0	0	0	M	X	X	X	XX	XX
ER-22	Pool, riffle	L-M	1.0	3.0	L	L	L	X	XX	X	XX	X
ER-23	Pool, glide	L	2.0	6.0	L	L	L	X	XX	X	XX	X
ER-24	Pool, wetland	L	2.0	4.0	H	H	M	XX	X	X	X	X
EB-1	Riffle, run, pool	M	0.8	3.0	L	L	L		X	X	XX	X
EB-2	Riffle, run, pool	L-M	1.0	3.5	L	L	L-M	X	XX	XX	XX	X
EB-3	Riffle, run, pool	L	1.5	3.0	M	M	M	X	X	X	X	X
EB-4	Pool, run	L	1.0	1.5	M	M	L-M	X	XX	XX	XX	X
EB-5	Riffle, run, pool (mostly dry)	L-M	0.2	1.5	0	L-M	L	X	X	X	XX	XX
EB-6	Riffle, pool (mostly dry)	L-M	0.2	1.0	0	L-M	L	X	X	X	XX	XX
EB-7	Riffle, run, pool	L-M	0.4	2.0	0	L-M	L	X	X	X	XX	XX
EB-8	Pool	L	2.0	>3.0	H	H	H	XX	XX	X	X	
EB-9	Riffle, run, pool (mostly dry)	L	0.4	3.0	0	L	L	X	X	XX	XX	X
EB-10	Riffle, run, pool (mostly dry)	L	0.3	2.0	0	L	L	X	X	X	XX	X
EB-11	Riffle, run (dry)	NA	0.0	0.0	L	0	L		X	X	XX	XX
EB-12	Riffle, run, pool (mostly dry)	L	0.5	1.5	0	M	M	X	X	X	XX	XX
EB-13	Riffle, run, pool (mostly dry)	L	0.2	1.0	0	M-H	M	X	X	X	XX	XX
HB-1	Pool	L	0.5	1.5	L	M	M-H	X	X	XX	X	X
HB-2	Riffle, run, pool	L-M	0.5	1.5	L	L	H	X	X	XX	XX	X
BB-1	Pool, run	L	1.0	5.0	L	L	M	X	XX	XX	X	
FB-1	Pool (tidal)	L-M	1.5	4.0	H	M	L	XX	XX	X	X	

1. Qualitative categories of flow velocity: L = light/slow, M = moderate, F = fast.
2. Cover: Veg = submerged or emergent vegetation, Wood = large woody debris or coarse detritus. "0" = not present, "L" = light/sparse, "M" = moderate, "H" = heavy/dense.
3. Substrate Abbreviations: Si = silt, S = sand, G = gravel, C = cobble, B/BR = boulder/bedrock. "X" = present, "XX" = dominant or co-dominant.

dry summer. Discharge in the Eightmile River (USGS 01194000) was near 0.5 ft/sec during the survey, and discharge in the East Branch (USGS 01194500) was closer to 0.3 ft/sec. At these flows, significant amounts of the streambed were dry or had hyporheic (subsurface) flows, shallow runs and riffles were only inches deep, and pools that held water were relatively isolated. The Eightmile River had ample wetted areas for mussels and fish,

but parts of the East Branch were fully dewatered from bank to bank. These conditions made it challenging to conduct surveys, but also provided important insight into habitat suitability and stability in areas that would appear suitable during periods of higher flows. Droughts are important bottlenecks for aquatic species, and surveys were conducted during a significant drought.



Site EB-4 in the East Branch Eightmile River where brook floater, triangle floater, and creeper were found.

SURVEY RESULTS

I. Species Found

Live animals of eight mussel species were found during the survey (Tables 4 and 5). Six species were found in the Eightmile River, five in the East Branch, three in Falls Brook and Harris Brook, and two in Beaver Brook. Live mussels were found at every site in the Eightmile River, Falls Brook, Beaver Brook, and Harris Brook, and at six sites in the East Branch. Species richness (i.e., number of species) ranged from one to five at sites in the Eightmile River; seven sites had one species, 11 sites had two species, five sites had three species, and one site had five species. In the East Branch, species richness ranged from zero to four at the ten survey sites (not including the three sites where only a habitat assessment was completed); four sites had none, two sites had one species, two sites had two species, one site had three species, and one site had four species.

Only two species were widespread and common in the study area: eastern elliptio (found at 28 sites) and eastern pearlshell (found at 26 sites). High densities of these two species were found at several sites in the Eightmile River, and upper Harris Brook (Site 2) and Beaver Brook also contain large eastern pearlshell populations. Despite being widespread and locally abundant throughout parts of

the watershed, eastern pearlshell were notably absent in most of the East Branch, except the lowermost reach (Site EB-1) near its confluence with the Eightmile River.

The other six species were rarely found and never more than a few per site (Tables 4 and 5). A total of 11 live brook floater were found at very low densities at just five sites, including four sites in the Eightmile River (ER 4, 5, 6, and 7) and one site in the East Branch (EB-4). This marks the first-ever report of brook floater from the East Branch. A



Eastern pearlshell from the Eightmile River.

Table 4. Summary of mussel species counts and abundance estimates at survey sites in the Eightmile River Wild & Scenic Watershed.

Site	Counts ¹						Abundance Class ^{1,2}		# Species	
	AlVa	StUn	AlUn	LaRa	LiNa	AnIm	MaMa	ElCo		
ER-1	0	0	0	0	0	1	2	2	3	
ER-2	0	0	0	4	1	1	3	4	5	
ER-3	0	0	0	0	0	0	3	6	2	
ER-4	2	0	0	0	0	0	7	6	3	
ER-5	3	0	0	0	0	0	3	4	3	
ER-6	1	0	0	0	0	0	6	4	3	
ER-7	1	0	0	0	0	0	7	4	3	
ER-8	0	0	0	0	0	0	5	2	2	
ER-9	0	0	0	0	0	0	2	1	2	
ER-10	0	0	0	0	0	0	5	1	2	
ER-11	0	0	0	0	0	0	5	3	2	
ER-12	0	0	0	0	0	0	5	3	2	
ER-13	0	0	0	0	0	0	3	3	2	
ER-14	0	0	0	0	0	0	5	3	2	
ER-15	0	0	0	0	0	0	3	0	1	
ER-16	0	0	0	0	0	0	7	0	1	
ER-17	0	0	0	0	0	0	3	0	1	
ER-18	0	0	0	0	0	0	6	0	1	
ER-19	0	0	0	0	0	0	1	0	1	
ER-20	0	0	0	0	0	0	4	0	1	
ER-21	0	0	0	0	0	0	4	1	2	
ER-22	0	0	0	0	0	0	1	1	2	
ER-23	0	0	0	0	0	0	1	1	2	
ER-24	0	0	0	0	0	0	0	1	1	
EB-1	0	0	0	0	0	0	2	1	2	
EB-2	0	0	0	0	0	0	0	2	1	
EB-3	0	4	3	0	0	0	0	2	3	
EB-4	4	4	8	0	0	0	0	2	4	
EB-5	0	0	0	0	0	0	0	0	0	
EB-6	0	0	0	0	0	0	0	1	1	
EB-7	0	1	0	0	0	0	0	1	2	
EB-8	No survey. Habitat assessment only.									
EB-9	0	0	0	0	0	0	0	0	0	
EB-10	0	0	0	0	0	0	0	0	0	
EB-11	0	0	0	0	0	0	0	0	0	
EB-12	No survey. Habitat assessment only.									-
EB-13	No survey. Habitat assessment only.									-
HB-1	0	1	0	0	0	0	0	2	2	
HB-2	0	0	0	0	0	0	6	4	2	
BB-1	0	0	0	0	0	0	7	2	2	
FB-1	0	0	0	0	1	3	0	5	3	

1. Species abbreviations provided in Table 1.

2. Qualitative abundance classes for *M. margaritifera* and *E. complanata*: 0 = none, 1 = <10, 2 = 11-25, 3 = 26-50, 4 = 51-100, 5 = 101-200, 6 = 201-400, 7 = >400.

total of ten live creeper were found at very low densities at just four sites, including three in the East Branch (EB 3, 4, 7) and one at the downstream end of Harris Brook (HB-1). A total of 11 triangle floater were found at two adjacent sites in the East Branch (ER-3, 4). Eastern lampmussel, eastern pondmussel, and alewife floater were found only in the lower Eightmile River (Sites ER-1 or ER-2) or the tidal Falls Brook (FB-1) but are likely more common in tidal freshwater areas of Hamburg Cove.

II. State-listed Species Summaries

Brook Floater: Eleven live brook floater were found at very low densities at five sites, including four adjacent sites in the Eightmile River (ER 4, 5, 6, and 7) and one site in the East Branch (EB-4) (Tables 4 and 5). Seven individuals were found in the Eightmile River, including two at Site 4, three at Site 5, one at Site 6, and one at Site 7. For these four sites, total search time was 11.6 hours and CPUE (catch-per-unit-effort) was 0.60 mussels/hour.

Table 5. Summary of mussel species found in the five study streams in the Eightmile River Wild & Scenic Watershed.

Species	State-listed?	Eightmile River		East Branch		Harris Brook		Falls Brook		Beaver Brook	
		# Sites	# Mussels	# Sites	# Mussels	# Sites	# Mussels	# Sites	# Mussels	# Sites	# Mussels
<i>Elliptio complanata</i>		18	2.08*	6	0.90*	2	51-100**	1	101-200**	1	11-25**
<i>Margaritifera margaritifera</i>	Yes	23	3.79*	1	0.20*	1	201-400**	0	0	1	>400**
<i>Alasmidonta varicosa</i>	Yes	4	7	1	4	0	0	0	0	0	0
<i>Alasmidonta undulata</i>		0	0	2	11	0	0	0	0	0	0
<i>Strophitus undulatus</i>	Yes	0	0	3	9	1	1	0	0	0	0
<i>Sagittunio nasutus</i>	Yes	1	1	0	0	0	0	1	1	0	0
<i>Utterbackiana implicata</i>	Yes	2	2	0	0	0	0	1	3	0	0
<i>Lampsilis radiata</i>		1	4	0	0	0	0	0	0	0	0
Number of Species		6		5		3		3		2	
Number of Sites with Mussels		24		6		2		1		1	
Percent of Sites with Mussels		100		46.2		100		100		100	
State-listed Species Present		Yes		Yes		Yes		Yes		Yes	

*Average of the eight qualitative abundance classes recorded at each site. See Table 4 footnote.

**Abundance class, see Table 4 footnote.

Total search time for the entire Eightmile River was 42.3 hours and CPUE was 0.16 mussels/hr (or one every 6.25 hours). For the first time ever, brook floater were found in the East Branch. Four live mussels were found at Site 4 in

2.5 hours (CPUE = 1.6 mussels/hr), in a large shallow pool with mostly unsuitable habitat both upstream and downstream. Only two of the survey sites in the East Branch appeared to provide suitable and stable habitat for brook



Alasmidonta varicosa (brook floater) from Site EB-4.



Alasmidonta varicosa (brook floater) from Site EB-4.



Alasmidonta varicosa (brook floater) from Site ER-5.



Alasmidonta varicosa (brook floater) from Site ER-7.

Table 6. Location, shell length, shell condition, and habitat for individual uncommon or state-listed mussels found during the survey. Shell length and shell condition were also recorded for *M. margaritifera* (see Table 7) but not specific locations or habitats.

Species	Site	Specific Location		Shell Length (mm)	Shell Condition ¹	Water Depth (ft)	Substrate ²
		Latitude	Longitude				
<i>A. undulata</i>	EB-3			40.0	0.50	1.0	Si, S, C
<i>A. undulata</i>	EB-3			41.0	0.75	1.0	Si, S, C
<i>A. undulata</i>	EB-3			35.0	0.50	1.0	Si, S, C
<i>A. undulata</i>	EB-4			37.0	0.50	1.0-1.5	Si, G, C
<i>A. undulata</i>	EB-4	coordinates not recorded		40.0	0.75	1.0-1.5	Si, G, C
<i>A. undulata</i>	EB-4	for <i>A. undulata</i>		37.0	0.50	1.0-1.5	Si, G, C
<i>A. undulata</i>	EB-4			43.0	0.50	1.0-1.5	Si, G, C
<i>A. undulata</i>	EB-4			32.0	0.50	1.0-1.5	Si, G, C
<i>A. undulata</i>	EB-4			28.0	0.25	1.0-1.5	Si, G, C
<i>A. undulata</i>	EB-4			39.0	0.75	1.0-1.5	Si, G, C
<i>A. undulata</i>	EB-4			40.0	0.50	1.0-1.5	Si, G, C
<i>A. varicosa</i>	EB-4	41.43273	-72.31585	40.5	0.00	1.5	S, G, C
<i>A. varicosa</i>	EB-4	41.43277	-72.31519	56.0	0.75	1.5	Si, G, C
<i>A. varicosa</i>	EB-4	41.43272	-72.31568	38.5	0.25	1.0	Si, G, C
<i>A. varicosa</i>	EB-4	41.43274	-72.31572	60.0	0.75	1.0	Si, S, G
<i>A. varicosa</i>	ER-4	41.41238	-72.33869	34.5	0.25	2.0	Si, S, G
<i>A. varicosa</i>	ER-4	41.41207	-72.33877	60.0	0.75	1.0	Si, S
<i>A. varicosa</i>	ER-5	41.41322	-72.33889	42.0	0.25	2.0	Si, S, G
<i>A. varicosa</i>	ER-5	41.41326	-72.33891	60.0	0.75	2.5	Si, S, G, C
<i>A. varicosa</i>	ER-5	41.41324	-72.33897	42.5	0.25	2.0	S, G
<i>A. varicosa</i>	ER-6	41.41444	-72.33914	55.0	0.25	2.5	Si, S, G, C
<i>A. varicosa</i>	ER-7	41.41585	-72.33780	42.0	0.25	2.0	S, C
<i>S. nasutus</i>	ER-2	41.40098	-72.34636	56.0	0.25	1.5	Si, S, G
<i>S. undulata</i>	EB-3			59.0	0.50	1.0	Si, S, C
<i>S. undulata</i>	EB-3			55.0	0.75	1.0	Si, S, C
<i>S. undulata</i>	EB-3			49.0	0.75	1.0	Si, S, C
<i>S. undulata</i>	EB-3			52.0	0.25	1.0	Si, S, C
<i>S. undulata</i>	EB-4	coordinates not recorded		53.0	0.50	1.0-1.5	Si, G, C
<i>S. undulata</i>	EB-4	for <i>S. undulatus</i>		49.0	0.25	1.0-1.5	Si, G, C
<i>S. undulata</i>	EB-4			61.0	0.75	1.0-1.5	Si, G, C
<i>S. undulata</i>	EB-4			44.0	0.25	1.0-1.5	Si, G, C
<i>S. undulata</i>	EB-7			67.0	0.25	1.5	S, C
<i>S. undulata</i>	HB-1			64.0	0.00	1.0	Si, S

1. Shell Condition: refers to degree of shell erosion, which is given one of 5 numeric scores. 0 = little/no shell erosion, 0.25 = light shell erosion, 0.50 = moderate shell erosion, 0.75 = moderate/heavy shell erosion, 1.0 = heavy shell erosion. These scores are averaged for all individuals in a sample to produce a Shell Condition Index ranging from 0.0 to 1.0.

2. Substrate abbreviations: Si = silt, S = sand, G = gravel, C = cobble.

floater and other rare riverine species: Sites EB-3 and EB-4. This isolated reach stands out as critically important for mussel conservation in the watershed. The 11 brook floater ranged in length from 34.5 to 60.0 mm (average = 48.3 mm) and exhibited moderate shell erosion (shell condition index = 0.41) (Tables 6, 7). There was some evidence of recruitment in the last 10 years, despite such low population densities. They were found in silty sand, gravel, and cobble substrates in water depths of 1.0 to 2.5 ft.

Creepers: Ten live creepers were found at very low densities, including one in Harris Brook at HB-1 (CPUE = 1.25 mussels/hr) and nine in the East Branch at Sites EB-3 (4), EB-4 (4), and EB-7 (1) (Tables 4 and 5). Total search time for the three sites in the East Branch where creepers were

found was 5.5 hours and CPUE was 1.64 mussels/hr. We believe these are the first reports of creepers in these two rivers. Creepers ranged in length from 44.0 to 67.0 mm (average = 55.3 mm) and exhibited moderate shell erosion (shell condition index = 0.43) (Tables 6, 7). All of the creepers were found in shallow pools with mostly unsuitable habitat both upstream and downstream. They were found in silty sand, gravel, and cobble substrates in water depths of 1.0 to 1.5 ft.

Eastern Pondmussel: Only two eastern pondmussels were found, including one in the Eightmile River (Site ER-2) and one in Falls Brook (Tables 4 and 5). The mussel found in the Eightmile River was 56.0 mm in length with light shell erosion, and found at a depth of 1.5 ft in silty

Table 7. Summary of shell length and shell condition data for *A. undulata*, *S. undulatus*, *A. varicosa*, and *M. margaritifera* found during the survey.

Parameter	<i>A. undulata</i>	<i>S. undulatus</i>	<i>A. varicosa</i>		<i>M. margaritifera</i>		
			Eightmile	East Branch	Eightmile	Harris Brook	Beaver Brook
Number Measured	11	10	7	4	170	25	25
Mean Length (mm)	37.5	55.3	48.0	48.8	87.1	103.7	87.2
Min Length (mm)	28.0	44.0	34.5	38.5	24.0	79.0	56.0
Max Length (mm)	43.0	67.0	60.0	60.0	113.0	123.0	109.0
Shell Condition Index ¹	0.55	0.43	0.39	0.44	0.47	0.73	0.48
Length Class							
<20.0 mm	0	0	0	0	0	0	0
20.0 - 29.9 mm	1	0	0	0	2	0	0
30.0 - 39.9 mm	5	0	1	1	1	0	0
40.0 - 49.9 mm	5	3	3	1	1	0	0
50.0 - 59.9 mm	0	4	1	1	2	0	1
60.0 - 69.9 mm	0	3	2	1	5	0	0
70.0 - 79.9 mm	0	0	0	0	19	1	2
80.0 - 89.9 mm	0	0	0	0	70	0	14
90.0 - 99.9 mm	0	0	0	0	47	4	4
>100.0 mm	0	0	0	0	23	20	4

1. Shell Condition: refers to degree of shell erosion, which is given one of 5 numeric scores. 0 = little/no shell erosion, 0.25 = light shell erosion, 0.50 = moderate shell erosion, 0.75 = moderate/heavy shell erosion, 1.0 = heavy shell erosion. These scores are averaged for all individuals in a sample to produce a Shell Condition Index ranging from 0.0 to 1.0.



Strophitus undulatus (creeper) from Harris Brook.



Sagittunio nasutus (eastern pondmussel) from the Eightmile River.

sand and gravel (Table 6). The mussel found in Falls Brook was not measured, but it was found in a shallow, weedy subtidal area not far upstream from Hamburg Cove. This species is likely more common in Hamburg Cove.

Alewife Floater: Only five alewife floater were found, including one each at two adjacent sites in the lower Eightmile River (ER-1 and ER-2) and in the tidal area of Falls Brook (Tables 4 and 5). Host fish for alewife include only American shad and alewife, and alewife floater populations are primarily restricted to riverine areas accessible to these migratory fish species. This species is more common in Hamburg Cove.

Eastern Pearlshell: This species is widespread and locally abundant throughout the non-tidal areas of the Eightmile River, and the limited surveys in Beaver Brook and Harris Brook indicate potentially large populations in both of those tributaries (Tables 4 and 5). It was not found in Falls Brook, and it was only found at the downstream-most survey site in the East Branch just upstream from the confluence with the Eightmile River. Habitat in much of the East Branch appears to be suitable, aside from the large dewatered areas observed during the 2022 drought, and the near-absence of eastern pearlshell is hard to explain. This species was too numerous to efficiently count at several sites in the Eightmile River and in Beaver Brook and Harris Brook, and thus we recorded coarse abundance classes



Utterbackiana implicata (alewife floater) from the Eightmile River.



Margaritifera margaritifera (eastern pearlshell) from Harris Brook.



Lampsilis radiata (eastern lampmussel) from the Eightmile River.



Alasmidonta undulata (triangle floater) from the East Branch.

rather than precise counts and only measured a small subsample of the individuals we observed. In the Eightmile River, mussels ranged in length from 24.0 to 113.0 mm (average = 87.1 mm), with strong evidence of both recruitment and longevity in the population. There were beds with several hundred mussels packed into small areas, with densities exceeding 50 per square meter. In Harris Brook, mussels ranged in length from 79.0 to 123.0 mm (average = 103.7 mm), providing evidence of longevity but not recruitment. CPUE at HB-2 was greater than 200 mussels/hr. In Beaver Brook, mussels ranged in length from 56.0 to 109.0 mm (average = 87.2 mm), and CPUE was closer to 400 mussels/hr. Generally, eastern pearlshell were found in sand, gravel, and cobble substrates, and were most abundant in shallow riffles and runs.

Tidewater Mucket: None were found during the survey,

but this species is more likely to occur in Hamburg Cove outside of marine influence. The salt wedge does push into the lower end of Hamburg Cove in the summer, limiting the distribution of freshwater species in that area.

DISCUSSION

This study found live animals of eight mussel species in the Eightmile Wild & Scenic Watershed, including six species in the Eightmile River, five in the East Branch, three in Falls Brook and Harris Brook, and two in Beaver Brook. Live mussels were found at every site in the Eightmile River, Falls Brook, Beaver Brook, and Harris Brook, and at six sites in the East Branch. Only two species were widespread and locally abundant in the study area: eastern eliptio and eastern pearlshell. High densities of these two species were found at several sites in the Eightmile River,



Eightmile River near Lyme Town Park (Site ER-5) where brook floater were found.

and upper Harris Brook and Beaver Brook also contain large eastern pearlshell populations. The other six species were rarely found and never more than a few per site.

Six state-listed mussel species are found in the Eightmile River Wild & Scenic Watershed, although only one of these—eastern pearlshell—is widespread and locally abundant. Other state-listed mussels are far less widespread and numerous. The state-endangered brook floater was an important focus of this survey. Prior to 2022, live brook floater had not been observed in the Eightmile River since 2008 (Biodrawversity 2008) and there was concern about the viability of this population. In 2022, 11 live brook floater were found at very low densities at five sites, including four sites in the Eightmile River that overlapped with locations where brook floater were observed in 2008, and one site in the East Branch. This marks the first-ever report of brook floater from the East Branch. Although these brook floater populations appear to be very small and isolated, it is reassuring that they can still be found in the watershed. Creeper and triangle floater, two uncommon riverine species, were found only in the East Branch subwatershed (including lower Harris Brook) and appeared to mostly overlap with brook floater. Other state-listed mussels appear to be confined to the lower Eightmile River and tidal areas of Hamburg Cove, including eastern pondmussel, alewife floater, and tidewater mucket (that was not detected during the survey).

Nearly all the Eightmile River, from Hamburg Cove to Devils Hopyard State Park, is critical habitat for one or more state-listed mussel species. Within this 10.8-mile reach, it appears that the state-endangered brook floater is con-

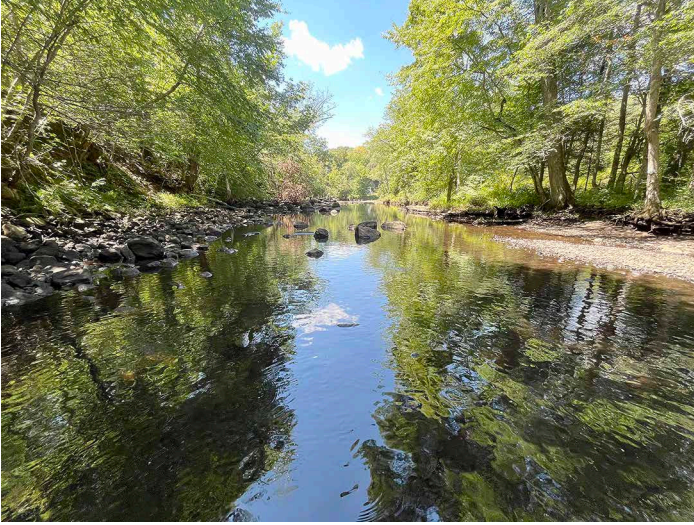
fined to a reach less than 0.7 miles long near Macintosh Road and Lyme Town Park. This is a critical reach for mussel conservation in the watershed. In the East Branch, nearly all the rarest mussels (brook floater, creeper, and triangle floater) were confined to two adjacent survey sites (EB-3 and EB-4), spanning a total distance of only 0.25 miles. Additional surveys could detect mussels farther upstream or downstream, but regardless, this entire reach is critical habitat for mussel conservation in the watershed.

If there is interest and funding for more mussel research and conservation in the Eightmile Wild & Scenic Watershed, it would be informative to conduct additional surveys within, upstream, and downstream from areas where brook floater were found to gain a better understanding of the total population size, viability, and habitat of brook floater in these areas. Some of these areas could not be surveyed in 2022 due to either limited access or lack of landowner permission. Most of the upland landscape near these two critical areas is already protected, so it's not clear what more can be done to protect mussels and habitat in these areas.

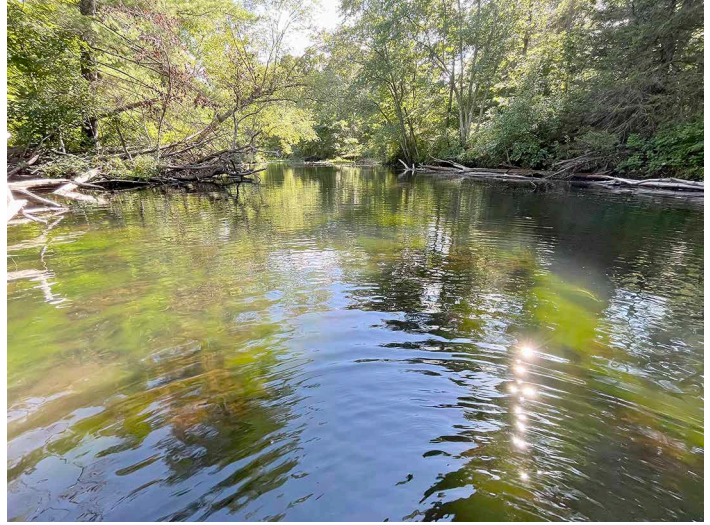
CITED

- Biodrawversity. 2008. Statewide surveys of threatened and endangered freshwater mussels in Connecticut. Report prepared for the Connecticut Department of Energy and Environmental Protection, Hartford, CT.
- Nedeau, E.J. 2008. *Freshwater Mussels and the Connecticut River Watershed*. Connecticut River Watershed Council, Greenfield, MA.

APPENDIX 1: Representative Habitat Photos



Eightmile River, Site ER-1



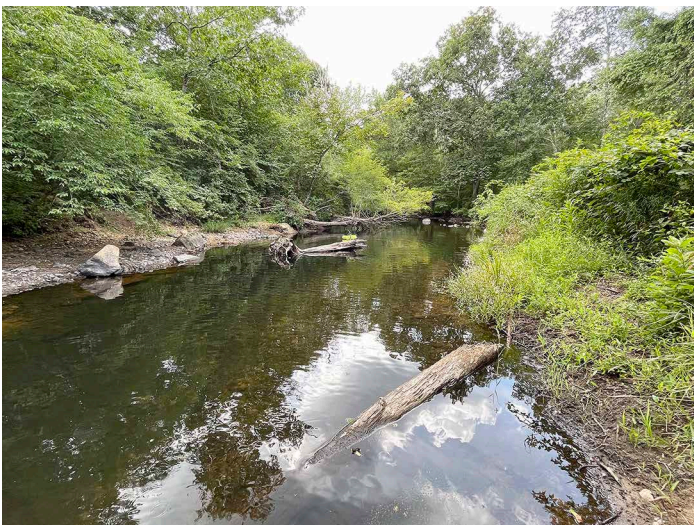
Eightmile River, Site ER-2



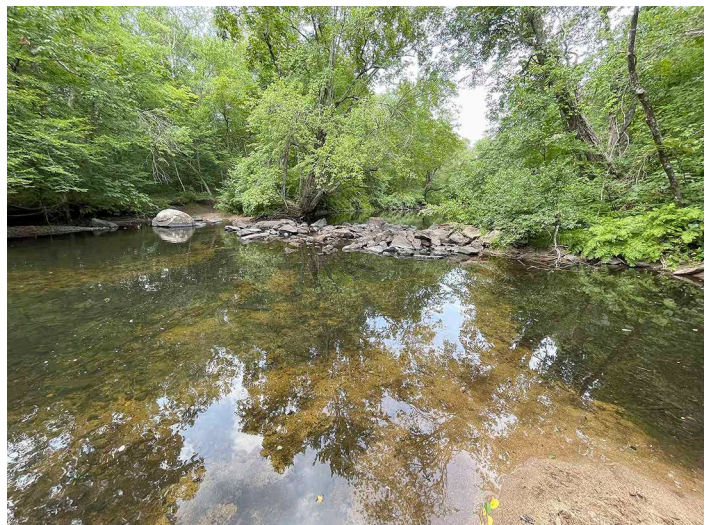
Eightmile River, Site ER-4



Eightmile River, Site ER-5



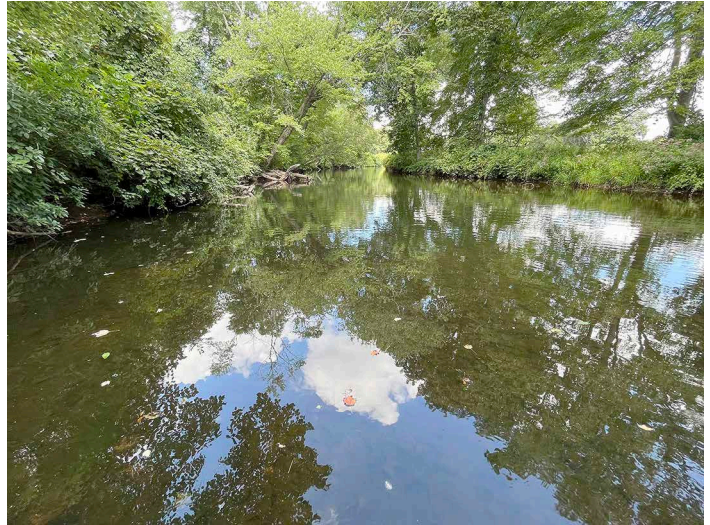
Eightmile River, Site ER-6



Eightmile River, Site ER-7



Eightmile River, Site ER-9



Eightmile River, Site ER-13



Eightmile River, Site ER-16



Eightmile River, Site ER-19



Eightmile River, Site ER-23



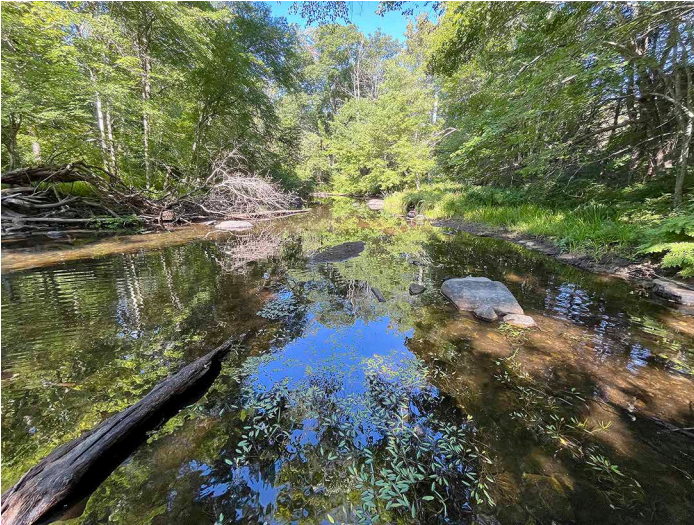
Eightmile River, Site ER-24



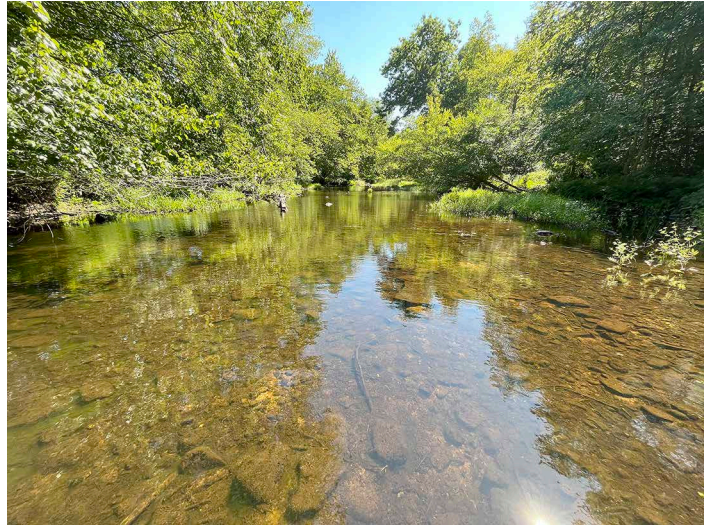
East Branch Eightmile River, Site EB-1



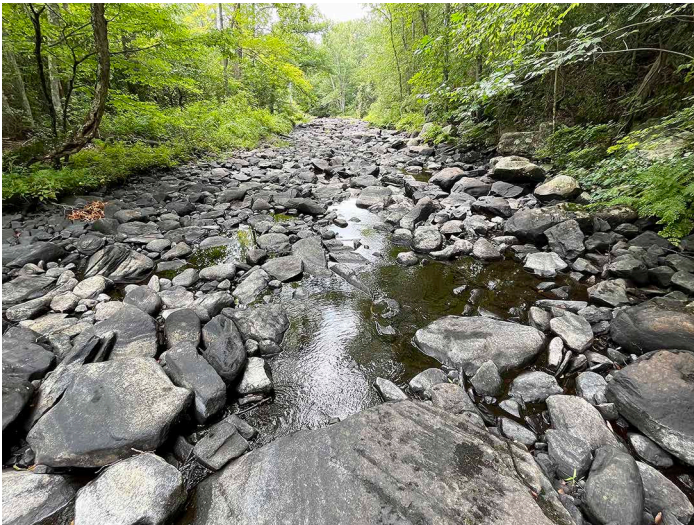
East Branch Eightmile River, Site EB-2



East Branch Eightmile River, Site EB-3



East Branch Eightmile River, Site EB-4



East Branch Eightmile River, Site EB-5



East Branch Eightmile River, Site EB-8



East Branch Eightmile River, Site EB-9



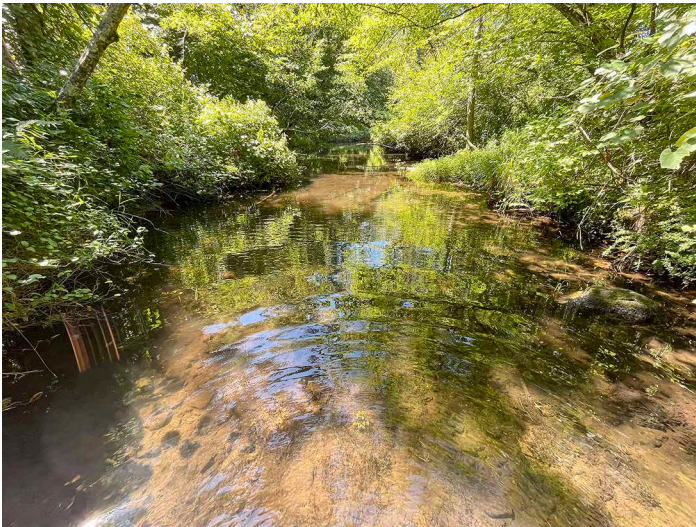
East Branch Eightmile River, Site EB-11



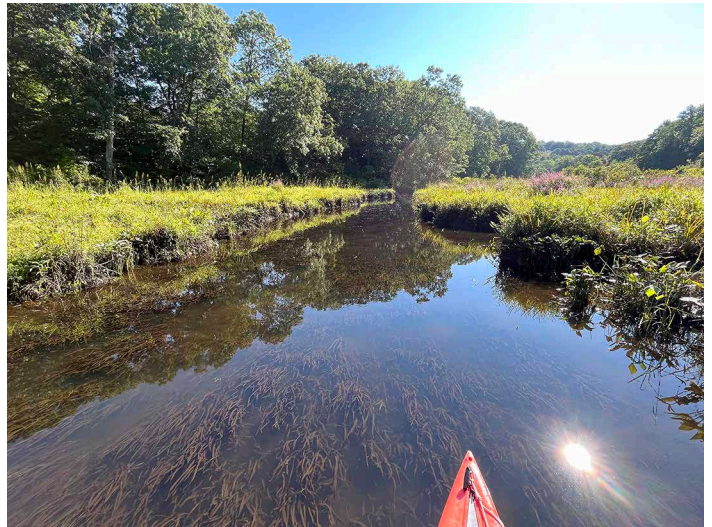
Harris Brook, Site HB-1



Harris Brook, Site HB-2



Beaver Brook, Site BB-1



Falls Brook, Site FB-1