

**FRESHWATER MUSSEL STUDY FOR
THE ENBRIDGE LINE 5 WISCONSIN
SEGMENT RELOCATION PROJECT**
Ashland, Iron, and Bayfield Counties,
Wisconsin

Prepared for:



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Project No.: 18707

Date: 1/9/2024

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Freshwater Mussel Study for the Line 5
Wisconsin Segment Relocation Project
Document Date: 1/9/2024
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Prepared for: ERM

Authorization for Release

The analyses, opinions, and conclusions in this document are based entirely on EnviroScience's unbiased, professional judgment. EnviroScience's compensation is not in any way contingent on any action or event resulting from this study.

To the best of their knowledge, the undersigned attest that this document and the information contained herein are accurate and conform to EnviroScience's internal Quality Assurance standards.

A handwritten signature in dark ink, reading "Matthew Gilkey", written over a horizontal line.

Matthew Gilkey
Malacologist | Field Manager | Report Author

A handwritten signature in dark ink, reading "Phil Mathias", written over a horizontal line.

Phil Mathias
Director of Marine Services

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1.0 INTRODUCTION

EnviroScience, Inc. was contracted by Environmental Resources Management (ERM; client) to perform freshwater mussel studies at several proposed riverine crossings associated with the Enbridge Line 5 Wisconsin Segment Relocation Project (Project), located in Ashland, Bayfield, and Iron Counties, Wisconsin (Figure 1). Through communications with the United States Environmental Protection Agency (USEPA) and the Wisconsin Department of Natural Resources (WDNR), a desktop review and mussel surveys were requested as a part of the environmental clearances for the Project.

In February 2023, ERM consulted with the WDNR Bureau of Natural Heritage Conservation, and an Endangered Resources Review was completed (ER Log #20-034), which consisted of a query of the Wisconsin Natural Heritage Inventory database for endangered resources records in the proposed Project areas. The Project area that was evaluated included the proposed facilities and workspace, and a buffer area surrounding the proposed facilities. The buffer area encompassed one mile for terrestrial and wetland species and two miles for aquatic species. No protected mussels were identified within the proposed facility sites, workspace, or associated buffer areas.

Although no known state or federally protected mussels have been previously documented in the Project area which would require mussel surveys, Enbridge voluntarily conducted a preliminary mussel habitat assessment at thirteen perennial waterbodies crossed by the proposed pipeline centerline via a non-trenchless installation method (e.g., dam and pump or flume method). Where suitable mussel habitat is present, EnviroScience conducted a quantitative mussel survey within the Project workspace following the methodology listed in the WDNR Guidelines for Sampling Freshwater Mussels in Wadable Streams (Guidelines). Table 1 contains centerline coordinates and other applicable location information.

2.0 METHODS

2.1 INITIAL SURVEYS

A preliminary mussel search was conducted to determine the presence or absence of mussels at each site. Initial surveys consisted of a qualitative search effort performed via wading and view bucket techniques. The survey was conducted by two field personnel starting at the downstream extent of the survey area and quartering back and forth between the streambank and the middle of the stream. Mean stream width (MSW) was anticipated to be less than 7 m, therefore the extent of the surveys was 100 meters (m) upstream and downstream of the proposed crossing midline, for a total of 200 m of stream length. Searching was performed for the full extent of the survey length unless evidence of a mussel community (shell material and/or a live mussel) was collected. Search effort exceeded one hour per initial survey site. If shell material or a live individual was collected, the survey would transition into a qualitative survey following the methodology outlined below.

2.2 QUALITATIVE SURVEYS

Qualitative timed searches were used to estimate mussel abundance and species richness at each stream crossing that was found to have a mussel community. The anticipated workspace at each of the thirteen crossing locations extended across the width of each stream (all <15 m). Per Wisconsin's mussel sampling guidelines, the mussel survey area included a maximum stream length of 200 m (100 m upstream and 100 m downstream of the proposed pipe centerline), and

a minimum of four person-hours of search time would be conducted in the survey area at each triggered crossing. The downstream extent of the qualitative searches would be the end point of the initial survey that triggered the need for a qualitative survey. Biologists searched the substrate via wading or snorkeling, collecting all mussels encountered visually and tactually in the allotted search time. If mussels were encountered, a cumulative species curve would be developed to determine the likelihood that all species present in the project area have been collected. Depth and substrate composition were recorded for each survey area.

2.3 DATA AND MUSSEL HANDLING

Live mussels were to be kept submersed in ambient river water to keep them cool and moist during processing. Live mussels were identified to species, counted, measured (length in millimeters), aged (external annuli count), and sexed (sexually dimorphic species only) by the team malacologist. Dead shell specimens were scored as fresh dead (dead less than one-year, lustrous nacre), weathered dead (dead one to many years; chalky nacre, fragmented, and worn periostracum), or subfossil (dead many years to many decades; severely worn and fragmented). Detailed digital images of the study areas and representative mussel species were recorded. A WDNR Mussel Sampling Data Sheet was completed at each project site. Taxonomy followed guidance from the Freshwater Mollusk Conservation Society (FMCS, 2021).

3.0 RESULTS AND DISCUSSION

The mussel surveys were conducted from October 23 – 26, 2023. Mr. Matthew Gilkay led the field crew as the WDNR approved malacologist (Appendix A). Habitat and survey condition data can be found in Tables 2 and 3, respectively. Digital photographs of each survey site can be found in Appendix B, and completed WDNR Mussel Sampling Data Sheets can be found in Appendix C. Several site names are un-named tributaries (UNTs) of larger creeks and rivers, and lack a WDNR Waterbody ID.

SITE 1: BAY CITY CREEK (ERM KEY: SASE006P)

The Bay City Creek crossing location was surveyed on October 23, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. The dominant substrate throughout the site was sand, with an average depth of 0.5 m. Stream visibility was stained but clear to bottom throughout the site. A total of 1.5 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2A. Photos of the survey site can be found in Appendix B, Photos 1 – 7.

SITE 2: ROCK CREEK (ERM KEY: SASC041P)

The Rock Creek crossing location was surveyed on October 24, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. The dominant substrate throughout the site was sand, with an average depth of 0.3 m. Stream visibility was silted and estimated to be 0.2 m. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2B. Photos of the survey site can be found in Appendix B, Photos 8 – 14.

SITE 3: UNT OF MARENGO CREEK (ERM KEY: SASD011P)

The UNT of Marengo Creek crossing location was surveyed on October 24, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. The dominant substrate throughout the site was sand, with an average depth of 0.3 m. Stream visibility was silted and estimated to be 0.2 m. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2C. Photos of the survey site can be found in Appendix B, Photos 15 – 21.

SITE 4: UNT OF BRUNSWEILER CREEK (ERM KEY: SASC1006P)

The UNT of Brunswailer Creek crossing location was surveyed on October 24, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. The dominant substrate throughout the site was sand and gravel, with an average depth of 0.5 m. Stream visibility was clear and visible to the bottom. A total of 1.5 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2D. Photos of the survey site can be found in Appendix B, Photos 22 – 28.

SITE 5: UNT OF TROUT BROOK (ERM KEY: SASC1003P_X1)

The UNT of Trout Brook crossing location was surveyed on October 24, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. The dominant substrate throughout the site was sand, with an average depth of 0.3 m. Stream visibility was clear and visible to the bottom. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2E. Photos of the survey site can be found in Appendix B, Photos 29 – 35.

SITE 6: UNT OF SILVER CREEK (ERM KEY: SASD1015P)

The UNT of Silver Creek crossing location was surveyed on October 25, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 2.0 m. Substrate composition was a heterogenous mixture of sand, gravel, and cobble, with an average depth of 0.6 m. Stream visibility was clear and visible to the bottom. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2F. Photos of the survey site can be found in Appendix B, Photos 36 – 42.

SITE 7: UNT OF SILVER CREEK (ERM KEY: SASE005P_X2)

The UNT of Silver Creek crossing location was surveyed on October 25, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. The dominant substrate throughout the site was sand, with an average depth of 0.5 m. Stream visibility was clear and visible to the bottom. A total of 1.5 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2G. Photos of the survey site can be found in Appendix B, Photos 43 – 49.

SITE 8: UNT OF SILVER CREEK (ERM KEY: SASV004P)

The UNT of Silver Creek crossing location was surveyed on October 25, 2023. The surrounding land use was dominated by pasture, and MSW was approximately 1.0 m. The dominant substrate

throughout the site was silt, with an average depth of 0.3 m. Stream visibility was clear and visible to the bottom. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. Surveyors noted this site appeared to have unrestricted cattle access, and stream morphology appeared to resemble a seep rather than a channelized stream. A map of the survey area can be found in Figure 2H. Photos of the survey site can be found in Appendix B, Photos 50 – 56.

SITE 9: UNT OF KRAUSE CREEK (ERM KEY: SASV020P)

The UNT of Krause Creek crossing location was surveyed on October 25, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. Substrate composition was a heterogenous mixture of sand, cobble, and gravel, with an average depth of 0.3 m. Stream visibility was clear and visible to the bottom. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2I. Photos of the survey site can be found in Appendix B, Photos 57 – 63.

SITE 10: UNT OF BAD RIVER (ERM KEY: SASA008P)

The UNT of Bad River crossing location was surveyed on October 26, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. Substrate composition was a heterogenous mixture of silt, sand, detritus, and clay, with an average depth of 0.3 m. Stream visibility was turbid and estimated at 0.2 m. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A recent rain event brought the stream overbank of its shallow channel, as well as increasing turbidity. A map of the survey area can be found in Figure 2J. Photos of the survey site can be found in Appendix B, Photos 64 – 70.

SITE 11: UNT OF GEHRMAN CREEK (ERM KEY: SASA004P)

The UNT of Gehrman Creek crossing location was surveyed on October 26, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. Substrate composition was a heterogenous mixture of gravel and sand, with an average depth of 0.4 m. Stream visibility was silted and estimated at 0.3 m. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A recent rain event increased turbidity. A map of the survey area can be found in Figure 2K. Photos of the survey site can be found in Appendix B, Photos 71 – 77.

SITE 12: UNT OF FELDCHER CREEK (ERM KEY: SIRB010P)

The UNT of Feldcher Creek crossing location was surveyed on October 26, 2023. The surrounding land use was dominated by woodland, and MSW was approximately 1.0 m. Substrate composition was a heterogenous mixture of gravel, sand, and cobble, with an average depth of 0.3 m. Stream visibility was clear and visible to the bottom. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2L. Photos of the survey site can be found in Appendix B, Photos 78 – 84.

SITE 13: UNT OF VAUGHN CREEK (ERM KEY: SIRD009P)

The UNT of Vaughn Creek crossing location was surveyed on October 26, 2023. The surrounding land use was dominated by wetland, and MSW was approximately 1.0 m. Substrate composition was a heterogeneous mixture of sand and detritus, with an average depth of 0.5 m. A layer of loose detritus along the bottom of the stream ranged from 0.1 m to 1.0 m in depth. Stream visibility was clear and visible to the bottom. A total of 1.0 work-person-hours was spent on the initial sampling effort, and no evidence of a mussel community (live individuals or shell material) was collected from the survey site. A map of the survey area can be found in Figure 2M. Photos of the survey site can be found in Appendix B, Photos 85 – 91.

4.0 CONCLUSIONS

No evidence of any current or historical mussel communities was collected across the 13 surveyed sites. The majority of the surveyed streams had minimal to no flow, and stream bottoms with compositions high in unconsolidated sand and silt, which are generally not conducive to mussel colonization. It is unlikely the proposed construction activities at these sites will impact any mussel community within these stream reaches.

5.0 REFERENCES

- Freshwater Mollusk Conservation Society. (2021). 2021 FMCS checklist of freshwater mussels (Mollusca: Bivalvia: Unionida) of the United States and Canada. https://molluskconservation.org/Library/Committees/Names/Appendix_1_Bivalves_Revised_Names_List_20210825.pdf.
- Piette, R. R. (2015). Guidelines for sampling freshwater mussels in wadable streams. Wisconsin Department of Natural Resources. 50pp.
- Wentworth, C. K. (1922). A scale of grade and class terms for clastic sediments. *Journal of Geology*, 30, 377-392.

Tables

Table 1. Summary of proposed in-stream work centerlines associated with the Line 5 Segment Relocation Project, 2023.

Site Number	GPS Coordinate (Lat - Long.)	Waterbody	City	County
1	46.550733, -90.895891	Bay City Creek	Ashland	Bayfield
2	46.490678, -90.90076	Rock Creek	White River	Ashland
3	46.451173, -90.898612	UNT of Marengo River	Ashland	Ashland
4	46.401492, -90.801603	UNT of Brunswelier River	Minersville	Ashland
5	46.39762, -90.781587	UNT of Trout Brook	North York	Ashland
6	46.372182, -90.718205	UNT of Silver Creek	High Bridge	Ashland
7	46.365449, -90.706777	UNT of Silver Creek	Mellen	Ashland
8	46.360179, -90.695723	UNT of Silver Creek	Mellen	Ashland
9	46.355133, -90.683174	UNT of Krause Creek	Mellen	Ashland
10	46.336882, -90.662766	UNT of Bad River	Mellen	Ashland
11	46.365594, -90.588167	UNT of Gehrman Creek	Mellen	Ashland
12	46.382246, -90.548053	UNT of Feldcher Creek	Tyler Forks	Iron
13	46.484192, -90.485478	UNT of Vaughn Creek	Gurney	Iron

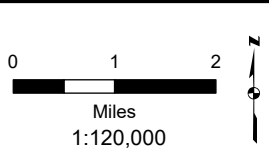
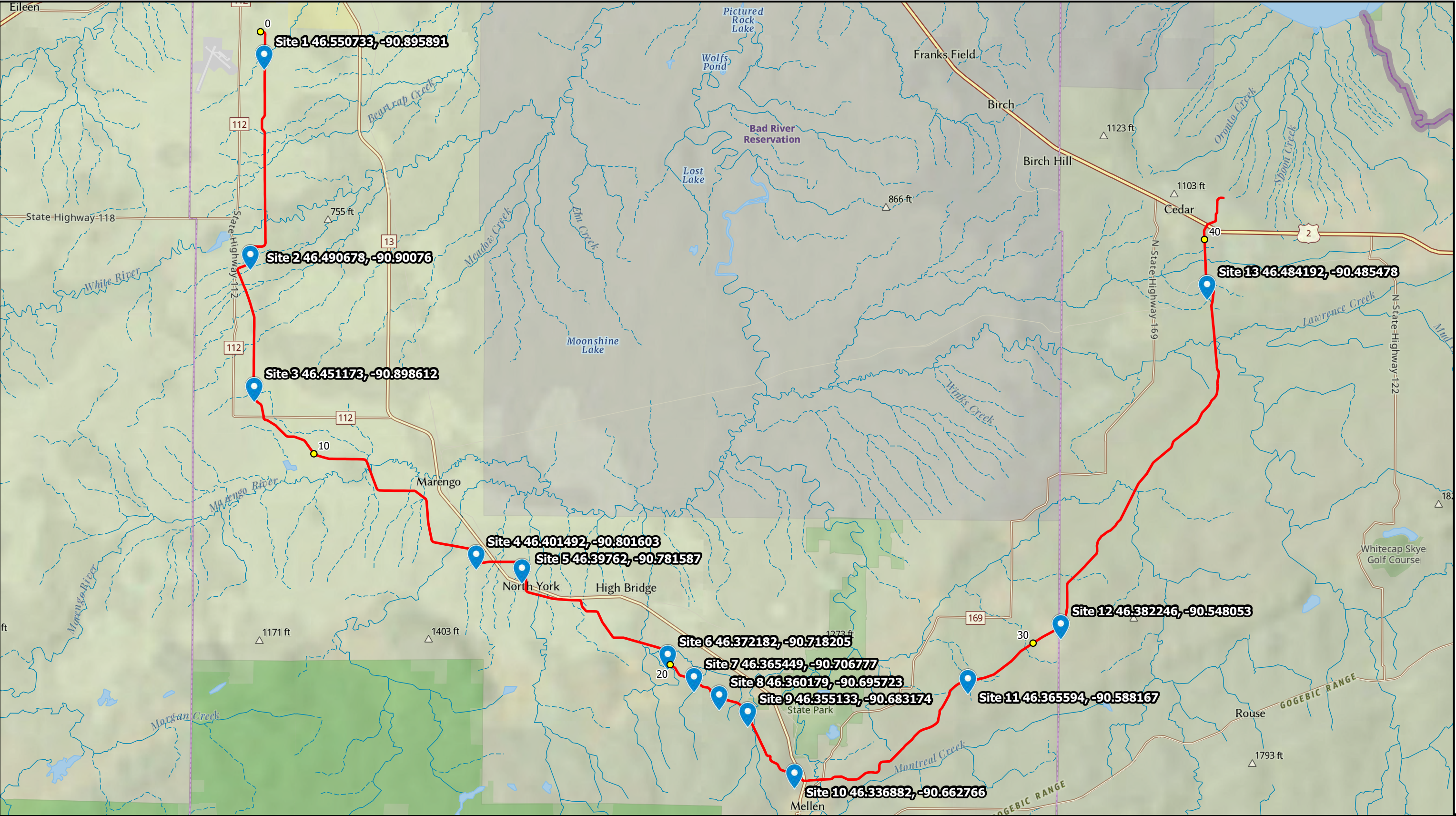
Table 2. Habitat Data, Average Depth, and Survey Effort for the Mussel Survey Sites associated with the Line 5 Segment Relocation Project, 2023.

Waterbody	Site	Detritus	Clay	Silt	Sand	Gravel	Cobble	Boulder	Bedrock	Woody Debris	Average Depth (ft)	Survey Effort (hours)
Bay City Creek	1	10	0	10	70	0	0	0	0	10	0.5	1.5
Rock Creek	2	0	0	10	70	10	0	0	0	10	0.3	1.0
UNT of Marengo River	3	0	0	10	60	20	10	0	0	0	0.3	1.0
UNT of Brunsweller River	4	0	0	10	50	30	0	0	0	10	0.5	1.5
UNT of Trout Brook	5	0	0	10	60	20	0	0	0	10	0.3	1.0
UNT of Silver Creek	6	0	0	10	40	30	20	0	0	0	0.6	1.0
UNT of Silver Creek	7	0	0	0	60	20	10	0	0	10	0.5	1.5
UNT of Silver Creek	8	0	20	60	0	0	10	10	0	0	0.3	1.0
UNT of Krause Creek	9	0	0	0	50	20	30	0	0	0	0.3	1.0
UNT of Bad River	10	20	10	50	20	0	0	0	0	0	0.3	1.0
UNT of Gehrman Creek	11	10	0	10	30	40	10	0	0	0	0.4	1.0
UNT of Feldcher Creek	12	0	0	0	30	50	20	0	0	0	0.3	1.0
UNT of Vaughn Creek	13	30	0	0	40	10	0	0	0	20	0.5	1.0

Table 3. Survey Conditions and Site Information for the Mussel Survey Sites associated with the Line 5 Segment Relocation Project, 2023.

Date	Waterbody	Site	Air Temp (°C)	Water Temp (°C)	Visibility (m)
10/23/2023	Bay City Creek	1	14.4	9.0	0.4
10/24/2023	Rock Creek	2	10.0	10.1	0.2
10/24/2023	UNT of Marengo River	3	12.2	9.4	0.2
10/24/2023	UNT of Brunsweller River	4	13.9	10.4	0.5
10/24/2023	UNT of Trout Brook	5	13.3	10.4	0.3
10/25/2023	UNT of Silver Creek	6	7.8	10.0	0.3
10/25/2023	UNT of Silver Creek	7	9.4	9.9	0.3
10/25/2023	UNT of Silver Creek	8	9.4	9.9	0.2
10/25/2023	UNT of Krause Creek	9	9.4	9.8	0.3
10/26/2023	UNT of Bad River	10	6.1	9.1	0.2
10/26/2023	UNT of Gehrman Creek	11	6.7	9.2	0.3
10/26/2023	UNT of Feldcher Creek	12	7.8	9.1	0.3
10/26/2023	UNT of Vaughn Creek	13	8.3	9.2	0.4

Figures

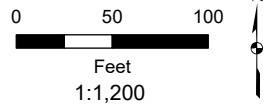
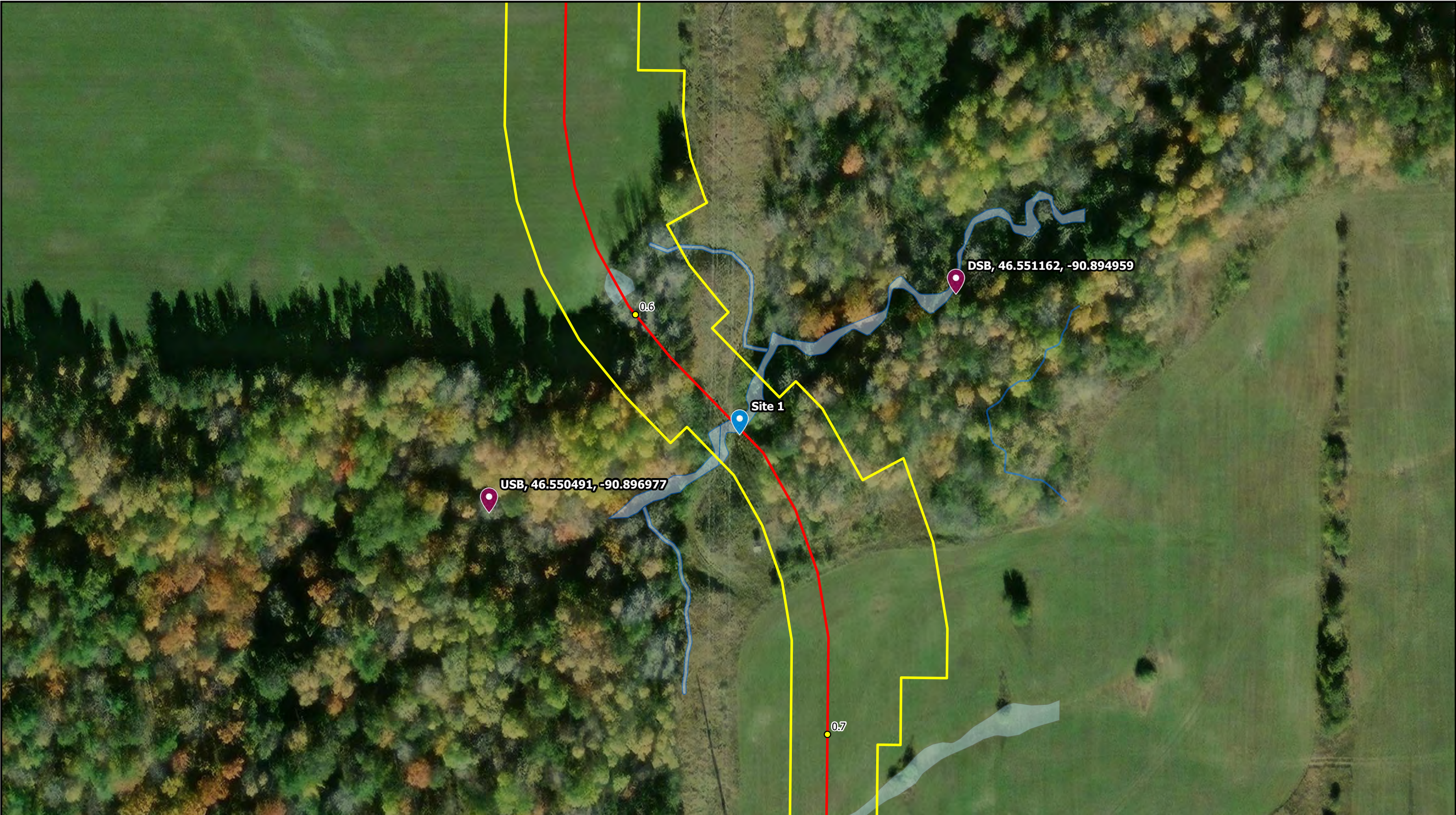


- Milepost
- Proposed Centerline
- Survey Location



Figure 1
Mussel Survey Overview
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



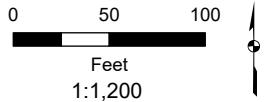
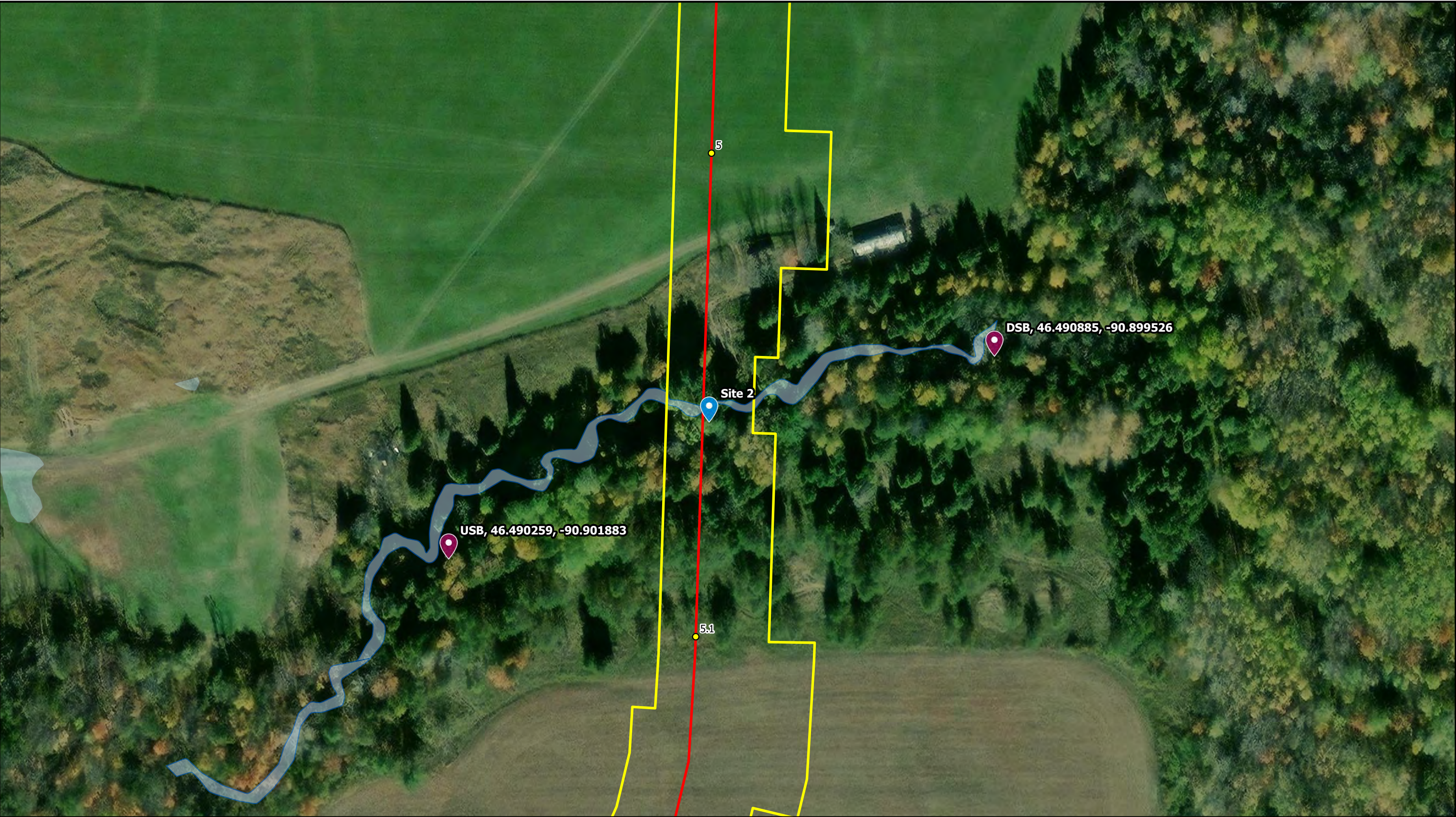


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2A
Mussel Location Site 1
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



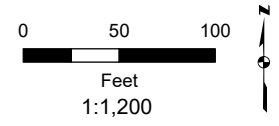


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2B
Mussel Location Site 2
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



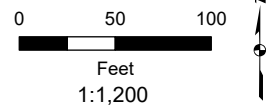
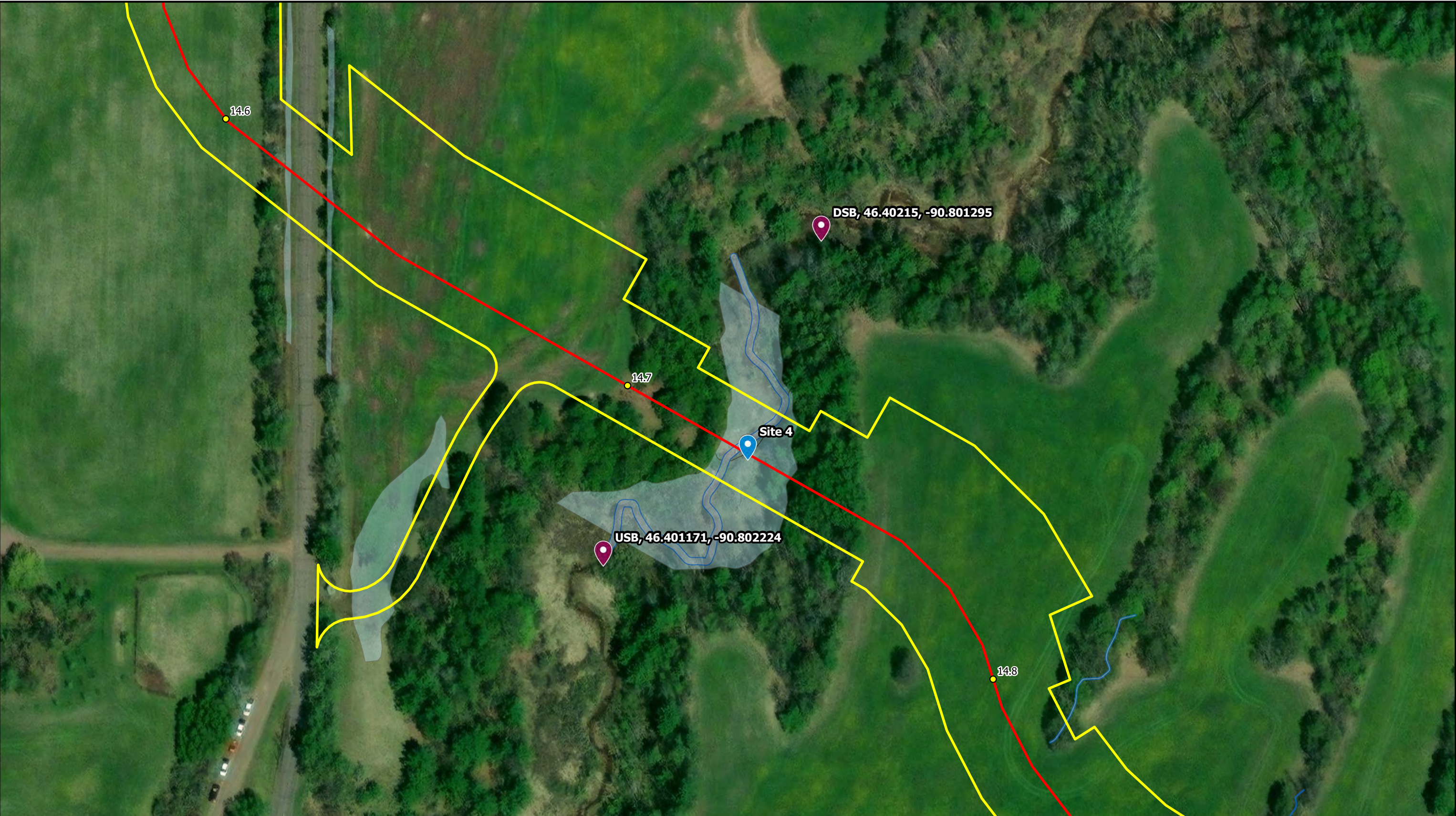


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2C
Mussel Location Site 3
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



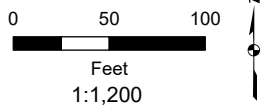


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2D
Mussel Location Site 4
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



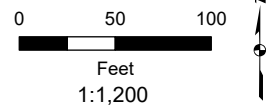
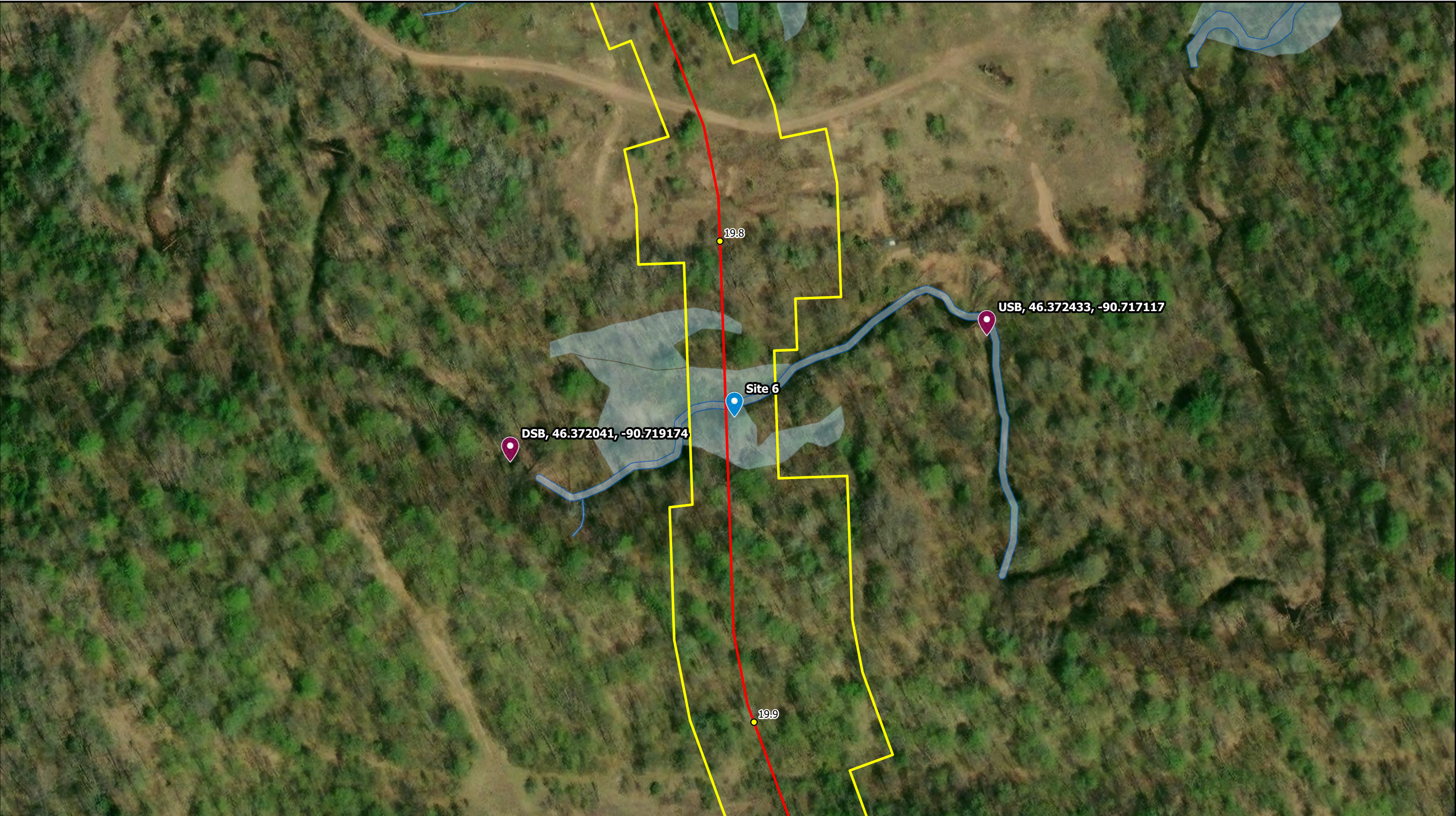


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2E
Mussel Location Site 5
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



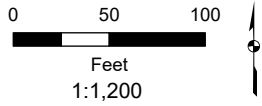


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2F
Mussel Location Site 6
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



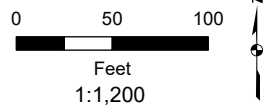


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2G
Mussel Location Site 7
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



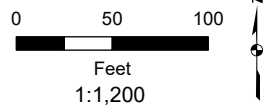
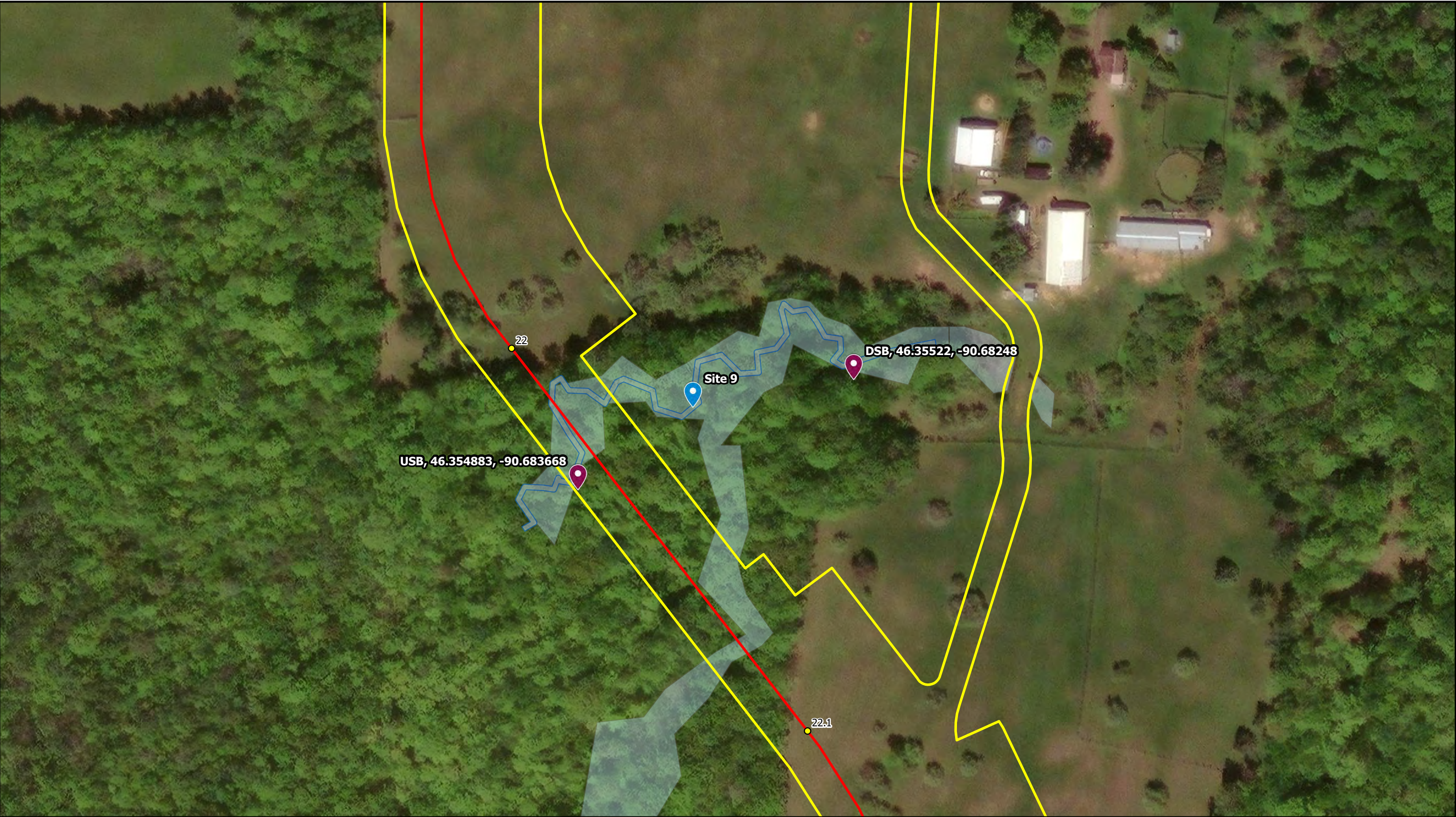


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2H
Mussel Location Site 8
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



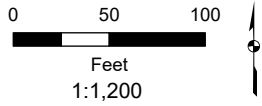
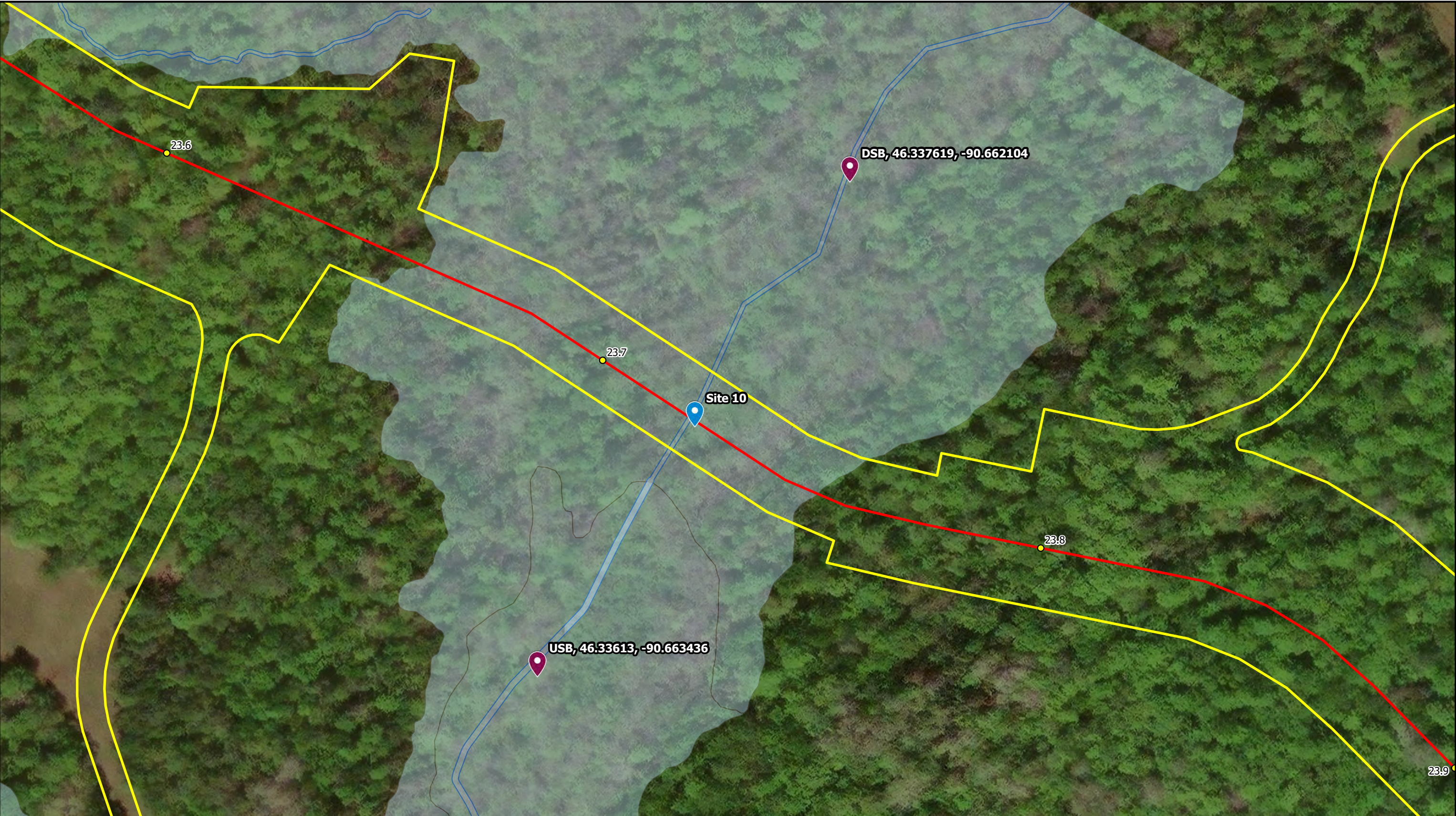


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 21
Mussel Location Site 9
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



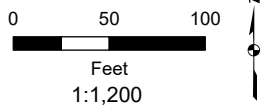
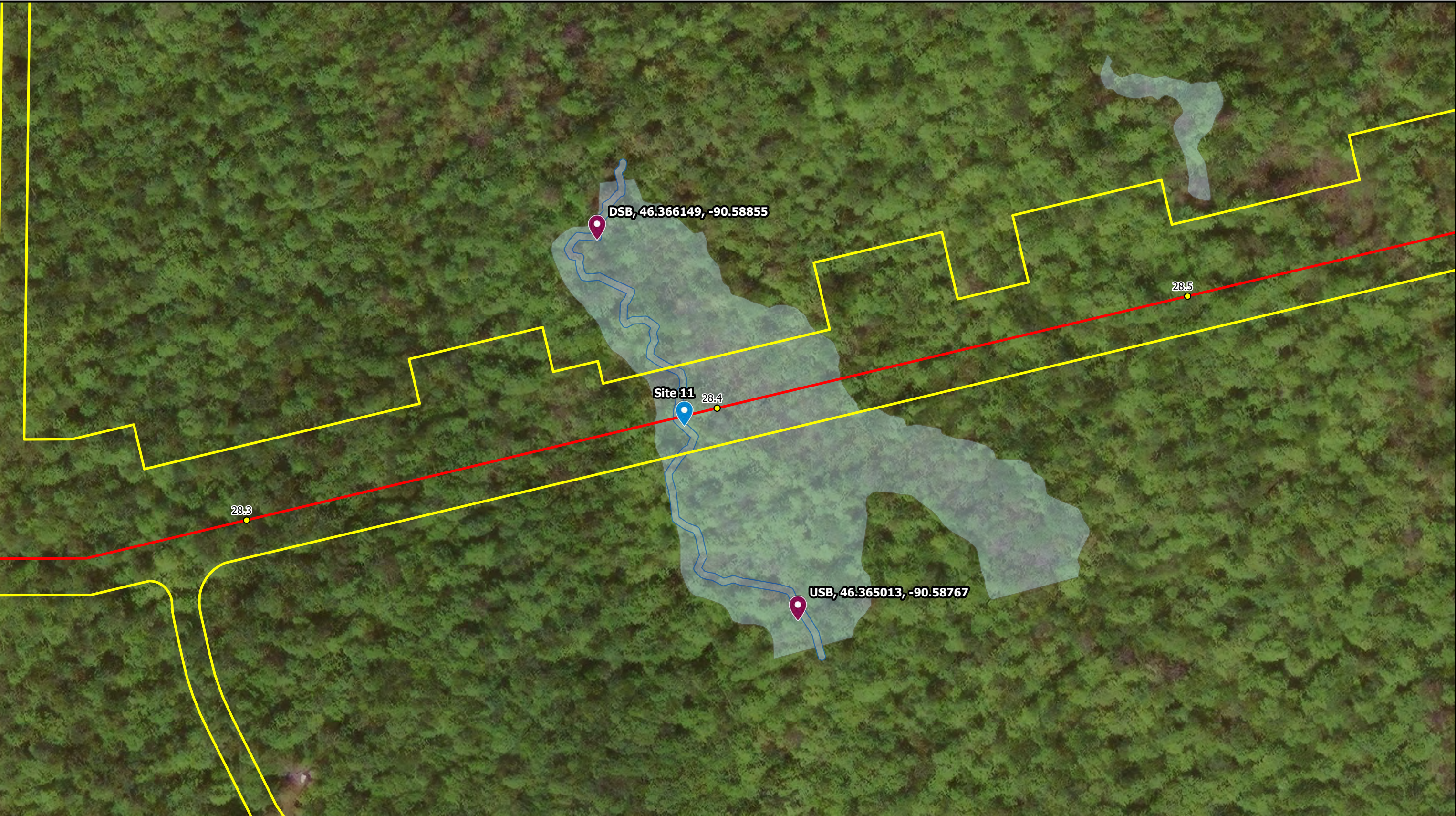


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2J
Mussel Location Site 10
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



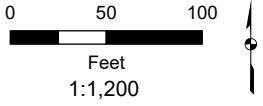


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2K
Mussel Location Site 11
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



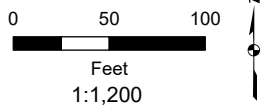


- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2L
Mussel Location Site 12
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin





- Milepost
- Proposed Centerline
- Survey Location
- Survey Start/End
- Limits of Disturbance
- Delineated Waterbody
- Delineated Wetland



Figure 2M
Mussel Location Site 13
Line 5 Wisconsin Segment Relocation Project
Enbridge Energy, LP
Ashland, and Iron Counties, Wisconsin



Appendix A

Survey Plan and WDNR Approval

Matt Gilkay

From: Weinzinger, Jesse J - DNR1 <jessej.weinzinger@wisconsin.gov>
Sent: Monday, October 23, 2023 4:51 PM
To: Matt Gilkay; Kitchel, Lisie E - DNR; Emily Grossman; Weinzinger, Jesse J - DNR
Cc: Philip Mathias
Subject: RE: Ashland, WI area mussel surveys

[EXTERNAL EMAIL - Please use caution]

Great, looking forward to your results!

We are committed to service excellence.

Visit our survey at <http://dnr.wi.gov/customersurvey> to evaluate how I did.

Jesse Weinzinger

Conservation Biologist – NHC
Wisconsin Department of Natural Resources
Cell Phone: (608) 576-8631
Jessej.weinzinger@wisconsin.gov



dnr.wi.gov



From: Matt Gilkay <mgilkay@envirosienceinc.com>
Sent: Monday, October 23, 2023 1:51 PM
To: Kitchel, Lisie E - DNR <Lisie.Kitchel@wisconsin.gov>; Emily Grossman <egrossman@envirosienceinc.com>; Weinzinger, Jesse J - DNR <Jesse.Weinzinger@wisconsin.gov>
Cc: Philip Mathias <pmathias@envirosienceinc.com>
Subject: RE: Ashland, WI area mussel surveys

**CAUTION: This email originated from outside the organization.
Do not click links or open attachments unless you recognize the sender and know the content is safe.**

Lisie,

I wanted to notify you that we are going to begin the Ashland County surveys today, our client wanted to continue with the surveys as planned. Additionally, I have attached a modified survey plan. Based on your insights on what we might expect to find (or not find), I added language for performing Initial Surveys based on the WI Wadable Guidelines. That is the only change to survey plan attached. I plan to use the data sheets found within the wadable guidelines.

If you have any questions for me, please let me know.

Matthew Gilkay

Aquatic Biologist / Malacologist

From: Kitchel, Lisie E - DNR <Lisie.Kitchel@wisconsin.gov>
Sent: Thursday, October 19, 2023 2:59 PM
To: Emily Grossman <egrossman@enviroscienceinc.com>; Weinzinger, Jesse J - DNR <Jesse.Weinzinger@wisconsin.gov>
Cc: Philip Mathias <pmathias@enviroscienceinc.com>; Matt Gilkey <mgilkay@enviroscienceinc.com>
Subject: RE: Ashland, WI area mussel surveys

[EXTERNAL EMAIL - Please use caution]

I might be able to save you a lot of time. My experience is if these are trout streams/classified as cold water streams that they do NOT contain mussels, so you could likely skip them especially if on a short timeframe, coolwater streams may contain musels, but not always. That said, if you are obligated to look at them all then go ahead. I doubt you will find much.

Your proposed survey plan is fine as proposed and may be modified as needed, just contact Jesse and I for confirmation.

You better get going, temps are dropping.....

Lisie Kitchel
Cell Phone: 608-220-5180

From: Emily Grossman <egrossman@enviroscienceinc.com>
Sent: Wednesday, October 18, 2023 9:52 PM
To: Kitchel, Lisie E - DNR <Lisie.Kitchel@wisconsin.gov>; Weinzinger, Jesse J - DNR <Jesse.Weinzinger@wisconsin.gov>
Cc: Philip Mathias <pmathias@enviroscienceinc.com>; Matt Gilkey <mgilkay@enviroscienceinc.com>
Subject: Ashland, WI area mussel surveys

Hi Lisie and Jesse,

Late in the season, but we have one last mussel survey project in Wisconsin we're hoping to squeeze into the next couple weeks, assuming temps hold. The project is a pipeline re-routing project which will include several perennial stream crossings. Our survey plan is attached, which essentially just consists of some qualitative searches at each proposed pipeline crossing to assess mussel presence/species composition.

It's our understanding that, because there are no records of T&E species occurring in these streams, that we just need your approval to proceed with the survey (no permit needed for handling non-listed mussel species, per correspondence from the WDNR ER Review/permit person). The survey will likely be led by our malacologist Matt Gilkey, who's been out with me on some Mississippi basin and Wisconsin work; his resume, and resumes of others who may be in the field with him, are also included in the attached survey plan.




Please let us know if you have any questions or need more info.

Thanks!

Emily Grossman
Senior Scientist/Project Manager



5070 Stow Road, Stow, OH 44224 | EnviroScienceInc.com
O. 800.940.4025 | C. 847.269.4159 | 24-HR 888.866.8540

OH | TN | VA | WV | NC   
Meet our new team in [North Carolina!](#)

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SURVEY PLAN FOR FRESHWATER MUSSEL SURVEYS FOR THE LINE 5 PIPELINE RE-ROUTING

Ashland, Iron, and Bayfield Counties, Wisconsin

Prepared for:



Wisconsin Department of Natural Resources
101 S Webster Street
Madison, WI 53707

Project No.: 18707
Date: 10/23/2023

Prepared by:



5070 Stow Rd.
Stow, OH 44224
800-940-4025
www.EnviroScienceInc.com

1.0 PROJECT INFORMATION

EnviroScience, Inc. presents this survey plan to the Wisconsin Department of Natural Resources Division of Wildlife (WDNR) on behalf of Environmental Resources Management (ERM; Client) to perform thirteen freshwater mussel surveys across three counties associated with the proposed Line 5 Pipeline Re-Routing (Figure 1). EnviroScience requests review and approval from WDNR on the survey plan described below.

PROJECT BACKGROUND

The proposed pipeline route crosses streams at thirteen distinct points across three counties. In February 2023, WDNR was consulted and an Endangered Resources Review was completed (ER Log #20-034), which consisted of a query of the Wisconsin Natural Heritage Inventory database for endangered resources records in the proposed Project areas. The Project area that was evaluated included the proposed facilities and workspace, and a buffer area surrounding the proposed facilities. The buffer area encompassed one mile for terrestrial and wetland species and two miles for aquatic species. No protected mussels were identified within the proposed facility sites, workspace, or associated buffer areas.

Although no known state or federally protected mussels have been previously documented in the Project area which would require mussel surveys, the client is voluntarily conducting a preliminary mussel habitat assessment at each perennial waterbody crossed by the pipeline centerline via a non-trenchless installation method (e.g., dam and pump or flume method). Where suitable mussel habitat is present, EnviroScience will conduct a quantitative mussel survey within the Project workspace following the methodology listed in the WDNR Guidelines for Sampling Freshwater Mussels in Wadable Streams (Guidelines).

PROJECT LOCATION AND SITE DESCRIPTION

The Project has thirteen distinct crossing points. Table 1 contains centerline coordinates and other applicable location information.

Table 1. Summary of proposed in-stream work centerlines associated with the Line 5 Pipeline Re-Routing, 2023.

Site Number	GPS Coordinate	Waterbody	City	County
1	46.550733, -90.895891	Bay City Creek	Ashland	Bayfield
2	46.490678, -90.90076	Rock Creek	White River	Ashland
3	46.451173, -90.898612	UNT of Marengo River	Ashland	Ashland
4	46.401492, -90.801603	UNT of Brunswelier River	Minersville	Ashland
5	46.39762, -90.781587	UNT of Trout Brook	North York	Ashland
6	46.372182, -90.718205	UNT of Silver Creek	High Bridge	Ashland
7	46.365449, -90.706777	UNT of Silver Creek	Mellen	Ashland
8	46.360179, -90.695723	UNT of Silver Creek	Mellen	Ashland
9	46.355133, -90.683174	UNT of Krause Creek	Mellen	Ashland
10	46.336882, -90.662766	UNT of Bad River	Mellen	Ashland
11	46.365594, -90.588167	UNT of Gehrman Creek	Mellen	Ashland
12	46.382246, -90.548053	UNT of Feldcher Creek	Tyler Forks	Iron
13	46.484192, -90.485478	UNT of Vaughn Creek	Gurney	Iron

2.0 METHODS

INITIAL SURVEYS

A preliminary mussel search will be conducted to determine the presence or absence of mussels at each site. Initial surveys will consist of a qualitative search effort performed via wading and view bucket techniques. The survey will be conducted by two field personnel starting at the downstream extent of the survey effort, and quartering back and forth between the streambank and the middle of the stream. Mean stream width (MSW) is anticipated to be less than 7 m, therefore the extent of these surveys will be 100 m upstream and downstream of the proposed crossing midline, for a total of 200 m of stream length. Searching will run for the full extent of the survey length unless evidence of a mussel community (shell material and/or a live mussel) is collected. Search effort will exceed one hour per initial survey site. If shell material or a live individual is collected, the survey will transition into a qualitative survey following the methodology outlined below.

QUALITATIVE SURVEYS

Qualitative timed searches will be used to estimate mussel abundance and species richness at each stream crossing. The anticipated workspace at each of the thirteen crossing locations will extend across the width of each stream (all <15 m) and will be approximately 30 – 35 m long. Per Wisconsin's mussel sampling guidelines, the mussel survey area will include a maximum stream length of 200 m (100 m upstream and 100 m downstream of the proposed pipe centerline), and a minimum of four person-hours of search time will be conducted in the survey area at each crossing. The downstream extent of the qualitative searches will be the ending point of the initial survey that triggered the need for a qualitative survey. Biologists will search the substrate via wading or snorkeling, collecting all mussels encountered visually and tactually in the allotted search time. A cumulative species curve will be developed to determine the likelihood that all species present in the project area have been collected. Depth, substrate composition will be recorded for each survey area.

The surveys will be lead by Mr. Phil Mathias, Mr. Matthew Gilkay, or Mr. Scott LaValley (resumes and experience summaries found in Appendices A, B, and C, respectively), and will be assisted by experienced field personnel (>200 hours of mussel survey time).

MUSSEL PROCESSING, HANDLING, AND DATA COLLECTION

All live mussels will be identified to species, counted, and categorized as adult (>5 external annuli) or juvenile (≤5 external annuli). At least one individual of each mussel species will be photographed. All dead shells will be identified to species, scored as either fresh dead (lustrous nacre, dead less than one year), weathered dead (dull or chalky nacre, dead one to many years), or subfossil (heavily weathered and fragmented, dead many years to many decades), and noted as present. Mussels will be kept cool and moist and will not be out of the water for more than five minutes during processing. Taxonomy will follow guidance from the Freshwater Mollusk Conservation Society (FMCS, 2021).

MUSSEL SURVEY REPORTING

A final report for distribution to regulatory agencies will be completed within five business days after receiving ERM's comments (within a 45-day timeframe). The report will include introduction, methods, results, and discussion sections. GIS-based mapping will provide further visual presentations of the survey findings.

3.0 SURVEY SCHEDULE

EnviroScience will conduct the mussel surveys upon authorization from WDNR in October 2023, as long as weather and survey conditions remain within the thresholds outlined in the Guidelines (air temperature is above 32 °F and water temperature is above 40°F).

4.0 LITERATURE CITED

- Freshwater Mollusk Conservation Society. (2021). 2021 FMCS checklist of freshwater mussels (Mollusca: Bivalvia: Unionida) of the United States and Canada. https://molluskconservation.org/Library/Committees/Names/Appendix_1_Bivalves_Revised_Names_List_20210825.pdf.
- Piette, R. (2015). Guidelines for sampling freshwater mussels in wadable streams. Wisconsin Department of Natural Resources, Fisheries and Aquatic Sciences Research Program. 50pp.

Figure 1
Project Location Map



Appendix A:

Resume and Summary of Field Experience: Phil Mathias



PHILIP MATHIAS

Marine Services Manager | Malacologist

As a Malacologist for EnviroScience, Inc., Philip Mathias's role includes helping municipal and industry clients meet state and federal protocols for mussel protection. Philip began his mussel career in 2007 while attending the University of Toledo and continued to graduate school at Central Michigan University. Philip has worked on projects nationwide and has held sampling permits throughout the Midwest and Ontario, Canada, with current permits in Michigan, Pennsylvania, West Virginia, Ohio, New York, Texas, and Illinois. Philip was Wyoming's State Native Mussel Biologist for five years, where he designed and implemented the statewide native mussel survey protocols. He has worked extensively with federally and state-listed species in the Great Lakes, Ohio River, and Illinois River drainages. Additionally, he has completed or assisted with numerous Biological Assessments, Incidental Take Authorizations, and 316a/b permits. He is active in the Freshwater Mollusk Conservation Society member.

EDUCATION

M.Sc. Conservation Biology,
Central Michigan University, 2016

B.Sc. Environmental Science
(Biology), University of Toledo,
2009

CERTIFICATIONS

Approved State Mussel Contractor
in IL, MI, OH, NY, PA, TX, & WV

SSI Open Water Diver Certified

Ohio Division of Watercraft
NASBLA Approved Boating
Education Course

DAN O₂ Provider

Roadway Worker Protection
Contractor Safety Certified

YEARS OF EXPERIENCE

EnviroScience, Inc.: 5

Wyoming Game & Fish
Department: 5

Central Michigan University: 2

University of Toledo Research
Technician: 3

RELEVANT EXPERIENCE

Endangered Mussel Surveys

Endangered Fish Surveys

Mussel Translocation and
Monitoring

GIS for Management of
Endangered Mussels and Fish

Stream Substrate or Habitat
Surveys

SELECTED PROJECT EXPERIENCE

U.S. Army Corps of Engineers Massillon Local Protection Project Mussel Survey and Relocation, Field Manager, 2020. EnviroScience was contracted to conduct a mussel survey and relocation along 3,940 linear meters (12,927 linear feet) of severely eroded levees in the Tuscarawas River through Stark County, Ohio. Philip led a crew of 12 surveyors, including a six-person commercial dive team and many snorkelers, to complete the survey and relocation within the survey protocol and emergency time constraints that the project presented. Nearly 1,200 individual survey cells were established along the banks, and a total of 6,600 live mussels representing 14 species were surveyed. Of those, 5,500 mussels in total were relocated daily over two months to an established relocation site in the Tuscarawas River. With the mussel resources removed the emergency repairs to the levees could be conducted.

PennDOT Programmatic Agreement Management Unit 3 Mussel Surveys, Crew Lead/Field Staff, 2018-2020. EnviroScience was the sole contractor tasked to complete mussel surveys on over 200 miles of stream in western PA. Philip assisted with over half of this work in the summer of 2018 while working with a 15-member staff. Findings from these survey efforts have been utilized to streamline the PennDOT coordination processes with USFWS and have confirmed the presence of T&E species and expanded the known range of the state-endangered salamander mussel.

**Philip was Wyoming's
State Native Mussel
Biologist for five years.**

RELEVANT EXPERIENCE (CONT'D):

Coordination with Government,
State Agencies, and Private
Landowners

USFWS Biological Assessment
Preparation

Field experience throughout the
Great Lakes, Ohio River, and
Illinois River Drainages

SELECTED PUBLICATIONS:

Mathias, P.T. 2018. Threatened
and Endangered Species
Conservation Measures for
Pipeline ILI Inspections in the
Kankakee River. Near
Wilmington, Illinois. Final Report
to BP U.S. Pipeline and Logistics.

Tronstad, L.M., **P.T. Mathias**, O.J.
Wilmot, A. Cvancara, & K.
Lippincott. 2017. Mussels of
Wyoming. University of Wyoming
Biodiversity Institute, Laramie,
WY.

Mathias, P.T., J.R. Hoffman, C.C.
Wilson, & D.T. Zanatta. 2016.
Signature of postglacial
colonization on contemporary
genetic structure and diversity of
Quadrula quadrula (Bivalvia:
Unionidae). *Hydrobiologia*:
doi:10.1007/s10750-016-3076-0
pp. 1-19

PennDOT Hunter Station Mussel Salvage and Relocation for Bridge Replacement, Tagging and Relocation Manager/Field Assistant/Diver, 2016; Monitoring 2017 – Present. EnviroScience was the lead contractor for the largest endangered species salvage and reintroduction effort to date. Over 130,000 mussels were salvaged from the Hunter Station Bridge project area and relocated to suitable habitat across the species' historic range in the Midwest and Northeast. Monitoring of relocated populations will continue for several years. Philip directed and streamlined the PIT tag, glitter tag, and relocation efforts by managing EnviroScience staff and federal and state government personnel, including individuals from PennDOT, FHWA, USFWS, Western Pennsylvania Conservancy, U.S. Forest Service, and nine state agencies. Philip kept detailed records of the mussels before, during, and post-relocation efforts.

WVDOH Mussel Surveys, Translocations, and Monitoring Events, Field Staff to Project Manager, 2016 – Present. Philip has participated in over five mussel surveys and relocations for WVDOH since 2016. Project sizes have ranged from small streams to large rivers. Surveys were completed for ESA and state compliance and often included both qualitative and quantitative components. Philip has assisted with one Biological Assessment for WVDOH and was project manager for the large scale I-79 over the Tygart River bridge replacement mussel survey.

ODOT Freshwater Mussel Bridge Surveys, Project Manager/Field Leader, 2016 – Present. Philip has led and assisted with over 10 mussel surveys and population studies for bridge and waterline projects for ODOT. Projects range from reconnaissance surveys on small streams to completing a two-week-long survey and relocations with an eight-man crew on the Maumee River. These surveys were completed for ODNR compliance and funded by ODOT.

BP-U.S. Pipeline and Logistics Mussel and Fish Survey, Relocation, and Monitoring, Project Manager 2016-Present. EnviroScience was contracted by BP U.S. Pipelines & Logistics, Inc. (BP USPL) to support time-sensitive Department of Transportation pipeline inspections and repairs near Wilmington, IL. EnviroScience provided environmental services that included baseline surveys for mussels, fish, reptiles, endangered plants, bat habitat, vegetation/wetland delineation, bats, mammals, terrestrial insects, and birds. Because federally and state listed mussels were detected within the project area, A full-scale mussel relocation for federally and state listed and non-listed mussels was conducted under the direction of Philip in 2017. Beginning in 2018, a 10-year monitoring program was initiated at the project and relocation areas for mussels and non-listed and state-listed fish.

Philip Mathias

Malacologist

1989 Marhofer Ave, Stow, OH 44224

Ph. (419) 340-2487 • mathias.philip@gmail.com

EDUCATION

MASTER OF SCIENCE

(May 2009 – December 2016)

Central Michigan University (CMU)

Mount Pleasant, MI

Program: Conservation Biology

Title: Signature of postglacial colonization on contemporary genetic structure and diversity of *Quadrula quadrula* (Bivalvia: Unionidae)

Advisors: Dr. David T. Zanatta (CMU) and Dr. Chris C. Wilson (Trent University Peterborough, Ontario, Canada)

BACHELOR OF SCIENCE

(August 2005 – May 2009)

ENVIRONMENTAL SCIENCE (BIOLOGY)

University of Toledo

Toledo, OH

Cum laude and Departmental Honors

Honors Thesis: Distribution of Unionid Mussels (Unionidae) in Ottawa River from the University of Toledo Main Campus to the Stranahan Arboretum

Advisor: Dr. Jonathan M. Bossenbroek

WORK EXPERIENCE

SENIOR SCIENTIST & MALACOLOGIST

(APRIL 2016 - PRESENT)

EnviroScience, Inc., Stow, OH

• Qualified Malacologist:

- Pennsylvania
 - Great Lakes and Ohio River drainages
 - Permitted for all species including Federally Listed Species
- West Virginia
 - Permitted for all species including Federally Listed Species
- Ohio
 - All streams except those with Federally Listed Species
- Illinois
 - All species, including state threatened and endangered species, except Federally listed species
- Michigan
 - All species, including state threatened and endangered species, except Federally listed species
- Texas
 - All species, including state threatened and endangered species, except Federally listed species
- Extensive knowledge of the permitting process in Illinois with the IDNR and USFWS
- Lead over 20 surveys a year with crews ranging from two personnel to over 13
 - Author reports for every survey and relocation conducted
- Used SCUBA, snorkeling, tactile, and viewbucket search methods to survey for native mussels depending on approved methods and site conditions
- Led ADCI commercial dive teams on navigable waters to conduct mussel surveys and relocations
- Support clients with USFWS Endangered Species Act Section 7 consultation
 - Authored Biological Assessments in IL, WV, and PA
- Support Gov, NGO, A & E firms, and Oil & Gas firms with mussel surveys and permitting
- 316b and 316a assessments on mussels

Philip Mathias

Malacologist

1989 Marhofer Ave, Stow, OH 44224

Ph. (419) 340-2487 • mathias.philipt@gmail.com

- Ability to obtain:
 - U.S. Fish and Wildlife Service (USFWS) Federal Recovery Permit for Mussels
 - NY State Collection Permit
 - Ohio Hellbender Permit

Recent and Large Projects:

- U.S. Army Corps of Engineers Bank Stabilization, Tuscarawas River, Ohio
 - Managed up to 13 people in two separate crews surveying and relocating mussels
 - 4,450 linear meters (14,600 linear feet) of survey distance to support upgrades to the levee.
 - Nearly 55,472 m² (600,000 ft²) of area was surveyed over 2.5 months
- Cambridge Springs
 - Managed a crew of 12 divers
 - 1,117 m² (12,021 ft²) salvage area
 - Five federally listed species and several state listed species, including the salamander mussel
- Kalamazoo River (2021-2022)
 - Managed 11 people between two dive crews working simultaneously
 - 51,220 m² (551,327 ft²) of survey and relocation area
 - Negotiated with MDNR to a reduced scope to advocate for out client
- Kankakee River for the BP pipeline repair (2016, 2017, 2018, 2019, 2021, 2023, 2025, 2027)
 - Project manager of a six week, \$450,000 mussel relocation and subsequent monitoring events averaging \$40,000 to \$130,000 each year
 - Lead all identification, relocation, tagging of mussels ($n=13,622$; T&E $n=918$)
 - Over 90% salvage efficiency
 - *P. cyphus* was present along with three state listed species
 - Managed and coordinated up to 12 individuals at a time for the duration of the project (six weeks)
 - Stayed at the project site during construction to oversee environmental permits
- PennDOT Programmatic Biological Opinion updates
 - Leading the updates on the programmatic agreement between USFWS and PennDOT for every project in the Ohio River basin of PA.
- PennDOT Management Unit 3 Stream Survey (2018-2019)
 - Field lead for over 100 surveys on unknown mussel streams
 - Paddled over 100 miles of stream
 - Managed up to eight individuals per paddling trip
- Supervised all tagging and shipping operations of federally endangered and non-listed mussel species in 2016 at the Hunters Station Bridge replacement project over the Allegheny River
 - Assisted with project management, data recording, mussel identification, and sorting
 - Assisted with report writing and data management
 - Collected mussels from search cells and excavated pre-salvage and post-salvage quadrats
- Assisted with the salvage, PIT/Hallprint Tagging, and relocation of *Villosa fabillis* and *Theliderma cylindrica* from French Creek (Saegertown, PA)
- Extensive experience with the Ohio and West Virginia Mussel Survey Protocols
- Assisted with cell searches, quadrat excavations, data analysis, and report writing for a mussel survey in the Delaware River on the PA/NY border.

Philip Mathias

Malacologist

1989 Marhofer Ave, Stow, OH 44224

Ph. (419) 340-2487 • mathias.philip@gmail.com

NATIVE MUSSEL BIOLOGIST

(May 2011 – April 2016)

Wyoming Game & Fish Department (WGFD) - Aquatic Assessment Crew

Casper, WY

- Designed and implemented Native Mussel Survey Protocols for the State of Wyoming
- Planned, organized, and supervised native mussel survey trips throughout WY
- Surveyed for rare species in western WY that are potential candidates for federal protection
- Maintained a database for historic and current records of WY's native mussels
- Composed professional administrative, annual progress, and annual performance reports
- Applied for and received funding through multiple sources to perform statewide native mussel surveys
- Managed and tracked multiple budgets and reported on expenditures to supervisors
- Hired and supervised a team of two seasonal technicians per field season
- Taught taxonomic identification skills of native mussel species in WY to WGFD personnel
- Provided performance evaluations and reference letters for technicians
- Required to demonstrate strong communication skills both internally and externally (e.g. numerous governments agencies, NGO's, and private landowners)
- Provided management recommendations and conservation status ranking suggestions for native mussels in Wyoming to WGFD administration
- Discussed concerns and recommendations for habitat usage and habitat improvements for native mussels with private landowners
- Represented the state on native mussel research at numerous meetings and in workgroups
- Collected and prepared live and relic voucher specimens for museum collections
- Used snorkels, viewbuckets, tactile searches, and clam rakes to survey for native mussels
- Led crews into remote areas and over rough terrain to survey for native mussels for up to two weeks at a time and up to three weeks a month
- Identified Corbiculacea to the genus level for the WY Aquatic Invasive Species Program
- Operated boats and 4WD vehicles with trailers up to 22 feet long and was responsible for the maintenance of field equipment

Assisted other crews with field work (e.g. herpetofauna surveys, backpack and raft electrofishing, reservoir hydroacoustic fish monitoring, greater sage grouse lek counts, fish hatchery stocking preparation, and pheasant hatchery operations and maintenance)

MASTER OF SCIENCE WORK

(May 2009 – Dec2016)

Central Michigan University

Mount Pleasant, MI

- Field collected genetic tissue samples and glochidia from *Quadrula quadrula* throughout North America
- Organized and executed collection trips in five states (OH, MI, IN, IL, MO) and Ontario, Canada for two species of native mussel over two field seasons
- Obtained scientific collection permits for native mussel collection (OH, IN, IL, MO) and composed collection reports to the permitting states
- Collected native mussels using tactile, SCUBA, viewbucket, and snorkeling methods
- Performed and assisted with timed, semi-quantitative, and substrate excavation surveys for native mussels
- Applied for and received funding through multiple sources for field work
- Taught taxonomic identification skills for common native mussel species in the Midwest and Great Lakes drainages to numerous undergraduate and graduate students.
- Trained undergraduate and graduate students in genetic laboratory and field sampling techniques
- Contacted multiple agencies and individuals for tissue samples and genetic primer information
- Presented data from my research at various meetings
- Extracted, amplified, and analyzed genomic DNA for over 1300 individual *Q. quadrula* from 40 sites among 26 different rivers

Philip Mathias

Malacologist

1989 Marhofer Ave, Stow, OH 44224

Ph. (419) 340-2487 • mathias.philip@gmail.com

UNDERGRADUATE RESEARCH TECHNICIAN (December 2007 – May 2009)

University of Toledo Lake Erie Center – Applied Spatial Ecology Lab Toledo, OH

- Managed and inputted data in ArcGIS, Microsoft Excel, and Microsoft Access
- Field assistant for native non-game fish and native mussel studies throughout the Great Lakes, Ohio River, and Tennessee River drainages
- Designed and conducted an undergraduate thesis project on the distribution and presence of unionid mussels in an urban stream
- Performed and assisted with timed, semi-quantitative, substrate excavation, and transect line surveys for native mussels
- Taught other undergraduate students taxonomic identification skills for common native mussel species in the Midwest and Great Lakes drainages.
- Mapped and analyzed ArcGIS data for supervisory, graduate, and personal research projects
- Assisted in ArcGIS data collection and management for emerald ash borer studies

UNDERGRADUATE RESEARCH TECHNICIAN (May 2008 – September 2008)

University of Toledo – Wetlands Ecology Lab Toledo, OH

- Studied fish assemblages in agricultural ditches in the Lake Erie drainage
- Identified fish species present in waterways

VOLUNTEER INTERNSHIP (May 2007 – December 2007)

University of Toledo Toledo, OH

- Assisted with native mussel and native fish research in OH, MI, NC, VA, TN, and KY
- Learned the proper use of seine nets and the proper handling of fish and unionids for research

TEACHING EXPERIENCE

TEACHING ASSISTANT (January 2010 – May 2011)

Central Michigan University Mount Pleasant, MI

- Led undergraduate student labs for Introduction to Biology for Non-majors and Zoology
- Graded examinations and homework
- Created quizzes and tests for students

COMPUTER SKILLS

- Windows and Macintosh Operating Systems
- ArcGIS and ArcPad (analyses, map making, field data collection, and troubleshooting)
- Microsoft Office Suite
- GPS units (e.g. Geode, Trimble, Magellan, Garmin, etc.)
- Statistical Software (e.g. Minitab, R, and SAS)

SELECTED WORKS (PUBLICATIONS AND FINAL REPORTS)

Zimmerman, G.F., R.S. Schwegman, **P.T. Mathias**, & D.D. Dunford. 2022. 2015 – 2020 Endangered Mussel Salvage Summary Report: Hunters Station Bridge Replacement Project S.R. 0062 Section B01 over the Allegheny River Tionesta Township, Forest County, Pennsylvania; USFWS Project #2009-0550. Draft Report to the Pennsylvania Department of Transportation District 1-0 and the USDOT Federal Highway Administration. pp.169

Mathias, P.T. 2018. Threatened and Endangered Species Conservation Measures for Pipeline ILI Inspections in the Kankakee River. Near Wilmington, Illinois. Final Report to BP U.S. Pipeline and Logistics.

Mathias, P.T. & G.F. Zimmerman. 2016. Freshwater Mussel Survey for Roebling Bridge upgrade project over the Delaware River Pike County, Pennsylvania and Sullivan

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- County, New York. Final Report to the USDOT Federal Highway Administration.
- Tronstad, L.M., **P.T. Mathias**, O.J. Wilmot, A. Cvancara, & K. Lippincott. 2017. Mussels of Wyoming. University of Wyoming Biodiversity Institute, Laramie, WY.
- Wilmot, O.J., **P.T. Mathias**, & L.M. Tronstad. Wyoming native freshwater mussel surveys:2015-2016. Wyoming Game and Fish Department Fish Division Administrative Report.
- Mathias, P.T.**, J.R. Hoffman, C.C. Wilson, & D.T. Zanatta. 2016. Signature of postglacial colonization on contemporary genetic structure and diversity of *Quadrula quadrula* (Bivalvia: Unionidae). *Hydrobiologia*: doi:10.1007/s10750-016-3076-0 pp. 1-19
- Mathias, P.T.** 2016. Signature of postglacial colonization on contemporary genetic structure and diversity of *Quadrula quadrula* (Bivalvia: Unionidae). Master's Thesis. Central Michigan University, Mount Pleasant, MI.
- Mathias, P.T.** 2014. Native freshwater mussel surveys of the Bear and Snake rivers of Wyoming. Wyoming Game and Fish Department Fish Division Administrative Report.
- Mathias, P.T.** 2014. Document the distribution and population status of native mussels in the state. Annual Progress Report to WGFD Fish Division Administration.
- Mathias, P.T.** In Review. Native freshwater mussel surveys of the Wind-Bighorn drainage of Wyoming. Wyoming Game and Fish Department Fish Division Administrative Report.
- Mathias, P.T.** 2014. Distribution and Ecology of Wyoming's Native Freshwater Mussels. U.S. Fish and Wildlife Service State Wildlife Grant Program Performance Report.
- Mathias, P.T.** 2013. Distribution and Ecology of Wyoming's Native Freshwater Mussels. U.S. Fish and Wildlife Service State Wildlife Grant Program Performance Report.
- Mathias, P.T.** 2013. Document the distribution and population status of native mussels in the state. Annual Progress Report to WGFD Fish Division Administration.
- Mathias, P.T.** 2012. Distribution and Ecology of Wyoming's Native Freshwater Mussels. U.S. Fish and Wildlife Service State Wildlife Grant Program Performance Report.
- Mathias, P.T.** 2012. Document the distribution and population status of native mussels in the state. Annual Progress Report to WGFD Fish Division Administration.
- Mathias, P.T.** and G.E. Edwards, Jr. 2012. Study to Document Mussel Diversity in Wyoming. *Ellipsaria* 14(1): 9-11.
- Mathias, P.T.** 2011. Distribution and Ecology of Wyoming's Native Freshwater Mussels. U.S. Fish and Wildlife Service State Wildlife Grant Program Performance Report.
- Mathias, P.T.**, J.M. Bossenbroek, E.A. Heppner, and T.D. Crail. 2009. Distribution of Unionid Mussels in the Ottawa River from University of Toledo Main Campus to the Stranahan Arboretum. Honors Thesis in the Univ. of Toledo Undergrad Summer Research Program.
- Crail, T.D., J.F. Gottgens & **P.T. Mathias**. 2007. Status and distribution of native unionid mussels (Unionidae) in the coastal wetlands of the Winous Point Marsh Conservancy. Final Report to the Winous Point Marsh Conservancy: 21 pp.

RESEARCH SUPPORT

- U.S. Fish and Wildlife Service State Wildlife Grant + WGFD match. 2017-2019. **\$183,131**. Co PI's: G.P. Edwards, Jr. and **P.T. Mathias**. *Native freshwater mussel follow up investigations: filling survey gaps and exploring newly discovered populations.*
- U.S. Fish and Wildlife Service State Wildlife Grant + WGFD match. 2015-2017. **\$183,131**. Co PI's: G.P. Edwards, Jr. and **P.T. Mathias**. *Native freshwater mussel follow up investigations: filling survey gaps and exploring newly discovered populations.*
- U.S. Fish and Wildlife Service State Wildlife Grant + WGFD match. 2014-2015. **\$74,700**. Co PI's: G.P. Edwards, Jr. and **P.T. Mathias**. *Distribution and ecology of native freshwater mussels in Northeast Wyoming.*
- Wyoming Governor's ESA Funding + WGFD Match. 2013-2014. **\$106,103**. Co PI's: G.P. Edwards, Jr. and **P.T. Mathias**. *Distribution and ecology of Wyoming's native freshwater mussels: Phase two.*

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- U.S. Fish and Wildlife Service State Wildlife Grant + WGFD match. 2011-2013. **\$196,950**. Co PI's: G.P. Edwards, Jr. and **P.T. Mathias**. *Distribution and ecology of Wyoming's native freshwater mussels*.
- Conchologist of America-Grants to Malacology. 2010-2011. **\$1,400**. PI: **P.T. Mathias**. *The Geographic Genetic Structure and Diversity of *Quadrula quadrula* (Bivalvia: Unionidae): Post-Glacial Colonization of the Great Lakes*.
- Student Research and Creative Endeavors: Office of Research and Sponsored Programs (CMU). 2010. **\$800**. Co-PI's **P.T. Mathias** and D.T. Zanatta. *The Geographic Genetic Structure and Diversity of *Quadrula quadrula* (Bivalvia: Unionidae): Post-Glacial Colonization of the Great Lakes*.
- Endangered Species Recovery Fund (ESRF) – World Wildlife Fund Canada (**\$57,938 per year +DFO match**), 2008. Co-PI's: Dr. David Zanatta, CMU; Dr. Chris Wilson, Trent University; and Dr. Josef Ackerman, University of Guelph. **NOTE: \$12,000US sub-contracted to Central Michigan University for MS student stipend support allocated to Philip Mathias**.
- URS&CAP/OUR Summer Research Award. 2008. **\$3,000**. Co-PI's **P.T. Mathias** and J.M. Bossenbrook-University of Toledo-Lake Erie Center. *Distribution of Unionid Mussels (Unionidae) in Ottawa River from the University of Toledo Main Campus to the Stranahan Arboretum*.

ORAL PRESENTATIONS

- Mathias, P.T.** & G.F. Zimmerman. Freshwater Mussel Survey for Roebling Bridge upgrade project over the Delaware River Pike County, Pennsylvania and Sullivan County, New York. 2017 New England/NY Freshwater Mussel Meeting, March 7, 2017, Hadley, MA.
- Schwegman, R., G.F. Zimmerman, and **P.T. Mathias**. PennDOT / Hunter Station (S.R. 62) Bridge Replacement Project Endangered Mussel Salvage and Relocation. West Forest Elementary, November 2017, Tionesta, PA.
- Schwegman, R., G.F. Zimmerman, and **P.T. Mathias**. PennDOT / Hunter Station (S.R. 62) Bridge Replacement Project Endangered Mussel Salvage and Relocation. West Forest Elementary, January 2017, Tionesta, PA.
- Mathias, P.T.** Wyoming's Native Freshwater Mussels. Joint Meeting of the Idaho Chapter of The Wildlife Society, Washington Chapter of The Wildlife Society, Society for Northwestern Vertebrate Biology & NW Partners in Amphibian and Reptile Conservation, February 2016, Coeur d'Alene, ID.
- Mathias, P.T.** Wyoming's Native Freshwater Mussels. Wyoming Game & Fish Commission April Meeting, April 2015, Casper, WY.
- Mathias, P.T.** UPDATE: Native Freshwater Mussels of Wyoming. Colorado/Wyoming Chapter of the American Fisheries Society. Laramie, WY March 2015.
- Mathias, P.T.** Native Mussels of (and around) the Bridger Teton National Forest. Webinar for the USFS Fisheries Biologist of the Bridger Teton National Forest, January 2013.
- Mathias, P.T.** Mussels of Wyoming. Webinar for the Pacific Northwest Native Mussel Workgroup Quarterly Meeting, December 2012.
- Mathias, P.T.** Wyoming's Native Freshwater Mussels. Western Division American Fisheries Society Annual Meeting, March 2012, Jackson, WY.
- Mathias, P.T.** Mussel Surveys in the Bear River and Snake River drainages of Wyoming. WGFD Fisheries Management Section Meeting, November 2011, Riverton, WY.
- Mathias, P.T.**, D.T. Zanatta, and C.C. Wilson. In Progress. The Geographic Genetic Structure of *Quadrula quadrula* (Bivalvia: Unionidae): Post-Glacial Colonization of the Great Lakes Basin. Freshwater Mollusk Conservation Society Symposium, April 2011, Louisville, KY.

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ORAL PRESENTATIONS (CONTINUED)

- Mathias, P.T.** Distribution of Unionid Mussels in the Ottawa River from the University of Toledo Main Campus to the Stranahan Arboretum. Undergraduate Thesis Defense Symposium, March 2009, Toledo, OH.
- Crail, T.D., **P.T. Mathias**, J.F. Gottgens, and J.M. Bossenbroek. 2009. Wind-derived seiches as a means for detecting and monitoring the unionid community in the western basin of Lake Erie. International Association of Great Lakes Researchers Conference, May 2009, Toledo, OH. (Presenter: Crail, T.D.).

POSTER PRESENTATIONS

- Mathias, P.T.** Wild Trout and Native Freshwater Mussels: Their Relationship, Focusing on *Margaritifera falcata* (Western Pearlshell). The Wild Trout Symposium XI, September 2014, West Yellowstone, MT.
- Mathias, P.T.** Wild Trout and Native Freshwater Mussels: Their Relationship, Focusing on *Margaritifera falcata* (Western Pearlshell). Colorado-Wyoming American Fisheries Society Chapter Meeting, March 2014, Laramie, WY.
- Mathias, P.T.**, D.T. Zanatta, and C.C. Wilson. In Progress. The Geographic Genetic Structure of *Quadrula quadrula* (Bivalvia: Unionidae): Post-Glacial Colonization of the Great Lakes Basin. Student Research and Creative Endeavors Exhibition, April 2011, Mount Pleasant, MI.
- Mathias, P.T.**, J.M. Bossenbroek, E.A. Heppner, and T.D. Crail. 2009. Distribution of Unionid Mussels in the Ottawa River of Lucas County Ohio. International Association of Great Lakes Researchers Conference, May 2009, Toledo, OH.
- Mathias, P.T.**, J.M. Bossenbroek, E.A. Heppner, and T.D. Crail. 2009. Distribution of Unionid Mussels in the Ottawa River of Lucas County Ohio. Posters at the Capitol, April 2009, Columbus, OH.
- Selden, J., J.F. Gottgens, T.D. Crail, **P.T. Mathias**, and E.A. Heppner. In Progress. The effect of channel heterogeneity on fish communities in agricultural streams in Sandusky and Seneca Counties of Ohio. International Association of Great Lakes Researchers Conference, May 2009, Toledo, OH.
- Mathias, P.T.**, J.M. Bossenbroek, E.A. Heppner, and T.D. Crail. 2008. Distribution of Unionid Mussels (Unionidae) in Ottawa River from the University of Toledo Main Campus to the Stranahan Arboretum. Sigma Xi Student Research Symposium, November 2008, Toledo, OH.
- Mathias, P.T.**, J.M. Bossenbroek, E.A. Heppner, and T.D. Crail. 2008. Distribution of Unionid Mussels (Unionidae) in Ottawa River from the University of Toledo Main Campus to the Stranahan Arboretum. Undergraduate Summer Research and Creative Activity Program (USR&CAP)/Office of Undergraduate Research (OUR) Presentations, August 2008, Toledo, OH.

AWARDS

- Student Travel Award-Freshwater Mollusk Conservation Society. 2011. \$530 to attend the FMCS Symposium: April 11-15, 2011.
- UT Pride Scholarship. 2005-2009. \$2000 an academic year, renewable.
- C.V. Wolfe Scholarship. 2006-2007. \$500 an academic year, non-renewable.
- University of Toledo College of Arts and Science Dean's List.
- Departmental Honors, Thesis: Distribution of Unionid Mussels in the Ottawa River from University of Toledo Main Campus to the Stranahan Arboretum, Advisor: Dr. Jonathan Bossenbroek, The University of Toledo Lake Erie Center.
- Cum Laude*. Spring 2009. Bachelor of Science in Environmental Science, The University of Toledo, Toledo, OH.

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TRAINING AND CERTIFICATES

- SSI Open Water Diver Certified
- DAN O₂ Provider
- 40hr HAZWOPER + Annual Refreshers
- OSHA 10hr Certification
- Emergency First Aid and CPR (with AED certification)
- Previously certified Aquatic Invasive Species Inspector for WGFD
- Valid driver license
- 4x4 Vehicle training

Appendix B:

Resume and Summary of Field Experience: Matthew Gilkay



MATTHEW GILKAY

Malacologist/Biologist

Matthew Gilkay is a Malacologist/Biologist working out of EnviroScience's Ohio office. He has experience performing mussel surveys (including SCUBA, surface-air pumps, snorkel, waterscope), fish surveys (gill net, seine, minnow trap, PIT tagging), electrofishing, sediment and macroinvertebrate collection via PONAR, stream flow measurements and macroinvertebrate sampling (D-net and kick net), aquatic plant surveys, mammal trapping (small, mesocarnivore, bear), bird point-count surveys, and radio telemetry. He is proficient with GPS and boat use. His identification skills include Midwest plants, mammals, birds, and fish; Ohio River Valley mussels, aquatic plants, fish, and macroinvertebrates (to family).

EDUCATION

B.S. Fisheries, Wildlife, and Conservation Biology, University of Minnesota, 2018

Minors in Marine Biology, Sustainability Studies, and Environmental Science, Policy, and Management

CERTIFICATIONS

West Virginia, Ohio, New York, Michigan, Iowa Mussel Surveyor Permits

CPR / O2 Certifications

HAZWOPER 40 Hour Training

Safeland Training

OSHA 10-Hour Construction Safety and Health Certification

Advanced Open Water Diving Certification (Approx. 150 Dives)

Electrofishing Safety (DOI)

YEARS OF EXPERIENCE

EnviroScience, Inc.: 2

AllStar Ecology: 1

Idaho Dept. Of Fish and Game: .5

National Park Service: .5

University of Minnesota Lab Assistant: 2

RELEVANT EXPERIENCE

Natural Resources

Endangered Mussels

Endangered Crayfish

Fisheries Surveys

Macroinvertebrate Identification

Biological Assessments

Submerged Aquatic Vegetation

SELECTED PROFESSIONAL EXPERIENCE

Biologist/Diver, EnviroScience, WV and OH (June 2020 - Present). Mussel identification and surveys across WV, PA, OH, WI, IA, and NY, ranging in size from shallow creeks to large rivers. Familiarity with proper mussel survey techniques following various state and federal requirements. Endangered and threatened crayfish surveys in WV (*C. veteranus* and *C. callainus*). Water sampling for lab analysis and field water quality testing. Stream-bottom sonar mapping via canoe and submerged aquatic vegetation (SAV) sampling.

Environmental Scientist I/Aquatic Biologist, AllStar Ecology, Fairmont WV (May 2019 - June 2020). Assisted with the collection and identification of mussel species in WV, PA, OH, and KY. Collection, sorting, and identification (to the family level) of benthic macroinvertebrates. Fish identification and surveys on large rivers (Kanawha, Monongahela) involving backpack electrofishing, minnow traps, seines, and gill nets. Flow monitoring, pipeline discharge sampling, and well water sampling across WV. Trained and familiar with pipeline safety and PPE, proper water sampling techniques, and a range of dive gear including full face masks, topside communications, wet suits, and dry suits. Prepared and finalized written reports for private clients, as well as WV state reporting

Biological Aide, Springfield Fish Hatchery, Idaho Dept. Of Fish and Game (January 2019 - April 2019). Involved with the rearing of endangered Snake River Sockeye salmon and Chinook salmon. Maintain raceway and vat cleanliness. Examination, care, ponding, and picking of salmon eggs and fry.

Park Ranger (AIS), Curecanti National Recreation Area, National Park Service (June 2018 - October 2018). Educate boaters and the public on aquatic invasive species on topics ranging from their biology to their negative impacts on waterways. Follow strict decontamination protocols to remove and eliminate aquatic invasive species.

Aquatic Macrophyte Lab Assistant, University of Minnesota-Twin Cities (April 2016- October 2016, September 2017 – May 2018). Aquatic plant biomass collection (via snorkel, rake throws), processing, and identification. Use of PONAR aquatic sediment collection equipment and analysis. Boat electrofishing with fish measurements and stomach sampling.

Matthew Gilkay

Aquatic Biologist | Malacologist
6552 West Shore Drive, Kent, OH 44240
763.222.5107 | mgilkay@gmail.com

Education

Bachelor of Science (September 2014 - May 2018)
Fisheries, Wildlife, and Conservation Biology (Fisheries Focus)
University of Minnesota
Minors in Marine Biology, Sustainability Studies, and Environmental Science, Policy,
and Management

Work History

Aquatic Biologist | Malacologist (June 2020 - Present)
EnviroScience, Inc., Kent, OH

- Qualified Malacologist:
 - I. Ohio Approved Mussel Surveyor (excluding known T&E streams)
 - II. West Virginia Approved Mussel Surveyor
 - III. Michigan State Endangered Species Permit (Sub-permittee)
 - Pending Permits:
 - I. Federal Recovery Permit (for the states of: MN, IA, MI, OH, WV, PA, NY)
 - II. Pennsylvania Permit (identification test to be scheduled)
 - III. New York Permit (application package status pending)
 - IV. Iowa Collector's Permit (application package status pending)
 - Multiple years assisting in the collection, processing, and identification of mussels across the Ohio River and Mississippi River basins (approx. 70 surveys; 1000 survey hours)
 - Where qualified, lead survey crews following appropriate state protocols
 - I. Author reports from all survey work to be submitted to clients and state / federal agencies
 - Familiarity with a wide ranged of mussel survey methodologies (transect, quadrat, cell) and survey equipment (surface supplied air, snorkel, view-bucket)
 - Evaluation of habitat quality for threatened and endangered species for FERC re-licensing projects and presence/absence surveys in conjunction with USFWS
-

Notable Fieldwork

Mississippi River, Davenport, IA. Mussel Survey. (2021)

- I. Assisted in the processing and identification of mussels, including Higgins Eye (*L. higginsii*) and Rock Pocketbook (*A. confragosus*)
- II. Sampling methods following Iowa protocol for large rivers (random sampling; quadrats)

Wisconsin Surveys; White River, Trego and Gile Flowages. (2022)

- I. Assisted in the processing and identification of mussels, including Pistolgrip (*T. verrucosa*), Purple Wartyback (*C. tuberculata*), and Black Sandshell (*L. recta*)
- II. Sampling methods following a modified Minnesota Protocol (Level 1 survey)

Allegheny River, Seneca Nation of Indians (PA) Mussel Inventory Surveys. (2022)

- I. Habitat evaluation of several miles of the Allegheny River for quality mussel habitat
- II. Collection of several federally listed species, including Snuffbox (*E. triquetra*), Northern Riffleshell (*E. rangiana*), and Rayed Bean (*V. fabalis*)
- III. Methods followed modified Strayer and Smith (2003) guidelines including transect and quadrat sampling

Scioto Brush Creek, Otway OH. Survey to Identify Habitat and Rare Species Detection. (2021, 2022)

- I. Habitat evaluation and survey for Snuffbox (*E. triquetra*) across several miles of Scioto Brush Creek and its tributary South Fork Scioto Brush Creek; one live individual recovered
- II. Habitat was scored by characteristics such as substrate and local land use impacts
- III. Survey methods followed a modified Ohio Protocol for Group 2 (endangered species present) stream, including random quadrat sampling at high scoring habitat areas

French Creek, PA. PENNDOT Bridge Surveys. (2020, 2021 2022)

- I. Several surveys collecting, relocating, and monitoring federal species, including Rabbitsfoot (*T. cylindrica*), Snuffbox, Rayed Bean, and Northern Riffleshell
 - II. Methods followed Strayer and Smith (2003) guidelines including transect and quadrat sampling
 - III. Multi-year post-construction monitoring efforts, including tagged (hull, glitter, PIT) mussel monitoring to estimate relocation success (growth, survivorship)
-

Aquatic Biologist | Environmental Scientist I

(May 2019 - June 2020)

AllStar Ecology, LLC.

- Assisted with the collection and identification of mussel species in WV, PA, OH, and KY
- Collection, sorting, and identification (to the family level) of benthic macroinvertebrates
- Fish identification and surveys on large rivers (Kanawha, Monongahela) involving backpack electrofishing, minnow traps, seines, and gill nets
- Flow monitoring, pipeline discharge sampling, and well water sampling across WV
- Trained and familiar with pipeline safety and PPE, proper water sampling techniques, and a range of dive gear including full face masks, topside communications, wet suits, and dry suits
- Prepared and finalized written reports for private clients, as well as WV state reporting

Aquatic Macrophyte Lab Assistant

(April 2016- October 2016, September 2017 – May 2018)

Newman Laboratory, University of Minnesota-Twin Cities

- Aquatic plant biomass collection (via snorkel, rake throws), processing, and identification
- Use of PONAR aquatic sediment collection equipment and analysis
- Identification of aquatic macro-invertebrates (to family) and life stages
- Boat electrofishing with fish measurements and stomach sampling

Table 1. Master list of survey and report work (2019 - 2022); sorted by state and regional relevancy.

Survey Year	State	River	Federal or MN Listed Species	Work Type
2021	MN	Mississippi River		Data entry, Report drafting
2021	IA	Mississippi River	<i>A. confragosus</i> ; <i>E. lineolata</i> ; <i>L. higginsii</i> ; <i>M. nervosa</i> ; <i>P. cyphus</i> ; <i>T. donaciformes</i> ; <i>T. metanevra</i>	Field crew, crew management
2021	WI	Mississippi River		Data entry, Report drafting
2022	WI	White River / Trego	<i>C. tuberculata</i> ; <i>L. recta</i> ; <i>L. costata</i>	Field Crew
2022	WI	Gile Riverway	<i>C. tuberculata</i> ; <i>L. recta</i> ; <i>L. costata</i>	Field Crew
2021	MI	Kalamazoo River	<i>A. ligamentina</i> ; <i>A. marginata</i>	Field Crew, Data Entry
2021	MI	Kalamazoo River	<i>A. ligamentina</i> ; <i>A. marginata</i>	Field crew, crew management
2022	MI	Kalamazoo River	<i>A. ligamentina</i> ; <i>L. compressa</i> ; <i>A. marginata</i>	Field Crew management, habitat scope, draft reporting
2019	PA	Shenango River		Field Crew
2019	PA	Monongahela River		Field Crew, Data Entry, Survey Report Drafting
2019	PA	Racoon Creek		Field Crew, Data Entry
2021	PA	Allegheny River		Data entry, Report drafting
2020	PA	French Creek	<i>E. dilatata</i> ; <i>E. rangiana</i> ; <i>V. fabalis</i>	Field Crew
2020	PA	French Creek	<i>E. dilatata</i> ; <i>P. sintoxia</i> ; <i>T. cylindrica</i>	Field Crew
2020	PA	Allegheny River	<i>E. dilatata</i> ; <i>E. rangiana</i> ; <i>P. clava</i>	Field Crew
2021	PA	Ohio / Allegheny Rivers		Data entry, Report drafting
2021	PA	French Creek		Data Entry
2021	PA	Allegheny River	<i>A. ligamentina</i> ; <i>E. dilatata</i> ; <i>V. fabalis</i> ; <i>P. clava</i> ; <i>P. sintoxia</i>	Relocation Monitoring
2021	PA	Shenango River	<i>E. complanata</i>	Field Crew
2022	PA	French Creek	<i>T. cylindrica</i> ; <i>P. sintoxia</i> ; <i>V. fabalis</i>	Mussel survey, habitat assessment, relocation monitoring
2022	PA	Little Shenango River	<i>E. triquetra</i>	Mussel survey, habitat assessment, relocation monitoring
2019	WV	Elk Fork Creek		Field Crew

2019	WV	Greenbrier River		Field Crew
2019	WV	Ohio River	<i>L. recta; E. lineolata</i>	Field Crew, Data Entry, Survey Report Drafting
2019	WV	Ohio River	<i>L. recta; E. lineolata</i>	Field Crew, Data Entry, Survey Report Drafting
2019	WV	Kanawha River		Field Crew, Data Entry
2019	WV	Elk Fork Creek		Field Crew, Data Entry
2019	WV	Ohio River	<i>L. recta</i>	Field Crew, Data Entry, Survey Report Drafting
2020	WV	Elk Fork Creek		Field Crew
2020	WV	Ohio River		Field Crew
2020	WV	Camp Creek		Field Crew
2020	WV	Big Sandy River		Field Crew
2020	WV	Ohio River		Field Crew
2020	WV	North Fork Hughes River		Field Crew
2021	WV	Ohio River		Dive Safety Plan / Protocol, data entry
2021	WV	Ohio River		Dive Safety Plan / Protocol, data entry
2021	WV	Mud River		Field Crew, data entry, mussel ID
2021	WV	Little Kanawha	<i>E. triquetra; O. subrotunda; P. sintoxia</i>	Field Crew, crew management, data entry, report drafting
2021	WV	Kanawha River		Survey Plan
2021	WV	Kanawha River		Dive Safety Plan / Protocol
2022	WV	Elk River		Mussel presence/absence survey, habitat monitoring
2020	NY	Oak Orchard Creek		Field Crew
2020	NY	Allegheny River	<i>E. rangiana; P. sintoxia; V. fabalis</i>	Field Crew
2020	NY	Susquehanna River		Field Crew
2020	NY	Chenango River		Field Crew
2020	NY	Chadakoin River		Field Crew
2021	NY	Allegheny River	<i>P. sintoxia; V. fabalis</i>	Field Crew
2022	NY	Delaware River	<i>E. complanata</i>	Field Crew management, habitat scope, draft reporting
2022	NY	Allegheny River	<i>V. fabalis</i>	Field Crew, habitat scoring

2021	OH	Little Miami	<i>T. verrucosa</i>	Field Crew, crew management, data entry, report drafting
2021	OH	Riley Creek		Recon. Survey
2021	OH	Scioto Brush Creek	<i>E. triquetra</i>	Field Crew, data entry
2021	OH	Great Miami River		Field crew, crew management
2022	OH	Erie Canal		Proposal Development, 2x Field lead, Full report
2022	OH	Killbuck Creek	<i>E. dilatata; L. costata</i>	Field Lead, Full report
2022	OH	Ohio River		Survey Plan
2022	OH	Cuyahoga River		Field Crew, Data Entry, Survey Report Drafting
2022	OH	Rocky Ford Creek		Field Lead, Draft Report
2022	OH	Sandy Creek		Field Lead, Full report
2022	OH	Solida Creek		Proposal Development, Field Lead, Full Report
2022	OH	South Fork Captina Creek	<i>M. nervosa</i>	Proposal Development, Field Lead, Full Report
2022	OH	Scioto Brush Creek		Field Crew, habitat scoring
2022	OH	Ohio River	<i>M. nervosa</i>	Mussel survey, Draft Report
2022	OH	Mad River		Mussel survey, Full Report
2022	OH	Mad River		Mussel survey, Full Report
2022	VA	Dunlap Creek		Proposal Development, Field Crew
2019	KY	Ohio River	<i>E. crassidens; T. metanevra; Q. nodulata</i>	Field Crew, Data Entry
2019	KY	Ohio River	<i>P.cyphyus; T. metanevra; Q. nodulata</i>	Field Crew, Data Entry, Survey Report Drafting
2019	KY	Ohio River	<i>R. ebenus</i>	Field Crew, Data Entry

Field Crew defined: Assisted in mussel identification site-setup (bank flagging, transect laying, etc.) site surveying (SCUBA, snorkel, or Surface-Supplied Air (SSA)), boat usage, equipment prep. and decontamination

Appendix C:

Resume and Summary of Field Experience: Scott LaValley



Scott LaValley

Malacologist

Scott LaValley joined the EnviroScience, Inc. in 2023 as a Malacologist. He brings years of experience working with and surveying freshwater mussels. Specializing in conducting comprehensive freshwater mussel surveys to assess population demographics, and species distributions, and performing relocations.

SELECTED PROJECT EXPERIENCE

Mussel propagation and stocking for South River Restoration Project, Virginia, 2022 – 2023. Scott aided in the collection of freshwater mussel broodstock for lab culture, grow out, and release of hatchery raised freshwater mussels into the South River working alongside the USFWS, and the Virginia Department of Wildlife Resources malacologist.

Michigan Snuffbox (*Epioblasma triquetra*) population assessments, 2020 - 2022. As part of his Master's thesis data collection, all known Snuffbox populations in Michigan rivers were sampled to compare population structures using freshwater mussel community, microhabitat assessments, male:female ratios, age and size classes, and estimated population sizes. Scott planned and led surveys with crews of 3-5 researchers targeting Snuffbox.

Kalamazoo River Watershed Freshwater Mussel Survey, 2017 – 2020. A watershed scale survey of the Kalamazoo River Watershed including tributaries. Over 160 sites were visited and surveyed for freshwater mussels in 2018. Scott developed a specific protocol for this project, planned and led surveys with two teams of researchers.

Exposure Experiment with Contaminants of Emerging Concern (CEC) on Fish and Freshwater Mussels for USFWS in Agricultural, Urban, and Lab settings, DC, 2017 - 2018. Scott worked alongside the USFWS and St. Cloud State University researchers to run a mobile exposure laboratory trailer, following set protocols for performing water collection, animal collection, system maintenance, sacrificing animals for tissue sampling/biopsies, and running glycogen analysis of tissues using sugar storage as a metric for animal health. Scott also helped conduct two 100 day long lab exposures using fish and freshwater mussels.

Relocation of Federally Endangered Snuffbox (*Epioblasma triquetra*) from Dam Removal site, Lyons, MI, USA 201ab5. Aided in all parts of a quadrat based relocation of Snuffbox downstream of a dam scheduled for removal while working alongside the Michigan Department of Natural Resources, and communicating with the USFWS. Monitoring of the relocated mussels was conducted and reported yearly from 2016 through 2022.

EDUCATION

MS Conservation Biology, Central Michigan University, 2022

BS Biology Natural Resources, Central Michigan University, 2017

CERTIFICATIONS

Ohio DNR Scientific Collection Permit for Freshwater Mussels

PADI Open Water Diver

Red Cross First Aid and CPR

40-hour HAZWOPER

OSHA 10-hour General Industry Training

YEARS OF EXPERIENCE

EnviroScience, Inc.: 1

RELEVANT EXPERIENCE

Kalamazoo River Watershed Freshwater Mussel Survey

Michigan Snuffbox Population Assessment Surveys

Contaminants of Emerging Concern Experiment with USFWS

SCOTT LAVALLEY

Freshwater ecologist

Malacologist

PROFESSIONAL SUMMARY

As a malacologist with 8 years of experience and a passion for freshwater ecosystems, I specialize in conducting comprehensive freshwater mussel surveys. My expertise includes designing and executing field studies, assessing population demographics, and my work has aimed to inform conservation and management efforts of imperiled species. My previous projects have been highly collaborative with project stakeholders, including government agencies and NGOs.

CONTACT

☎ 248-872-2932

✉ scottmlavalley@gmail.com

📍 Richmond, VA

EXPERIENCE

Propagation Biologist

VIRGINIA TECH [JUNE 2022 – PRESENT]

- Coauthored reports for the South River Restoration Project.
- Conducted field work including mussel releases, monitoring released mussels, and broodstock collection.
- Managed propagation duties including host fish infestation, enumeration of transformed juveniles, and daily system upkeep.
- Operated equipment including trailering and launching boats.

Graduate Assistant

CENTRAL MICHIGAN UNIVERSITY [AUGUST 2020 – MAY 2022]

- Developed and executed sampling procedure to collect population data from all Michigan Snuffbox populations.
- Coordinated and led freshwater mussel surveys following federal endangered species permit guidelines.
- Used GIS and R modeling to analyze data for M.S. thesis.
- Participated in a variety of field work including large river SCUBA and environmental DNA sample collection.

Laboratory Technician

CENTRAL MICHIGAN UNIVERSITY [MAY 2018 – AUGUST 2020]

- Planned, developed, and executed an extensive mussel survey of the Kalamazoo River Watershed.
- Mentored and trained 15 researchers in mussel species identification, standardized mussel survey techniques, and data collection/entry.
- Collaborated with project stakeholders, State and Federal agencies, and other universities.

SKILLS

- Field operations
- Report writing
- Communication
- Organization
- Problem-solving
- GIS analysis
- Teamwork
- Data analysis
- Program R

EDUCATION

Master of Science

CENTRAL MICHIGAN UNIVERSITY [2020 – 2022]

Degree in Conservation Biology

Thesis: AN ASSESSMENT OF FEDERALLY ENDANGERED SNUFFBOX (*Epioblasma triquetra*) POPULATIONS IN MICHIGAN, USA.

Bachelor of Science

CENTRAL MICHIGAN UNIVERSITY [2014 – 2017]

Degree in Biology – Natural Resources

Appendix B

Photographic Record

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 1. View of Bay City Creek looking downstream (northeast) from the downstream extent of site 1.



Photo 2. View of Bay City Creek looking upstream (southwest) from the downstream extent of site 1.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 3. View of Bay City Creek looking downstream (northeast) from the center of the ADI of site 1.



Photo 4. View of Bay City Creek looking upstream (southwest) from the center of the ADI of site 1.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 5. View of Bay City Creek looking downstream (northeast) from the upstream extent of site 1.



Photo 6. View of Bay City Creek looking upstream (southwest) from the upstream extent of site 1.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 7. View of the typical substrate encountered on Bay City Creek at site 1.



Photo 8. View of Rock Creek looking downstream (east) from the downstream extent of site 2.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 9. View of Rock Creek looking upstream (west) from the downstream extent of site 2.



Photo 10. View of Rock Creek looking downstream (east) from the center of the ADI of site 2.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 11. View of Rock Creek looking upstream (west) from the center of the ADI of site 2.



Photo 12. View of Rock Creek looking downstream (east) from the upstream extent of site 2.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 13. View of Rock Creek looking upstream (west) from the upstream extent of site 2.



Photo 14. View of the typical substrate encountered on Rock Creek at site 2.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 15. View of a UNT of Marengo River looking downstream (east) from the downstream extent of site 3.



Photo 16. View of a UNT of Marengo River looking upstream (west) from the downstream extent of site 3.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 17 View of a UNT of Marengo River looking downstream (east) from the center of the ADI of site 3.



Photo 18. View of a UNT of Marengo River looking upstream (west) from the center of the ADI of site 3.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 19. View of a UNT of Marengo River looking downstream (east) from the upstream extent of site 3.



Photo 20. View of a UNT of Marengo River looking upstream (west) from the upstream extent of site 3.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 21. View of the typical substrate encountered on the UNT of Marengo River at site 3.



Photo 22. View of a UNT of Brunswelier River looking downstream (north) from the downstream extent of site 4.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 23. View of a UNT of Brunsweler River looking upstream (south) from the downstream extent of site 4.



Photo 24. View of a UNT of Brunsweler River looking downstream (north) from the center of the ADI of site 4.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 25. View of a UNT of Brunswelier River looking upstream (south) from the center of the ADI of site 4.



Photo 26. View of a UNT of Brunswelier River looking downstream (north) from the upstream extent of site 4.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 27. View of a UNT of Brunsweler River looking upstream (south) from the upstream extent of site 4.



Photo 28. View of the typical substrate encountered on the UNT of Brunsweler River at site 4.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 29. View of a UNT of Trout Brook looking downstream (north) from the downstream extent of site 5.



Photo 30. View of a UNT of Trout Brook looking upstream (south) from the downstream extent of site 5.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 31. View of a UNT of Trout Brook looking downstream (north) from the center of the ADI of site 5.



Photo 32. View of a UNT of Trout Brook looking upstream (south) from the center of the ADI of site 5.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 33. View of a UNT of Trout Brook looking downstream (north) from the upstream extent of site 5.



Photo 34. View of a UNT of Trout Brook looking upstream (south) from the upstream extent of site 5.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 35. View of the typical substrate encountered on the UNT of Trout Brook at site 5.



Photo 36. View of a UNT of Silver Creek looking downstream (west) from the downstream extent of site 6.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 37. View of a UNT of Silver Creek looking upstream (east) from the downstream extent of site 6.



Photo 38. View of a UNT of Silver Creek looking downstream (west) from the center of the ADI of site 6.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 39. View of a UNT of Silver Creek looking upstream (east) from the center of the ADI of site 6.



Photo 40. View of a UNT of Silver Creek looking downstream (west) from the upstream extent of site 6.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 41. View of a UNT of Silver Creek looking upstream (east) from the upstream extent of site 6.



Photo 42. View of the typical substrate encountered on the UNT of Silver Creek at site 6.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 43. View of a UNT of Silver Creek looking downstream (northeast) from the downstream extent of site 7.



Photo 44. View of a UNT of Silver Creek looking upstream (southwest) from the downstream extent of site 7.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 45. View of a UNT of Silver Creek looking downstream (northeast) from the center of the ADI of site 7.



Photo 46. View of a UNT of Silver Creek looking upstream (southwest) from the center of the ADI of site 7.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 47. View of a UNT of Silver Creek looking downstream (northeast) from the upstream extent of site 7.



Photo 48. View of a UNT of Silver Creek looking upstream (southwest) from the upstream extent of site 7.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 49. View of the typical substrate encountered on the UNT of Silver Creek at site 7.



Photo 50. View of a UNT of Silver Creek looking downstream (north) from the downstream extent of site 8.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 51. View of a UNT of Silver Creek looking upstream (south) from the downstream extent of site 8.



Photo 52. View of a UNT of Silver Creek looking downstream (north) from the center of the ADI of site 8.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 53. View of a UNT of Silver Creek looking upstream (south) from the center of the ADI of site 8.



Photo 54. View of a UNT of Silver Creek looking downstream (north) from the upstream extent of site 8.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 55. View of a UNT of Silver Creek looking upstream (south) from the upstream extent of site 8.



Photo 56. View of the typical substrate encountered on the UNT of Silver Creek at site 8.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 57. View of a UNT of Krause Creek looking downstream (east) from the downstream extent of site 9.



Photo 58. View of a UNT of Krause Creek looking upstream (west) from the downstream extent of site 9.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 59. View of a UNT of Krause Creek looking downstream (east) from the center of the ADI of site 9.



Photo 60. View of a UNT of Krause Creek looking upstream (west) from the center of the ADI of site 9.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 61. View of a UNT of Krause Creek looking downstream (east) from the upstream extent of site 9.



Photo 62. View of a UNT of Krause Creek looking upstream (west) from the upstream extent of site 9.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 63. View of the typical substrate encountered on the UNT of Krause Creek at site 9.



Photo 64. View of a UNT of Bad River looking downstream (north) from the downstream extent of site 10.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 65. View of a UNT of Bad River looking upstream (south) from the downstream extent of site 10.



Photo 66. View of a UNT of Bad River looking downstream (north) from the center of the ADI of site 10.

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Photo 67. View of a UNT of Bad River looking upstream (south) from the center of the ADI of site 10.



Photo 68. View of a UNT of Bad River looking downstream (north) from the upstream extent of site 10.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 69. View of a UNT of Bad River looking upstream (south) from the upstream extent of site 10.



Photo 70. View of the typical substrate encountered on the UNT of Bad River at site 10.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 71. View of a UNT of Gehrman Creek looking downstream (north) from the downstream extent of site 11.



Photo 72. View of a UNT of Gehrman Creek looking upstream (south) from the downstream extent of site 11.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 73. View of a UNT of Gehrman Creek looking downstream (north) from the center of the ADI of site 11.



Photo 74. View of a UNT of Gehrman Creek looking upstream (south) from the center of the ADI of site 11.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 75. View of a UNT of Gehrman Creek looking downstream (north) from the upstream extent of site 11.



Photo 76. View of a UNT of Gehrman Creek looking upstream (south) from the upstream extent of site 11.

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Photo 77. View of the typical substrate encountered on the UNT of Gehrman Creek at site 11.



Photo 78. View of a UNT of Feldcher Creek looking downstream (north) from the downstream extent of site 12.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 79. View of a UNT of Feldcher Creek looking upstream (south) from the downstream extent of site 12.



Photo 80. View of a UNT of Feldcher Creek looking downstream (north) from the center of the ADI of site 12.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 81. View of a UNT of Feldcher Creek looking upstream (south) from the center of the ADI of site 12.



Photo 82. View of a UNT of Feldcher Creek looking downstream (north) from the upstream extent of site 12.

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Photo 83. View of a UNT of Feldcher Creek looking upstream (south) from the upstream extent of site 12.



Photo 84. View of the typical substrate encountered on the UNT of Feldcher Creek at site 12.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
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Photo 85. View of a UNT of Vaughn Creek looking downstream (east) from the downstream extent of site 13.



Photo 86. View of a UNT of Vaughn Creek looking upstream (west) from the downstream extent of site 13.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 87. View of a UNT of Vaughn Creek looking downstream (east) from the center of the ADI of site 13.



Photo 88. View of a UNT of Vaughn Creek looking upstream (west) from the center of the ADI of site 13.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 89. View of a UNT of Vaughn Creek looking downstream (east) from the upstream extent of site 13.



Photo 90. View of a UNT of Vaughn Creek looking upstream (west) from the upstream extent of site 13.

Line 5 Segment Relocation Project, Bayfield, Ashland, and Iron Counties, Wisconsin
Photographed October 23 - 26, 2023



Photo 91. View of the typical substrate encountered on the UNT of Vaughn Creek at site 13.

Appendix C

WDNR Mussel Sampling Data Sheets

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 7 of 13

Waterbody ID 2891100 [site 1] [crossing: SASE006P]

*Stream: Bay City Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/22/23 *Collectors: Matt Gilroy; Nick Cutler

Field GPS

*County: Ashtab

*Station Start GPS Location: N 46.554160
(hddd.ddddd) (W) -90.895495

*T _____ R _____ Sec _____ QQ _____ Q _____

Nearest Road/Access: Summit Road East Dist. from access Above 0.8 m Below _____

*Time (24 hr): 15:16 *Water Level: _____ Normal Above _____ (0.1 m) Below 0.2 (0.1 m)

*Air Temp (C°): 14.4 *Water Temp (C°): 48.2°F 9.0°C Conductivity (umhos): _____ Turbidity (NTU): _____

*Water Clarity: Cl (St) Slt Turb *Visibility (cm): 40 VTB Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N (L) M H *Natural ✓ Tailwater (< 5.0 mi below dam) _____ Dist below dam _____

*SAMPLING STRATEGY: Initial (Initial) - Timed Search - Quadrats

*Search Time (24 hr): Start 15:15 Stop 16:00 Total (min) 90 *Bank: L R (B)

*Area searched Length (m) 800 Mean Width (m) 1.0

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 2 1 1 1 1 2 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>30</u>	Detritus <u>10</u>	Emergent _____	Wetland <u>10</u>	RipRap _____
Run <u>170</u>	Clay _____	Submergent _____	Meadow _____	Seawall _____
Riffle _____	Silt <u>10</u>	Algae _____	Woodland <u>90</u>	Other _____
Rapids _____	Sand <u>70</u>		Pasture <u>10</u>	List Other _____
Other _____	Gravel _____		Cropland _____	
List Other _____	Cobble _____		Developed _____	
	Boulder _____		Other _____	
	Bedrock _____		List Other _____	
	Other <u>10</u> woody debris			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 2 of 13

Waterbody ID 28939001 [site 2] [crossing SASCOYIP]

*Stream: Rock Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/24/2023 *Collectors: Matthew Gilkey; Nick Carter

*County: Ashtab

*Station Start GPS Location: 46 49088
(hddd.ddddd)

*T R Sec QQ Q

W-90 89952

Nearest Road/Access: Olby Road Dist. from access Above Below 0.3 mi

*Time (24 hr): 09:15 *Water Level: 0 Normal Above (0.1 m) Below 0.2 (0.1 m)

*Air Temp (C°): 10.0 *Water Temp (C°): 10.1 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: Cl St (Slt) Turb *Visibility (cm): 20 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N (L) M H *Natural ✓ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial Timed Search - Quadrats)

*Search Time (24 hr): Start 09:30 Stop 1000 Total (min) 60 min

*Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1 2 surveyors

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 1 1 2 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>35</u>	Detritus <u> </u>	<u>None</u> Emergent <u> </u>	Wetland <u> </u>	RipRap <u> </u>
Run <u>160</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u>5</u>	Silt <u>10</u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>70</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>10</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u> </u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u>10</u> <u>Woody Debris</u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 3 of 13

(Marengo River) Waterbody ID 2911900 [site 3] [sasd01p]

*Stream: UNT of Marengo River Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/24/2023 *Collectors: Matthew Gilkey; Nick Carter

*County: Ashtland *Station Start GPS Location: 46.45074
(hddd.ddddd) -90.89797

*T R Sec QQ Q

Nearest Road/Access: Wilberg Road Dist. from access Above Below 960 ft

*Time (24 hr): 1030 *Water Level: Normal Above (0.1 m) Below 0.2 (0.1 m)

*Air Temp (C°): 12.2 *Water Temp (C°): 9.4 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: Cl St (Slt) Turb *Visibility (cm): 20 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N (L) M H *Natural Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial) Timed Search - Quadrats

*Search Time (24 hr): Start 1100 Stop 1130 Total (min) 60 *Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1 2 surveys

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 1 1 1 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>30</u>	Detritus <u> </u>	<u>None</u> Emergent <u> </u>	Wetland <u> </u>	RipRap <u> </u>
Run <u>170</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u> </u>	Silt <u>10</u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>60</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>20</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u>10</u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u> </u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 4 of 13

(Brunsweller) Waterbody ID 2913800 [site 4] [sasc1006p]

*Stream: UNT of Brunsweller River Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/24/2023 *Collectors: Matthew Gilkey, Nick Carter

*County: Ashland

*Station Start GPS Location: 46.40215
(hddd.ddddd)

*T R Sec QQ Q

-90.80129

Nearest Road/Access: Hanninen Road Dist. from access West 470 ft Above Below

*Time (24 hr): 1200 *Water Level: Normal Above (0.1 m) Below 0.1 (0.1 m)

*Air Temp (C°): 13.9 *Water Temp (C°): 10.4 Conductivity (umhos): Turbidity (NTU):

*Water Clarity (C) St Slt Turb 50.8°F *Visibility (cm): 50 VTB Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N (L) M H *Natural ✓ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial) Timed Search - Quadrats

*Search Time (24 hr): Start 1215 Stop 1300 Total (min) 90 *Bank: L R B

*Area searched Length (m) 200 Mean Width (m) 1.0 2 x Surveys

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 2 1 1 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>30</u>	Detritus <u> </u>	<u>None</u> Emergent <u> </u>	Wetland <u> </u>	RipRap <u> </u>
Run <u>130</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u>10</u>	Seawall <u> </u>
Riffle <u>40</u>	Silt <u>10</u>	Algae <u> </u>	Woodland <u>90</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>50</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>30</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u> </u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u>10</u> <u>woody debris</u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 5 of 13

(Trout Brook)
Waterbody ID 2913900 [site 5] [sasc1003p]

*Stream: WY of Trout Brook Station: NA Site Mile NA

*Date (mm/dd/yyyy): 10/24/2023 *Collectors: Mattew Gilley; Nick Carter

*County: Ashland

*Station Start GPS Location: 46.39791
(hddd.ddddd)

*T R Sec QQ Q

-90.78086

Nearest Road/Access: N. York Road Dist. from access West 930 ft Above Below

*Time (24 hr): 1400 *Water Level: Normal Above (0.1 m) Below 0.1 (0.1 m)

*Air Temp (C°): 13.3 50.8F° *Water Temp (C°): 10.4 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: CI St Slt Turb *Visibility (cm): 30 VTB Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N 0 M H *Natural ✓ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial) Timed Search - Quadrats

*Search Time (24 hr): Start 1300 Stop 1330 Total (min) 60

*Bank: L 0 R 0 B 0

*Area searched Length (m) 200 Mean Width (m) 1 x2 surveys

*Mussels present: Y 0 *Distance to live mussels (m) NA

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 1 1 1 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>20</u>	Detritus <u> </u>	<u>None</u> Emergent <u> </u>	Wetland <u> </u>	RipRap <u> </u>
Run <u>170</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u>10</u>	Silt <u>10</u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>60</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>20</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u> </u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u>10</u> <u>woody debris</u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 6 of 13

(Silver crk) Waterbody ID 2912300 [site 6] [sasd1015p]

*Stream: UNT of Silver Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/25/2023 *Collectors: Matthew Gilman, Nick Carter

*County: Ashland *Station Start GPS Location: 46.37204
(hddd.ddddd) -90.71917

*T R Sec QQ Q

Nearest Road/Access: Martha Road Dist. from access Above Below 310 ft

*Time (24 hr): 0930 *Water Level: Normal Above (0.1 m) Below 0.1 (0.1 m)

*Air Temp (C°): 7.8 *Water Temp (C°): 10.0 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: Cl St Slt Turb *Visibility (cm): 30 VTB Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N M H *Natural Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial - Timed Search - Quadrats)

*Search Time (24 hr): Start 1000 Stop 1030 Total (min) 60 *Bank: L R

*Area searched Length (m) 200 Mean Width (m) 2 2x surveyors

*Mussels present: Y *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 2 2 2 3 2 3 2 2 2 2

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>30</u>	Detritus <u> </u>	<u>None</u> Emergent <u> </u>	Wetland <u> </u>	<u>None</u> RipRap <u> </u>
Run <u>130</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u>40</u>	Silt <u>10</u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>40</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>30</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u>20</u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u> </u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 7 of 13

(Silver crk) Waterbody ID 2912300 [site 7] [case 005P-x2]

*Stream: UNT of Silver Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/25/2023 *Collectors: Matthew Gilkey Nick Carter

*County: Ashland *Station Start GPS Location: 46.36607

(hddd.ddddd) -90.70608

*T R Sec QQ Q

Nearest Road/Access: County Road C Dist. from access Above 0.65mi Below

*Time (24 hr): 12:00 *Water Level: Normal Above 0.1 (0.1 m) Below (0.1 m)

*Air Temp (C°): 9.4 *Water Temp (C°): 9.9 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: (C) St Slt Turb *Visibility (cm): 30 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N (L) M H *Natural ✓ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial - Timed Search - Quadrats)

*Search Time (24 hr): Start 1215 Stop 1300 Total (min) 90 *Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1 45 X 2 surveys

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 2 1 1 2 1 1 1 2

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>20</u>	Detritus <u> </u>	Emergent <u> </u>	Wetland <u> </u>	RipRap <u> </u>
Run <u>160</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u>20</u>	Silt <u> </u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>60</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>20</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u>10</u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u>10</u> woody debris			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 8 of 13

(Silver creek)
Waterbody ID 2912300 [site 8] [SASV004P]

*Stream: UNT of Silver Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10 / 25 / 2023 *Collectors: Matthew Gilkey, Nick Carter

*County: Ashland

*Station Start GPS Location: 46.36093
(hddd.ddddd)

*T R Sec QQ Q

-90.69594

Nearest Road/Access: County Road C Dist. from access Above 1,000 ft Below

*Time (24 hr): 1315 *Water Level: ☒ Normal Above (0.1 m) Below (0.1 m)

*Air Temp (C°): 9.4 *Water Temp (C°): 49.8 9.9 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: ☒ St ☐ Slt ☐ Turb *Visibility (cm): 20 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N ☒ L ☐ M ☐ H *Natural ☒ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial Timed Search -- Quadrats)

*Search Time (24 hr): Start 1330 Stop 1400 Total (min) 60 *Bank: L R ☒ X2 surveys

*Area searched Length (m) 200 Mean Width (m) 1

*Mussels present: Y ☒ N ☐ *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 1 1 1 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u> </u>	Detritus <u> </u>	<u>None</u> Emergent <u> </u>	Wetland <u> </u>	RipRap <u> </u>
Run <u>20</u>	Clay <u>20</u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u> </u>	Silt <u>60</u>	Algae <u> </u>	Woodland <u> </u>	Other <u> </u>
Rapids <u> </u>	Sand <u> </u>		Pasture <u>100</u>	List Other <u> </u>
Other <u>180</u>	Gravel <u> </u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u>10</u>		Developed <u> </u>	
<u>Heavy cattle use; more of a seep than a stream</u>	Boulder <u>10</u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u> </u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 9 of 13

(Krause)
Waterbody ID 2929000 [site 9] [sasv020p]

*Stream: UNT of Krause Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10 / 25 / 2023 *Collectors: Mattias / Gilkey / Nick Cutter

*County: Ashland

*Station Start GPS Location: 46.35522
(hddd.ddddd)

*T R Sec QQ Q

-90.68247

Nearest Road/Access: County Road C Dist. from access Above Below 490 ft

*Time (24 hr): 1430 *Water Level: Normal Above (0.1 m) Below 0.1 (0.1 m)

*Air Temp (C°): 9.4 *Water Temp (C°): 9.8 ^{49.6°F} Conductivity (umhos): Turbidity (NTU):

*Water Clarity: (C) St SlT Turb *Visibility (cm): 30 ^{VTB} Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N (L) M H *Natural ✓ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial) Timed Search - Quadrats

*Search Time (24 hr): Start 1500 Stop 1530 Total (min) 60 ^{x2 surveys}

*Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 1 1 1 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>20</u>	Detritus <u> </u>	<u>None</u> Emergent <u> </u>	Wetland <u> </u>	<u>None</u>
Run <u>160</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u>20</u>	Silt <u> </u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>50</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>20</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u>30</u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u> </u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 10 of 13

[Bat Riv.] Waterbody ID 2891900 [Site 10] [Sasa008p]

*Stream: UNT of Bad River Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/26/2023 *Collectors: Matthew Gimoy; N/A Carter

*County: Ashland

*Station Start GPS Location: 46.33761
(hddd.ddddd)

*T R Sec QQ Q

Nearest Road/Access: POW/MIA Mem. Hwy Dist. from access West 1,033 ft Above Below
over bank, out of channel

*Time (24 hr): 0915 *Water Level: Normal Above 0.2 (0.1 m) Below (0.1 m)

*Air Temp (C°): 6.1 *Water Temp (C°): 9.1 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: Cl St Slt Turb *Visibility (cm): 20 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N L M (H) *Natural Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial) Timed Search - Quadrats

*Search Time (24 hr): Start 0930 Stop 1000 Total (min) 60 *Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 1 1 1 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>10</u>	Detritus <u>20</u>	<u>N/A</u>	Wetland <u> </u>	RipRap <u> </u>
Run <u>190</u>	Clay <u>10</u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u> </u>	Silt <u>50</u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>20</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u> </u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u> </u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u> </u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 11 of 13

(Gehrman) Waterbody ID 2923500 [Site 11] [Sasa004p]

*Stream: UNT of Gehrman Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/26/2023 *Collectors: Matthew Gilroy; Nick Carter

*County: Ashland

*Station Start GPS Location: 46.36614
(hddd.ddddd)

*T _____ R _____ Sec _____ QQ _____ Q _____

Nearest Road/Access: Popko Road Dist. from access East 790 ft Above _____ Below _____

*Time (24 hr): 1030 *Water Level: _____ Normal Above 0.1 (0.1 m) Below _____ (0.1 m)

*Air Temp (C°): 6.7 *Water Temp (C°): 9.2 ^{48.6°F} Conductivity (umhos): _____ Turbidity (NTU): _____

*Water Clarity: Cl St (S) Turb *Visibility (cm): 30 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N L (M) H *Natural ✓ Tailwater (< 5.0 mi below dam) _____ Dist below dam _____

*SAMPLING STRATEGY: Initial (Initial - Timed Search - Quadrats)

*Search Time (24 hr): Start 1045 Stop 1115 Total (min) 60 *Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) | | | | | | | | | |

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>20</u>	Detritus <u>10</u>	<u>N/A</u> Emergent _____	Wetland _____	<u>N/A</u> RipRap _____
Run <u>160</u>	Clay _____	Submergent _____	Meadow _____	Seawall _____
Riffle <u>20</u>	Silt <u>10</u>	Algae _____	Woodland <u>100</u>	Other _____
Rapids _____	Sand <u>30</u>		Pasture _____	List Other _____
Other _____	Gravel <u>40</u>		Cropland _____	
List Other _____	Cobble <u>10</u>		Developed _____	
	Boulder _____		Other _____	
	Bedrock _____		List Other _____	
	Other _____			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 12 of 13

(Fletcher) Waterbody ID 2923800 [site 12] [Strib 010p]

*Stream: UNT of Fletcher Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10 / 26 / 2023 *Collectors: Matthew Gilroy; Nick Cunniff

*County: Iron *Station Start GPS Location: 46.38289
(hddd.ddddd)

*T R Sec QQ Q -90.54807

Nearest Road/Access: County Line Road Dist. from access East 190 ft Below

*Time (24 hr): 1130 *Water Level: Normal Above 0.1 (0.1 m) Below (0.1 m)

*Air Temp (C°): 7.8 *Water Temp (C°): 9.1 Conductivity (umhos): Turbidity (NTU):

*Water Clarity (C) St Slt Turb *Visibility (cm): 30 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N L M H *Natural ✓ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial - Timed Search - Quadrats)

*Search Time (24 hr): Start 1200 Stop 1230 Total (min) 60 *Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1 2x survey

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 1 1 1 2 2 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u>20</u>	Detritus <u> </u>	<u>N/A</u> Emergent <u> </u>	Wetland <u> </u>	<u>N/A</u> RipRap <u> </u>
Run <u>150</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u>30</u>	Silt <u> </u>	Algae <u> </u>	Woodland <u>100</u>	Other <u> </u>
Rapids <u> </u>	Sand <u>30</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>50</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u>20</u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u> </u>			

Mussel Sampling Data Sheet - Station (*indicates required field)

p. 13 of 13

(Vaughan) Waterbody ID 2906300 [Site 13] [Sird 004P]

*Stream: UNT of Vaughan Creek Station: N/A Site Mile N/A

*Date (mm/dd/yyyy): 10/26/2023 *Collectors: Matthew Gilroy; Nick Turner

*County: Iron *Station Start GPS Location: 46.48442
(hddd.ddddd) -90.48463

*T R Sec QQ Q

Nearest Road/Access: Steintz Road Dist. from access Above Below

*Time (24 hr): 1315 *Water Level: Normal Above 0.1 (0.1 m) Below (0.1 m)

*Air Temp (C°): 8.3 *Water Temp (C°): 9.2 Conductivity (umhos): Turbidity (NTU):

*Water Clarity: (C) St Slt Turb *Visibility (cm): 40 Measure depth to which fine substrate can be clearly seen

*Gradient (flow): N (L) M H *Natural ✓ Tailwater (< 5.0 mi below dam) Dist below dam

*SAMPLING STRATEGY: Initial (Initial - Timed Search - Quadrats)

*Search Time (24 hr): Start 1330 Stop 1400 Total (min) 60 *Bank: L R (B)

*Area searched Length (m) 200 Mean Width (m) 1 12 surveys

*Mussels present: Y (N) *Distance to live mussels (m) N/A

*General Habitat Description

River Widths (Approx. every 2 stream width apart) 1 1 1 1 2 1 1 1 1 1

Macro Habitat Length (m)	Substrate (nearest 5%)	Instream Vegetation (nearest 5%)	Riparian Land Use (Nearest 5% within 5 m)	Artificial Bank Features Length (m)
Pool <u> </u>	Detritus <u>30</u>	Emergent <u>90</u>	Wetland <u>100</u>	RipRap <u> </u>
Run <u>200</u>	Clay <u> </u>	Submergent <u> </u>	Meadow <u> </u>	Seawall <u> </u>
Riffle <u> </u>	Silt <u> </u>	Algae <u> </u>	Woodland <u> </u>	Other <u> </u>
Rapids <u> </u>	Sand <u>40</u>		Pasture <u> </u>	List Other <u> </u>
Other <u> </u>	Gravel <u>10</u>		Cropland <u> </u>	
List Other <u> </u>	Cobble <u> </u>		Developed <u> </u>	
	Boulder <u> </u>		Other <u> </u>	
	Bedrock <u> </u>		List Other <u> </u>	
	Other <u>20</u>			

Barely
channeled
wetland

Rooted
Vegetation