

Quality Assurance Project Plan for the
Friends of the Shiawassee River Water Quality Monitoring
Grantee: Friends of the Shiawassee River
EGLE Tracking Code: # 2022-0238
QAPP Prepared By: Sarah Baker, Programs Coordinator, FOSR

September 9, 2022

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QAPP Approval: Alyssa Riley Date: 9/13/2022
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1.0 Project Management

1.1 Responsible Parties

The Friends of the Shiawassee River (FOSR) is the grant recipient. FOSR staff and volunteers will be conducting this water quality monitoring study. Sarah Baker, FOSR's Programs Coordinator, will be the crew leader and data manager, responsible for sampling macroinvertebrates and measuring critical water quality parameters. John Matousek, Aquatic Biologist for EGLE and also an FOSR stream monitoring volunteer, will further assist with macroinvertebrate identification if samples are in question. Patrice Martin, FOSR's Interim Executive Director, will provide project oversight and quality control review.

Name	Responsibility	Address	Phone/e-mail
Patrice Martin	Project Oversight	FOSR 538 N. Shiawassee Owosso, MI 48817	(989)723-9062 executivedirector@shiawasseeiver.org
Sarah Baker	Team Leader/ Data Manager	FOSR 538 N. Shiawassee Owosso, MI 48817	(989)723-9062 sbaker@shiawasseeiver.org
John Matousek	Macroinvertebrate Analyst	EGLE Water Resource Division	(517)755-6125 matouseki@michigan.gov
Barney Boyer	EGLE Lansing District Contact	EGLE Water Resources Division	(517)290-4597 boyerb2@michigan.gov
Autumn Mitchell	Project Manager	EGLE Water Resources Division	(517)388-6662 MitchellA24@Michigan.gov

1.2 Documentation

This Quality Assurance Project Plan (QAPP) will be distributed to the EGLE Nonpoint Source (NPS) QAPP coordinator and to the Friends of the Shiawassee River, which is the organization responsible for coordinating the project. Draft reports of the water quality monitoring study will be provided to the NPS QAPP coordinator, the NPS project administrator, and to all those named above. Final reports and data files will be kept in FOSR files and made available to stakeholders and EGLE.

2.0 Study Design

2.1 Problem Definition

The Holly Drain, located in Vernon, is a natural drain that connects to the Shiawassee river near a small park and is upstream of the Vernon launch. Since 2011 the Shiawassee County Health Department has put out 25 notices to the public of Sanitary Sewer Overflows (SSOs) being released into the Shiawassee River from the Holly Drain. The City of Durand has made improvements to their wastewater treatment plant over the last few years. However, in some occasions of heavy rain events, both the City of Durand as well as a nearby manufactured home community do have overflow events. They release their SSOs into the Holly drain which connects to the Shiawassee River at the location of site #SH19 (see map on Appendix A). We hope to start collecting data at this location to see what the current state of the macroinvertebrate population is. We also hope to track a long term improvement as the City of Durand continues to make more improvements to their wastewater treatment plant and they, with the support of FOSR continue to inform residents on ways they can help prevent overflow events. Conclusions will not be drawn about this tributary in regards to the information above, it is simply to be used as background knowledge of the site and supplementary information as to the reasoning Friends of the Shiawassee River choose this location as an additional site to monitor. Additionally, collecting at this site will also be beneficial as both the Conrad Drain and the Pratt Drain flow into the Holly Drain farther upstream. Both of these drains run through highly agricultural and rural areas.

One issue we have with our stream monitoring program is that the majority of our current sites are on the mainstem of the Shiawassee River. We realize the importance of collecting data at the mouth of a tributary to better allow us to track sources of any potential issues that may affect the Shiawassee River. Adding this site to our macroinvertebrate study helps us obtain our goal for the program's expansion of tributary sites.

For a full problem definition for all other sites see Appendix B section A5.

2.2 Project Description

The Shiawassee Health Department has informed us that site# SH19 is a safe location to conduct our stream monitoring program, provided we use routine good hygiene practices, wear waders and do not hold a collection event after a period of heavy rains. We regularly follow these practices at all of our stream monitoring events because the Shiawassee River is approved for partial body contact only.

For a full project description see Appendix B section A6.

3.0 Data Acquisition

3.1 Data Sources

- Stream Macroinvertebrate Monitoring Protocols: Michigan Clean Water Corps (MiCorps) monitoring procedures. Updated December 2020.
- Voshell, J.R. Jr. 2002. A Guide to Common Freshwater Invertebrates of North America: resource for properly identifying macroinvertebrate species.

3.2 Monitoring Procedure

Volunteers will be recruited in the weeks leading up to each training or sampling event, using email, online notifications, and press releases. A volunteer database will be maintained by staff at the Friends of the Shiawassee River throughout the project.

Volunteers will work in small teams led by the crew leader to sample macroinvertebrate populations at all sites possible, provided weather and river conditions are safe (See sites on Addendum 1. B1.) All sites will be sampled within a two-week period biannually in the spring and fall. This two-week time frame is needed due the Shiawassee River having a tendency to be flashy during periods of rain, as well as limited volunteers who are willing to lead a team and have been trained in collecting protocols. It is intended that the sampling from year to year will take place during a consistent time period, with the realization that the actual dates will depend on weather and stream conditions. Ideally the sampling will take place from year to year during the same two-week period surrounding target dates.

Macroinvertebrate samples are stored in alcohol and further identified by the macroinvertebrate analyst, down to the family level if data is questionable. All data is collected and recorded, following the parameters outlined in MiCorps Stream Macroinvertebrate Data, Identification and Assessment sheets.

Information will be entered into FOSR's electronic database, as well as MiCorps Data Exchange. Datasheets will be saved in paper files at the Friends of the Shiawassee River office and all monitoring data will be shared with EGLE.

3.3 Data Verification

Maintaining consistent protocol for quality assurance and quality control is of utmost importance. Datasheets and monitoring procedures will be managed in the field by crew leader/data manager, Sarah Baker. Any questionable or inconsistent data will be re-measured or reassessed for accuracy before leaving the site. Double data entry and proofreading will be conducted by the data manager to check for accuracy and inconsistencies.

4.0 Data Analysis

See Appendix B section C. for a full description.

4.1 Assessments and Response Actions

Questionable data will be reviewed by the macroinvertebrate analyst John Matousek, FOSR Volunteer and EGLE Aquatic Biologist, and/or another EGLE personnel.

See Appendix B section C.1-3 for a full description.

4.2 Analysis

Once macroinvertebrate counts and identifications are complete, monitoring crews can establish a score rating for the site. This scoring system is based on the Hilsenhoff Biotic Index, a strategy established by Dr. William Hilsenhoff, an entomology professor from the University of Wisconsin Madison. Hilsenhoff had assigned pollution sensitivity ratings to most macroinvertebrate species, genera, and families. Using the sensitivity ratings, a type of weighted average can be calculated to generate the pollution tolerance rating (or water quality rating) for macroinvertebrate samples on a scale of 0 (very pollution sensitive) to 10 (very pollution tolerant). MiCorps protocol does not identify macroinvertebrates to the lower taxonomic levels (just to order level), so allowance had to be made with Hilsenhoff's sensitivity score to produce an average sensitivity rating for each of the taxonomic groups on the datasheet. MiCorps has done this by averaging the sensitivity rating of the different families and assigning the result to the larger taxonomic group. The sensitivity ratings that MiCorps uses are best estimates for that taxonomic order, but are not perfect. This loss of accuracy is because of the balance that needs to be met between identification and volunteer/program leader ability. The final MiCorps score given to the monitored site is called the WQR (Water Quality Rating).

FOSR's past and present involvement with MiCorps Volunteer Stream Monitoring Program (VSMP) allows us to share our monitoring information broadly and publicly through entering our data into MiCorps Data Exchange (MDE). Data gathered from all of our sites will be shared and publicly accessible through this MDE platform. This system plays a crucial role for providing reliable and current water quality information for water resources management and protection at the state and local level.

5.0 References

Michigan Clean Water Corps. (2020). *Macroinvertebrate Datasheet – Order Level (new methodology)*. MiCorps, EGLE, and Michigan State University Extension. <https://micorps.net/stream-monitoring/stream-documents/>

Steen, Latimore, MiCorps Staff, Huron River Watershed Council, and Michigan State University. (2020). *MiCorps Volunteer Stream Monitoring Program: Monitoring Procedures*. Michigan Clean Water Corps, EGLE, and Michigan State University Extension. <https://micorps.net/stream-monitoring/stream-documents/>

Michigan Clean Water Corps. (2020). *Macroinvertebrate Monitoring Gear*. MiCorps, EGLE, and Michigan State University Extension. <https://micorps.net/stream-monitoring/stream-documents/>

Voshell, J.R. Jr. 2002. *A Guide to Common Freshwater Invertebrates of North America*. Granville, Ohio, The McDonald & Woodward Publishing Company.

Appendix A

Operating Procedure

Friends of the Shiawassee River Water Quality Monitoring EGLE Tracking Code # 2022-0238

SUBJECT: Macroinvertebrate Sampling

WHO	DOES WHAT
Team Leader/ Data Manager & Pickers	<p>1) The Team Leader creates a crew of volunteers, consisting of no fewer than 2 people. The Team Leader is the macroinvertebrate Collector, who is trained in collection techniques. This person is the only one to use the d-net to pull out debris and macroinvertebrates from the sampling habitats in the stream. The Collector will have a Collector's Assistant who enters the water with them, and carries the collection bucket. The Team Leader directs the rest of the volunteers who will now be referred to as the Pickers. The Pickers and Collector's Assistant do not have to be trained ahead of time. They work under the supervision of the Team Leader.</p> <p>2) The Team Leader samples macroinvertebrates within a 300-foot reach of Holly Drain (and all other sites). The Collector will have 30-40 minutes of total sampling time. The sample start and end times will be recorded. Samples will be taken from all available stream habitats to maximize diversity and quality. Habitats include, but are not limited to stream margins, undercut banks, woody debris, leaf packs, deep pools, cobble/gravel, boulders, aquatic plants, riffles and runs. A dip net with a 1mm mesh will be used for sampling. The Collector may also collect samples by turning over larger submerged items by hand. The Collector will be sure to filter as much sand and silt out of the d-net during the collection period to ensure a clean sample is taken, which makes identification efforts much easier.</p> <p>3) The Collector will be responsible for following MiCorps <i>collection techniques</i> as outlined in MiCorps Stream Monitoring Procedures Manual.</p> <ul style="list-style-type: none">a) Collecting will begin at the downstream end of the stream reach and work upstream.b) Do not collect mussels, clams or crayfish. Make note of them if found.c) Be aggressive. Macroinvertebrates hold tight to their various habitats and they need to be shaken loose.d) Always face the opening of the net upstream so specimens do not wash out with the current.e) The Collector will follow trained techniques for sampling in different habitats. As each habitat has unique features and sampling protocol, these methods must be exercised when in these various environments.

3) After the collection time is up, the Collector, along with the Pickers will sort through the sample bucket. Samples are taken out of the bucket and placed in white sorting trays with clean water. The Team Leader will instruct the Pickers on sorting techniques and fill out the data sheets. The idea is to be thorough yet efficient. The Pickers and Team Leader should work on macroinvertebrate sorting for approximately one hour or until they have gone through all their sample material, whichever comes first. The time when the last specimen is placed in the jar will be recorded.

5) The Collector will place all macroinvertebrate samples found into a collection jar of ethanol preservative. This jar will be labeled with the site #SH19 and the sample date. The team should strive to get at least 100 specimens. The Water Quality Rating (WQR) is designed to be most accurate with sample sizes of at least 100 specimens.

6) Once all samples are collected, the datasheets will be completed. The Team Leader will calculate a WQR. Please refer to Fig. 2 & 3 at the end of Appendix A.

7) Before leaving the monitoring site the Team Leader and Pickers will thoroughly clean the net, buckets and sorting trays to avoid transporting animals or plants. Since multiple monitoring sites will be done at this time of year, waders and all other gear must be disinfected in order to sanitize it before entering another body of water. Full instructions on decontamination procedures can be found at <https://www.hrwc.org/volunteer/decontaminate/>.

APPENDIX A (1)

Basic Equipment List for Macroinvertebrate Sampling

- Five Gallon Buckets
- D-frame collection net
- Spare net bags
- Waders (at least 2 pair)
- Sorting trays
- Featherweight forceps
- Eyedroppers
- Specimen jars
- Ethanol (preservative)
- Garbage bags
- Decontamination kit

Appendix A

Operating Procedure

Friends of the Shiawassee River Water Quality Monitoring EGLE Tracking Code # 2022-0238

SUBJECT: Macroinvertebrate Sampling

Figure 1. Site Map



A map of all sites included in our monitoring program can be found at the link below.

<https://www.google.com/maps/d/u/0/edit?mid=1tDfMmJwx5CPqjDzPuUSy5qc9Mwg&ll=43.11000733672354%2C-84.00028061831215&z=10>

Appendix A

Operating Procedure

Friends of the Shiawassee River Water Quality Monitoring EGLE Tracking Code # 2022-0238

Site #	Site Name	Coordinates
SH17	Waterworks Park	(42.78621, -83.62649)
SH14	Byron Sesquicentennial Park	(42.82454, -83.94602)
SH11	Shiatown Park - Above Former Dam	(42.92828, -84.0695)
SH08	Shiatown Park - Below Former Dam	(42.93033, -84.07393)
SH 19	Holly Drain, Vernon	(42.94145, -84.03762)
SH15	Corunna - Above Former Dam	(42.98778, -84.11722)
SH16	Corunna - Below Former Dam	(42.98511, -84.117639)
SH07	Owosso -Above Dam	(42.99656, -84.17351)
SH06	Owosso - Below Dam	(43.00041, -84.17605)
SH03	DeVries Nature Conservancy	(43.03654, -84.18742)
SH09	South State Drain	(43.05402, -84.18644)
SH12	Showboat Park	(43.174869, -84.11176)
SH13	St. Charles, Hulien Road DNR Boat Launch	(43.30299, -84.11117)

Appendix A

Operating Procedure

Friends of the Shiawassee River Water Quality Monitoring EGLE Tracking Code # 2022-0238

SUBJECT: Macroinvertebrate Sampling

Figure 2. MiCorps Macroinvertebrate Datasheet (1)

MiCorps Site ID#: _____



Stream Macroinvertebrate Datasheet

Site Name: _____

Date: _____ Collection Start Time: _____ (AM/PM)

Major Watershed: _____ HUC Code (if known): _____

Latitude: _____ Longitude: _____

Names of Team members: _____

Stream Conditions:

Average water depth: _____ feet

Notable weather conditions of the last week: _____

Are there any current site conditions that may impede normal macroinvertebrate sampling? (weather, flooding, poor visibility, etc?)

Habitat Types: Check the habitats that were sampled. Include as many as possible.

Riffles Backwater areas Submerged Wood
 Rocks Leaf Packs
 Aquatic Plants Pools
 Runs Undercut banks/Overhanging Vegetation

Did you see any crayfish? #: _____, Clams/mussels? # _____
remember to include them in the assessment on the other side!

Do not take crayfish, fish, clams, and mussels from the water.

Collection Finish Time: _____ (AM/PM) Picking Finish Time: _____ (AM/PM)

Identifications made/supervised by: _____

Rate your confidence in these identifications: Quite confident Not very confident
 5 4 3 2 1

Datasheet checked for completeness by: _____ Datasheet version 11/13/2020
Data entered into MiCorps database by: _____ Date: _____

Appendix A

Operating Procedure

Friends of the Shiawassee River Water Quality Monitoring EGLE Tracking Code # 2022-0238

SUBJECT: Macroinvertebrate Sampling

Figure 2. MiCorps Macroinvertebrate Datasheet (2)

MiCorps Site ID#: _____



IDENTIFICATION AND ASSESSMENT

**** Do NOT count empty shells, pupae, or terrestrial macroinvertebrates****
****Taxa are listed from most pollution sensitive to most pollution tolerant****

Count	Common Name	Scientific Taxa	Sensitivity Rating (0-10)	Count x Sensitivity
	Hellgrammite (Dobsonfly)	Megaloptera, Corydalidae	0.0	
	Clubtail Dragonfly	Odonata, Gomphidae	1.0	
	Sensitive True Flies (water snipe fly, net-winged midge, dixid midge)	Athericidae, Blephariceridae, Dixidae,	1.0	
	Stonefly	Plecoptera	1.3	
	Caddisfly	Trichoptera	3.2	
	Mayfly	Ephemeroptera	3.5	
	Alderfly	Megaloptera, Sialidae	4.0	
	Scud	Amphipoda	4.0	
	Dragonfly	Odonata	4.0	
	Beetle	Coleoptera	5.1	
	Somewhat Sensitive True Flies	Dipterans (those not listed elsewhere)	6.0	
	Crayfish	Decapoda	6.0	
	Bivalves/Snails	Pelecypoda, Gastropoda	6.9	
	True Bug	Hemiptera	7.7	
	Damselfly	Odonata	7.7	
	Sowbug	Isopoda	8.0	
	Tolerant True Fly (mosquito, rat-tailed maggot, soldier fly)	Culicidae, Syrphidae, Stratiomyidae	8.7	
	Leech	Hirudinae	10.0	
	Aquatic Worm	Oligochaeta	10.0	

First: If your total abundance is Less than 30 → Automatically give it a WQR of 10 (Very Poor rating)
 Less than 60 → Automatically give it a WQR of 7 (Poor rating)

Water Quality Rating	Degree of Organic Pollution
0.0-3.50 excellent	Pollution unlikely
3.51-4.50 very good	Slight pollution possible
4.51-5.50 good	Some pollution possible
5.51-6.50 fair	Fairly substantial pollution likely
6.51-7.50 fairly poor	Substantial pollution likely
7.51-8.50 poor	Very substantial pollution likely
8.51-10.0 very poor	Severe pollution likely

	Total Abundance		Sum of (Count x Sensitivity):	
--	------------------------	--	--------------------------------------	--

Water Quality Rating =
Sum of (Count x Sensitivity) Divided By Total Abundance
 = _____

Appendix B.

A1. Title and Approval Sheet

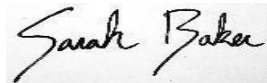
**Quality Assurance Project Plan for
Friends of the Shiawassee River, Stream Monitoring Program**

Date: 12/8/2020 Version # 2

Organization: Friends of the Shiawassee River

QAPP Prepared by: Sarah Baker Title:
Program Coordinator

Signature:



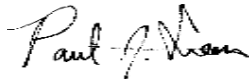
Other responsible individual: Title:
Signature:

(Other signatures may be added as necessary)

Signature upon approval:

MiCorps Reviewer: _____ Paul Steen

12/8/2020



Signature of reviewer

Date

QAPP is approved for two years after the date signature given; afterwards it must be reapproved.

A2. Table of Contents

A. Project Management A1.

Title and Approval Sheet

A2. Table of Contents

A3. Distribution List

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B. Program Design & Procedures

B1. Study Design & Methods

B2. Instrument & Equipment Testing, Inspection and Maintenance

B3. Inspection and Acceptance for Supplies and Consumables B5. Data Management

C. System Assessment, Correction and Reporting

C1. System Audits and Response Actions C2. Data Review, Verification, and Validation

C3. Reconciliation with Data Quality Objectives C4. Reporting

Appendices'

Appendix A

Time Table of Activities

Appendix B

Map of Shiawassee Watershed Sites

Appendix C

Stream Data Collection Sheet

A3. Distribution List

Nick Tereck
Board Past President, Friends of the Shiawassee River
P.O. Box 402
Owosso, MI 4886

Lory Thayer
Board Vice President, Friends of the Shiawassee River
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Owosso, MI 48867

Matt VanEpps
Board Secretary, Friends of the Shiawassee River
P.O. Box 402
Owosso, MI 48867

Frank Livingston
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Tom Cook
Board Past President, Friends of the Shiawassee River
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Lorraine Austin
Executive Director, Friends of the Shiawassee River
P.O. Box 402
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Sarah Baker
Program Coordinator, Friends of the Shiawassee River
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Owosso, MI 48867

John Matousek Constitution Hall (3
South) 525 West Allegan St.
P.O. Box 30458
Lansing, MI 4890

Matt Herbert
Aquatic Ecologist, TNC 101 E. Grand
River Ave. Lansing, MI 48906

Team Leaders

Friends of the Shiawassee River Volunteers

A4. Project Organization

Grant activities will be conducted by Friends of the Shiawassee River. Sarah Baker, the current Program Coordinator, will coordinate the program, including maintaining the QAPP, and all Stream Team activities. All work and final decisions made by the Program Coordinator will be overseen by the Executive Director of Friends of the Shiawassee River, Lorraine Austin. They will recruit, train, and oversee field volunteers and make arrangements for program events, including equipment purchases. The Program Coordinator will also be responsible for implementing corrective actions.

Identifications will be aided by aquatic ecologist, John Matousek. He currently conducts biological monitoring and assessment of Michigan's waters for EGLE, making him uniquely qualified for this volunteer position. Additional program oversight, such as pinpointing future site locations, will be provided by Matt Herbert, Aquatic Ecologist with TNC. He aided in the development of the FOSR MiCorps program in 2007/2008, when the former FOSR Director was partially funded by TNC. Following sample verification, the Program Coordinator will manage data and analysis. All reporting will come from Friends of the Shiawassee River.

A5. Problem Definition & Background

Located in a highly agricultural region, the Shiawassee River has historically been stressed by excessive levels of sedimentation as a result of incompatible land practices. The Village of Chesaning, St. Charles, Byron and the city of Owosso will partner with the Friends of the Shiawassee River (FOSR),

a volunteer-based organization, to monitor benthic macroinvertebrate communities within the Shiawassee River watershed. This project will be an expansion of the FOSR monitoring program, Stream Team, to include additional communities in the watershed and promote partnerships between local governments, community organizations, and citizens for the betterment of water quality. Monitoring will be conducted twice annually (spring and fall).

During the 2014 Great Lakes Restoration Initiative project worked with elected officials in the Shiawassee River watershed, stakeholders were surveyed regarding their interests in water quality. This survey determined that water quality protection is a concern of local governments, but is often not highly prioritized due to their limited resources as small, rural municipalities. By engaging a variety of community stakeholders in the monitoring process, we hope to achieve greater community buy-in for water quality improvement and therefore a higher prioritization of water quality improvement actions by local governments. More specifically, the goals of the proposed partnership and the Stream Team Program are:

- To collect baseline data and initiate a long-term data set on the health of the Shiawassee River;
- To determine variability in health of the River within different environs and watershed communities;
- To engage community organizations, local government officials, and other volunteers in data collection to foster appreciation of the Shiawassee River and its habitats.
- To work closely with local governments in order to encourage greater awareness of water quality issues and spur the adoption of water quality protection policies by local governments.

The Shiawassee River is a top conservation priority and has been identified as one of the best remaining examples of a warm-water river system within its ecoregion, a geographically-cohesive natural area that covers the southern half of the Lower Peninsula and reaches beyond Michigan's southern-most border. Of great ecological significance are the wetland systems located within the headwaters region of the Shiawassee River (e.g., prairie fens and wet meadows), which support a diverse assemblage of rare plants and animals. The Shiawassee is the principal river flowing into the Shiawassee National Wildlife Refuge, a wetland sanctuary for an array of migratory bird species and other wildlife. The Shiawassee River flows through largely rural regions of the state before merging with the Flint, Cass, and Tittabawassee River to form the Saginaw River, which drains into the Saginaw Bay of Lake Huron. The Shiawassee River Watershed contributes to sedimentation and nutrient loading issues in the bay. In order to create lasting water quality improvements for the bay, local governments within the watershed must engage in water quality protection.

This project will address sediment, the largest water quality issue of the Shiawassee River, which has the potential to damage habitat for

macroinvertebrates and spawning habitat for many species of fish, including those valued for recreation. As human impacts on the Shiawassee River continue to grow, it is our ultimate goal to create a long-term data set to supplement that collected by the MDEQ to continually monitor changes in the ecosystem. FOSR will both collect reliable data while actively engaging and educating the public in conservation issues and, consequently, building local support for natural resources. Through increased public awareness we anticipate more support from communities and funders within the watershed resulting in long-term sustainability.

A6. Project Description

Friends of the Shiawassee River (FOSR), a volunteer-based organization, will monitor benthic macroinvertebrate communities within the Shiawassee River Watershed. Sampling will occur at eight sites in the Owosso/Corunna area, as well as sites in Chesaning, St. Charles, Byron, Holly and Fenton. Some of the participating communities were chosen based on the response of community leaders during 2014 Great Lakes Restoration Initiative (GLRI) project work to build watershed partnerships for improving water quality.

Existing sampling sites in Owosso/Corunna include: Corunna Dam, DeVries Nature Conservancy (DNC), Owosso Dam, Shiatown Dam (Vernon), and a site on the South State Drain on Chipman Rd. north of the city of Owosso. The State Drain (agricultural site) and DNC are located significantly downstream of the Owosso wastewater treatment facility. The Corunna Dam and Owosso sites are located within two of the largest urban areas in the county. Both of these sites are sampled above and below a low-head dam whose removal is anticipated. Volunteers are continuing to sample above and below a former dam at the Shiatown Dam site throughout the phases of removal. The remaining landscape is dominated by agriculture and dotted by a few small villages. The DNC, Owosso, Shiatown, and State Drain sites have been sampled annually since 2008, and all of the data collected has been entered in the MiCorps database.

The sampling site in St. Charles area is on Bad River, a tributary of the Shiawassee River with heavy agricultural use. The Chesaning site is located on the main stem of the Shiawassee River as it flows through downtown Chesaning at ShowBoat Park. The community is invested in protecting this site as a natural resource. The Byron site is located within Byron's Sesquicentennial Park in a forested area where a storm water drain enters the river. The Holly site is located within Waterworks Park, this collection site is near the headwaters of the Shiawassee River. This particular site is also the gateway launch site to the Shiawassee River Heritage Water Trail. The Fenton Site is located near the

Fenton Community Center and represents a useful site in the warmer waters of the North Branch. We began collecting from this site in spring of 2017.

The current sites are heavily weighted toward the Shiawassee Mainstem. As our program expands, we would like to add sites within tributaries near where they flow into mainstem. Because they are smaller, tributaries respond to perturbations much more strongly and quickly than mainstem sites. In addition, tributary sites offer a much more specific perspective as to what is going on spatially within the watershed. Also, having additional sites that match up with EGLE "Trend" sites would allow us to fill the gaps between the 5 years the EGLE is monitoring those areas.

To ensure that data is consistently reported to MiCorps beyond the grant position of the Program Coordinator in 2017, and a committee referred to as the "Share Team" has been created to ensure Board engagement and awareness of program processes.

Monitoring will be conducted twice annually (spring and fall), at 12 sites within and along the Shiawassee Watershed. All sites will be sketched, photographed and monitored as an event within a two-week period each season and, with the assistance of aquatic ecologists, all samples will be identified to family level. It is the intent that additional parameters, such as chemical analysis, habitat assessment, and sampling sites will be added as interest and volunteer numbers grow with the program in future years.

This program will rely upon recruitment and training of volunteers through local newsletters, social media outlets, press releases, websites and relationships with community groups. FOSR will be responsible for recruitment and training of volunteers for spring and fall sampling.

Prior to collection events, 'team leader' and 'collector' volunteers will be required to attend training from FOSR, Huron River Watershed Council, or any other MiCorps affiliated training course. Team leaders will get additional instruction from staff on overall procedure, safety precautions, data collection, and sample identification in order to assist other volunteers in collecting quality data. The team leader will also receive additional instruction in the field on proper sampling techniques. To track volunteer activities, FOSR maintains a web based relationship management system with dynamic data collection, communications, and tracking capabilities.

Sampling will be conducted as a team activity with one team per sample site. All sites will be located in wadable, accessible portions of the Shiawassee River watershed. Each team will consist of 1-2 team leaders and 2-7 additional collectors/sorters. Sampling will be conducted in one day, if possible. But in the event that numerous leaders are not obtainable, all sampling will be completed within a two-week period. Specimens will be preserved for a separate identification event, to occur no more than four weeks later than sampling. Collected specimens will be identified to order with the assistance of aquatic biologists.

A7. Data Quality Objectives

Precision/Accuracy

Since there is inherent variability in accessing the less common taxa in any stream site and program resources do not allow program managers to perform independent (duplicate) collection of the sampling sites, our goal for quality assurance is conservative. A given site's Stream Quality Index (SQI) score or total diversity (D) measure across macroinvertebrate taxa will be noted as "preliminary until three spring sampling events and tree fall sampling events have been completed.

Precision and accuracy will be maintained through following standardized MiCorps procedures. The Program Coordinator will be trained in MiCorps procedures at the annual MiCorps training led by MiCorps staff. MiCorps staff also conduct a method validation review with the Program Coordinator to ensure their expertise. This review consists of supervising the Program Coordinator's macroinvertebrate sampling and sorting methodology to ensure that they are consistent with MiCorps protocol. All cases of collecting deficiencies are promptly followed by additional training in the deficient tasks and a subsequent method validation review may be scheduled for the following collecting season. Upon request, MiCorps staff may also verify the accuracy of the program's macroinvertebrate identification. Precision and accuracy will be maintained by conducting consistent volunteer team leader training. The following techniques will be reviewed during training and in regular retraining of team leaders every three years: 1.) thorough and vigorous collecting style, 2.) habitat diversity, inclusive of all habitats present at the sampling site, and 3.) the transfer of collected macroinvertebrates, with particular attention to thoroughness, from the net to sampling jars. These techniques will also be reiterated and stressed by project staff and team leaders prior to sampling on collection day.

Bias

Volunteers will sign in and record activities at each sampling site for each sampling event. Sites will be sampled by different team leaders at least once every three years in each season (spring and fall) to examine the effects of bias in individual collection styles. The new measure should be within two standard deviations of the median of past measures. Sites not meeting this DQO will be evaluated by the Program Expert.

Completeness

Following a QA review of all collected and analyzed data, data completeness will be assessed by dividing the number of measurements judged valid by the number of total measurements performed. The data quality objective for completeness for each parameter for each sampling event is 90%. If the program does not meet this standard, the Program Coordinator will consult with MiCorps staff to determine the primary causes of data invalidation and develop an action plan to improve the completeness of future sampling events.

Representativeness

Study sites are selected to represent the full variety of stream habitat types available locally, emphasizing the inclusion of riffle habitat. All available habitats within the study site will be sampled and documented to ensure a thorough sampling of all of the organisms inhabiting the site. Resulting data from the monitoring program will be used to represent the ecological conditions of the contributing subwatershed. Since not enough resources are available to allow the program to cover the entire watershed, some subwatersheds will not initially be represented. Additional subwatersheds will be added in the future as resources and volunteers allow.

Sampling after extreme weather conditions may result in samples not being representative of the normal stream conditions. The Program Coordinator will compare suspect samples to the long term record as follows:

Measures of D and SQI for every sample will be compared to the median results from the past three years and each should be within two standard deviations of the median. If the sample falls outside this range, it can be excluded from the long-term data record.

Comparability

To ensure data comparability, all volunteers in the watershed will follow the same sampling and site selection methods and use the same units of reporting. Program coordinators and trainers will learn the standard MiCorps monitoring methods at annual training conducted by MiCorps staff and will train their volunteers to follow those methods to ensure comparability of results among all MiCorps programs. If a Program Coordinator leaves the position and a new Program Coordinator is hired, then the new hire will attend the next available training given by MiCorps. To the extent possible, the monitoring of all study sites will be completed on a single day. For each sampling event not completed on a single day, monitoring by volunteers will be conducted within a two-week period.

A8. Special Training & Certification

Program managers from FOSR will be trained following MiCorps procedures. Project managers will provide training to team leaders and collector volunteers. Team leaders must participate in one sampling day event (prior experience in benthic training will be sought out), attend a training session conducted by the project manager of FOSR, sample jointly with another team leader when possible, attend bug identification sessions following sampling days, sign in at all events, and participate in regular retraining events.

SECTION B: PROGRAM DESIGN AND PROCEDURES

B1. Study Design and Methods

Sampling Events

Ideally, twelve sites will be sampled during a one-day group sampling event held in the spring (May) and fall (October) each year for all benthic macroinvertebrates. Except for in the event that we do not have numerous Leaders, in that case, sampling will be completed within a two-week period. Each site will also be assessed for habitat at least once every five years, and more frequently if a group suspects a site is changing rapidly. Prior to collection events, “team leader/collector” volunteers will be required to attend training from FOSR or another MiCorps affiliated training program. The team leaders will get additional instruction from staff on overall procedure, safety precautions, data collection, and sample identification in order to assist other volunteers in collecting quality data. The collector will also receive additional instruction in the field on proper sampling techniques. All other volunteers that attend our collection events will be the “pickers” and pick macroinvertebrates from material in the trays to help sort into jars. Data forms and samples collected during the event are then submitted to the program managers on the day of the event or within a week of the event. A timeline of all tasks to be performed is included in *Appendix A*.

If possible, the bugs collected will be identified on site. This will allow the volunteers involved to see immediate results of their work. If a trained bug identifier is not on site, the program managers will schedule an identification workshop. During this workshop volunteers will help sort the macroinvertebrates collected into bug groups and the aquatic ecologist will further identify the specimens to order level.

Sampling Sites

Sites will be selected based on the following criteria: safety, accessibility, quality of habitat, prior sampling history (at some sites with EGLE), ability to inform future conservation efforts, as well as areas that are currently, or soon to be altered by dam removal.

The following sites will be monitored by Friends of the Shiawassee River:

1. Waterworks Park (42.78621, -83.62649), MiCorps Site ID #SH17
2. Downtown Fenton (42.79492, -83.7055), MiCorps Site ID #SH18
3. Byron Sesquicentennial Park (42.82454, -83.94602), MiCorps Site ID #SH14
4. Shiatown Dam, both above (42.92828, -84.0695), MiCorps Site ID #SH11 and below the dam (42.93033, -84.07393), MiCorps Site ID #SH08
5. Corunna Dam, both above (42.98778, -84.11722), MiCorps Site ID #SH15 and below the dam (42.98511, -84.117639), MiCorps Site ID #SH16

6. Owosso Dam, both above (42.99656, -84.17351), MiCorps Site ID #SH07 and below the dam (43.00041, -84.17605), MiCorps Site ID #SH06
7. DeVries Nature Conservancy (43.03654, -84.18742), MiCorps Site ID #SH03
8. South State Drain (43.05402, -84.18644), MiCorps Site ID #SH09
9. Showboat Park (43.174869, -84.111761), MiCorps Site ID #SH12
10. Hulien Road Site (43.30299, -84.11117), MiCorps Site ID #SH13

A map of our current sampling sites in Shiawassee Watershed is attached in *Appendix B*.

Prior to each collection event, the team leader will meet with the Program Coordinator to go over the procedures of the upcoming collection and to receive all equipment and materials that will be needed. Volunteers will be given directions to the site location when they sign up for the event on the FOSR website. Volunteers will meet at the site on the day of the collection, unless otherwise directed to meet at a more centralized location. Before beginning a collection, there will be a quick overview of the study for new volunteers, as well as an explanation of the exact location on where to collect the specimens. To help with consistency returning volunteers will be asked to sample the same locations at least 3 years in a row. However, sites will be sampled by different team leaders at least once every three years, preferably annually, in each season to examine the effects of bias in individual collection styles.

If a team is unable to monitor their site on our collection day, or the weather does not cooperate on our scheduled collection day, then the team/teams will be given a two-week period to sample their sites and return the data and equipment to the project coordinator. If an issue concerning inaccessibility continues beyond the two-week period, then no monitoring data will be collected during that season and there will be a gap in the data.

Sampling Procedures

Procedures for our sampling events will be based on the MiCorps “Techniques for Stream Macroinvertebrate Collecting” document. The team leader will make sure the collector takes multiple samples from each habitat types present at each site, including riffle, quiet place/pool, undercut bank/overhanging vegetation or roots, submerged or emergent vegetation, rocks/logs, and leaf packs while wading and using a D-frame kick net. The collector will start downstream and work upstream to avoid disturbing the areas yet to be sampled. Once specimens are collected the collector will transfer the material from the net into the white pans. During this time, the team leader will be communicating with the collector to make sure samples are taken from each habitat. The leader will also be recording information such as stream name,

location, date, monitoring team, stream conditions and site sketch on the “Stream Macroinvertebrate Datasheet”. Once the specimens have been transported into the white pans, the pickers will be picking out the macroinvertebrates from the rocks and leaves and putting them into a collection jar filled with 95% ethyl alcohol for later identification. Specimens of each invertebrate type will continue to be preserved until at least 15 individuals of each type are preserved. Prior to sampling, the team leader will explain to all pickers the importance of preserving multiple specimens of each type (i.e., will be used to define whether a taxa is rare or common, helps ensure that different families that may look alike to pickers both get preserved) and will explain that these collections will have no impact on local populations. The collection period will last 40 minutes, or as long as it takes to thoroughly sample every different kind of habitat, up to an hour. Picking will continue until all collected material has been sufficiently sorted. Collectors can help pick through material upon completion of collection activities. At the end of each sampling the nets and pans will be rinsed before leaving the site to avoid transporting animals or plants between sampling sites. The team leader will also double check that the data sheet is completely filled out and that all habitats have been sampled.

Potential sources of variability such as weather/stream flow differences, season, and site characteristic differences will be noted for each event and discussed in study results. Any variations in procedure will be explained on the data sheet. (*Appendix C*)

Identification Procedures

At the collecting site, all invertebrate sample jars receive a label written in pencil, collection date, location, name of collector, and number of jars containing the collection from this site, which is placed inside the jar. The data sheet also states the number of jars containing the collection from this site. The team leader is responsible for labeling and securely closing the jars and returning all jars and all equipment to the project manager. Upon return, the program managers check the collections for labels, makes sure the data sheets are complete with the correct information on the number of jars containing the collection from the site, and that the jars are secured together with a rubber band and site label and placed together in one box. The jars will be stored at FOSR office until they are examined and counted on the day of identification (one or two weeks later). The data sheets are used on the identification day, after which they remain on file indefinitely. At the time of identifying the samples, the project managers check the data sheet and jars to ensure that all the jars, and only the jars, from that collection are present prior to emptying them into a white pan for sorting. If any specimens are separated from the pan during identification, a site label will accompany them. For identification, volunteers sort all specimens from a single site into look-alike groups. An Aquatic ecologist will then identify them further to the order level. Literature references used for identification will include: Guide to Aquatic Invertebrates of the Upper Midwest: Identification Manual for Students, Citizen Monitors, and Aquatic Resource Professional, by Bouchard, A

Guide to Common Freshwater Invertebrates of North America by Voshell, and Aquatic Insects of North America by Merritt and Cummins. When an identification of a sample is complete, the entire collection is placed in a single jar of fresh alcohol with a poly-seal cap and a printed label inside the jar and stored at the FOSR Office indefinitely. The alcohol will be carefully changed (to avoid losing small specimens) in the jars every few years.

Sampling Equipment

FOSR provides the following equipment to the monitoring teams during each sample event:

4 D-frame nets	2 glass jars with preservative
5 sorting trays	2 tarps
5-10 forceps	waders as needed
4 squirt bottles	

All equipment will be stored at DeVries Nature Conservancy or the FOSR office. After each collection day the project managers will inspect the equipment and make any necessary repairs.

Equipment Quality Control:

- Check to make sure equipment is in working order and not damaged
- Clean equipment before and after taking it into the field
- Label equipment with their dates of purchase and dates of last usage
- Check the expiration date of chemical reagents prior to each use
- Check the batteries of all equipment that requires them

Field Procedures Quality Control:

- Collect replicate samples
- Conduct repeat and/or side-by-side tests performed by separate field crews
- At least once every three years in each season: change the composition of the field crews to maintain objectivity and minimize individual bias
- Review field records before submitting for analysis to minimize errors

Since our evaluation is based on the diversity in the community, we attempt to include a complete sample of the different groups present, rather than a random sub-sample. We do not assume that a single collection represents all the diversity in the community, but rather we consider our results reliable only after repeated collections spanning at least three years. Our results are compared with other locations in the same river system that have been sampled in the same way. All collectors attend an in-stream training session, and all sites are sampled by different collectors every three years to diminish the effects of bias in individual collecting styles. Samples where the diversity measures diverge substantially from past samples at the same site will be re-sampled by a new team within two weeks or will be discarded. If a change is confirmed, the site becomes a high priority for the next scheduled collection. Field checks include checking all data sheets to make sure each habitat type available was sampled, and the team leader examines several picking trays to ensure that all present families have been collected. All lab sorting is rechecked by an expert before completing identification.

B2. Instrument/Equipment Testing, Inspection, and Maintenance

Equipment	Inspection	Maintenance
D-frame collection nets	Firmly attached to poles and free of holes	Adhere the nets to the poles, replace and holes and if beyond repair then replace.
Sorting Tray	Clean and dry	Clean all trays before next collection. Replace as needed
Forceps	With tips that meet	Replace any forceps that the tips don't meet
Waders	Clean, do not leak	Fix any holes that have formed. Replace if beyond repair
Squirt Bottles	Clean and dry	Clean all bottles before next collection. Replace as needed

Inspections and maintenance will be conducted by the project manager once the equipment is returned to the storage site after each monitoring event. Equipment will also be inspected again before it is sent out for sampling. A tracking sheet will be created and kept with supplies that records the purchase

and replacement dates. Equipment will be stored at DeVries Nature Conservancy.

B3. Inspection/Acceptance for Supplies and Consumables

Equipment	Inspection	Maintenance
Preservative 70% Ethly Alcohol	Check expiration date. Make sure we have enough for next collection	Purchase more as needed.
Collection Jars	Poly seal top is intact. Make sure we have enough for next collection	Purchase more as needed

Inspections and maintenance will be conducted by the project manager once the equipment is returned to the storage site after each monitoring event. Equipment is also inspected again before it is sent out for sampling.

A tracking sheet will be created and kept with the supplies that records the purchase and replacement dates.

B5. Data Management

Field data sheets are completed in the field and checked by the project managers once submitted. All original data sheets will be scanned in and will be backed-up on FOSR's Google Drive. After every collection, all new data will be entered into MiCorps data exchange system. Data sheets will be filed at the FOSR office for a period of at least five years.

Metrics that will be calculated include the following:

- Stream Quality Index (SQI)
- Total Number of Orders
- Sensitive Taxa

Each of these metrics will be tracked over time at each site (significant trends will be identified through regression) and sites will be compared based upon mean scores over time and differences in trends among sites.

C1. System Audits and Response Actions

To ensure quality data collection, steps will be taken to evaluate whether data collection procedures are being implemented correctly. This will be accomplished by training team leaders to evaluate team performance and by periodic steps from program staff to evaluate team leaders and team performance. This will

ensure that data collection and management processes are being followed accurately. Any potential deviations from the process will be corrected, noted, and will be evaluated using the results of the data (both short-term and long-term). Actions will be taken to eliminate data, if warranted. Steps that will be taken to periodically evaluate the performance of the program include the following:

- Volunteer team leaders will be trained for MiCorps protocols and will be instructed to evaluate sampling procedures to assure that methods and quality assurance protocols are followed. They will be asked to report any issues possibly affecting data quality. Program staff will periodically visit sites to evaluate sampling procedures and the performance of team leaders.
- If deviation from the QAPP is noted at any point in the sampling or data management process, the affecting samples may be deleted from the data set. Re-sampling will be conducted if warranted and feasible, if the deviation is noted soon after occurrence and volunteers are available. Otherwise, a gap may be left in the monitoring record. All corrective actions, such as the above, will be documented and communicated to MiCorps.

C2. Data Review, Verification, and Validation

Data will be reviewed at multiple stages for completeness and accuracy. Macroinvertebrate identification will be performed as part of an identification day where volunteers will help to sort specimens and record data, but all identifications will be confirmed by qualified ecologists/entomologists. All results will be examined for potential outliers that might indicate poor collection techniques. Any outliers will be investigated and eliminated if necessary. Specific steps for Data Review and Verification and Validation include the following:

Data Review

- Data forms will be standardized and will be designed to prompt collectors to complete all tasks.
- Team leaders will be asked to review all data sheets for completeness prior to leaving the site.
 - Sheets will be reviewed by the program manager for completeness, unusual measurements, and accuracy of calculations.
 - Data sheets and data on computer will be scanned to proofread for data entry errors

Verification and Validation

- Macroinvertebrates will be identified by program experts with dichotomous keys, including Guide to Aquatic Invertebrates of the Upper Midwest: Identification Manual for Students, Citizen Monitors, and Aquatic Resource Professional, by Bouchard, A Guide to Common Freshwater Invertebrates of

North America by Voshell, and Aquatic Insects of North America by Merritt and Cummins.

- If total diversity undergoes a steep decline at a site, the site will be visited by staff to assess potential changes at the site and potentially to sample for missing taxa or to conduct a new survey. Sites with less than 70% of the diversity previously found at the site may indicate less-than-thorough sampling. In this event the site may be re-sampled for verification or results may be discarded.
- Some sites will overlap between MiCorps and EGLE P51 monitoring. We will compare MiCorps results with EGLE results to evaluate data collected at those locations.
- Data will be compared with data collected previously at the site, as described in the Data Quality Objectives (A7).
- Teams will shift to different sites over time, which will allow us to statistically compare efficiency among sampling teams (or team leaders) after several years of monitoring. Hopefully this will act to validate the data collected in the program. A certain amount of annual variability should be expected at each site, but if a team is consistently collecting a lower diversity of organisms over time (even if the results are within 1 standard deviation from the median), we will be able to detect this. Should some teams be less efficient than others, the issue will be documented and communicated to the volunteer and MiCorps. These data may still be utilized and may be statistically corrected for differences in sampling efficiency among teams, but this process will be noted and data points may need to be removed from the monitoring record. Similarly, sampling efficiency may improve over time as team leaders gain experience, which we will also be able to evaluate statistically.
- If time allows, replicate quality control sampling may be conducted by program staff at a subset of sites within 2 weeks of the volunteer monitoring.

C3. Reconciliation with Data Quality Objectives

Data will be reviewed periodically to determine if the project's data quality objectives are being met. The Program Coordinator will determine and ensure that the data have high quality (accuracy, precision, representativeness, comparability, and completeness) and if program protocols should be changed or updated and if corrective actions are necessary. The Program Coordinator will also consult with other staff and partners to review sampling locations and determine if any should be changed and/or what new stream sites might be added, as well as whether more data should be collected, different water quality indicators should be assessed, and/or different indices should be utilized. Project goals, aims, direction, and purpose will be reviewed on an annual basis.

C4. Reporting

Throughout the duration of this program, quality control reports are included with quarterly project reports that are submitted to MiCorp. Quality control reports provide information regarding problems or issues arising in quality control of the project. These could include, but are not limited to:

- List of sites monitored
- Comparison among sites and trends in data at each site
- QA results, with a summary of any problems discovered
- Any notable achievements
- Names of volunteers

Program staff generates annual reports sharing results of the program with volunteers, special interest groups, local municipalities, and relevant state agencies. Data and reports are made available upon request.

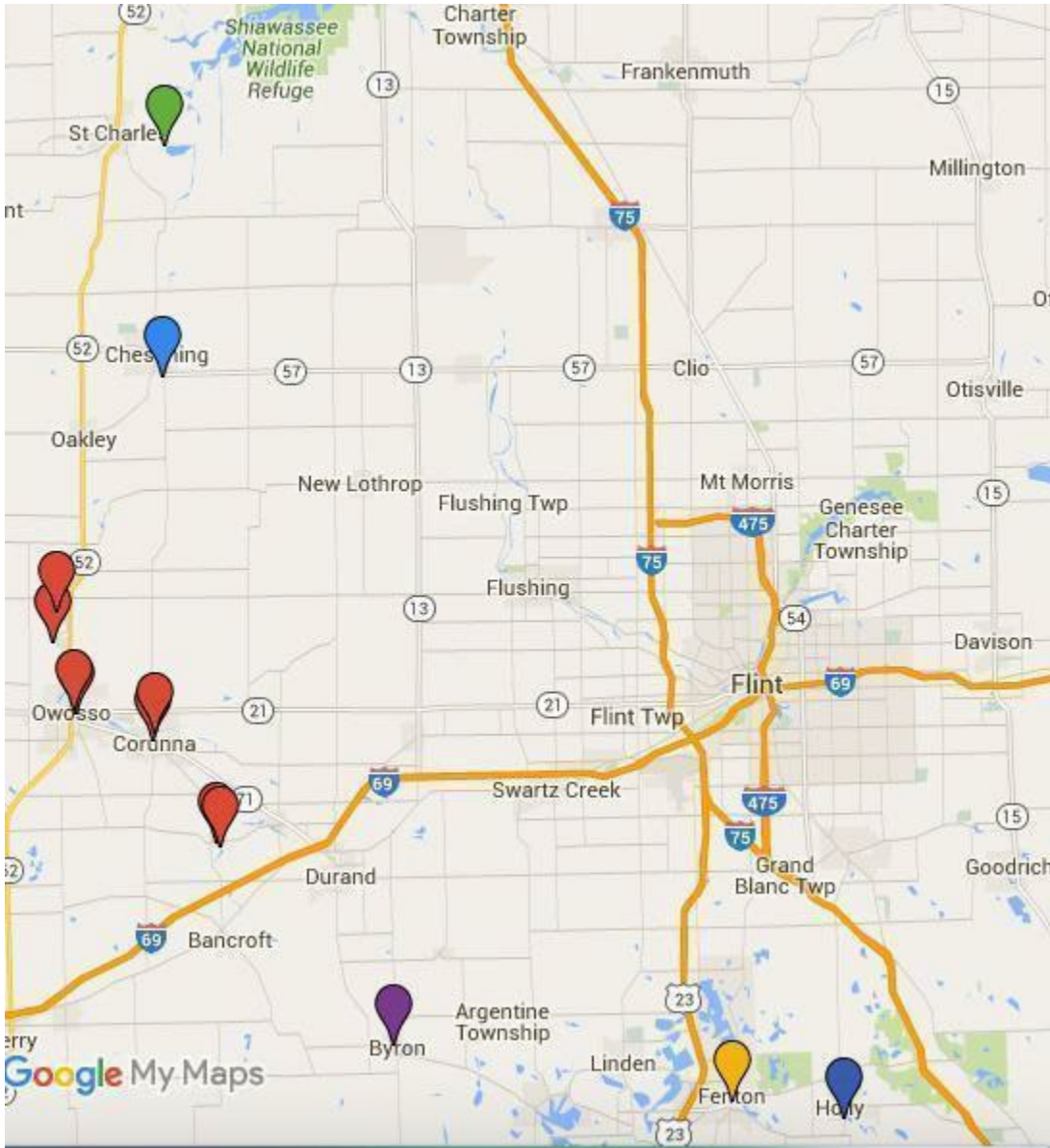
Project Year 1: 2020/2021

Task	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
Project Preparation	■	■	■	■						■	■	
Sampling Events				■	■						■	
Data Management						■	■	■	■	■		
Outreach & Education	■	■	■	■	■	■	■	■	■	■	■	■
Project Management		■			■			■			■	

Project Year 2: 2021/2022

Task	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan.	Feb	March	April	May
Project Preparation	■	■	■	■						■	■	
Sampling Events				■	■						■	
Data Management						■	■	■	■	■		
Outreach & Education	■	■	■	■	■	■	■	■	■	■	■	■
Project Management		■			■			■			■	

Appendix B:



To view this map in more detail please go to:

<https://www.google.com/maps/d/u/0/edit?mid=1tDfMmJwx5CPqjDzPuUSy5qc9Mwg&usp=sharing>

Appendix C: Please Click the link below to view the MiCorps Stream Macroinvertebrate Datasheet – Order Level.

<https://cdn2.cloud1.cemah.net/wp-content/uploads/sites/63/2017/12/VSMP-Macro-OrderLevel-Datasheet.pdf>