## A1. Title and Approval Sheet

**Quality Assurance Project Plan for**
**The Thornapple River Volunteer Stream Monitoring Project**

Date:
Version #: 1
Organization: Barry Conservation District

QAPP Prepared by: Matt Bain
Title: Aquatic Specialist

Other responsible individual: Rachel Frantz
Title: Conservation Technician

Reviewed and approved by: Paul Steen, MiCorps Stream Program Manager,

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

# A2. Table of Contents

# Section A: Project Description and Quality Objectives

## A3: Distribution List

- Paul Steen, MiCorps Stream Program Manager, Huron River Watershed Council

## A4: Project Organization

Key individuals involved in the project and their responsibilities include:

**Management Positions:**

1. Jamie Lewis Hedges, Executive Director, Barry Conservation District, 1611 S. Hanover St. Ste. 105, Hastings, MI 49058, jamie.hedges@macd.org
2. Rachel Frantz, Conservation Technician, Barry Conservation District, 1611 S. Hanover St. Ste. 105, Hastings, MI 49058, rachel.frantz@macd.org

Jamie and Rachel are the primary Program Managers for the volunteer stream monitoring project. Their responsibilities include:

- Develop and implement a Quality Assurance Project Plan.
- Attend 8-hour training session provided by MiCorps.
- Promote volunteer stream monitoring activities and solicit volunteers.
- Research and purchase necessary equipment for performing stream monitoring activities.
- Coordinate and conduct volunteer stream monitoring training sessions.
- Coordinate volunteer stream monitoring field data collection sessions.
- Coordinate and implement macroinvertebrate identification review sessions for experts.
- Coordinate and implement indoor macroinvertebrate identification sessions.
- Implement database development, data entry, and data analysis.
- Develop reports for local governments, special interest groups, lake/stream associations.
- Provide copies of all products and deliverables in both hard copy and electronic formats.

**Support Positions:**

1. Matt Bain, Aquatic Specialist, Grand Valley Metro Council, Lower Grand River Organization of Watersheds, 678 Front Ave #200, Grand Rapids, MI 49504, matt.bain@gvmc.org
2. Renee VanHouten, Committee Chair Thornapple River Watershed Council, PO Box 382, Caledonia, MI 49316, thornappleriverwc@gmail.com
3. Ella Carr, Watershed Programs Associate, Grand Valley Metro Council, Lower Grand River Organization of Watersheds, 678 Front Ave #200, Grand Rapids, MI, 49504, LGROWgrad@gvmc.org

Matt, Renee, and Ella will assist in program management when needed. Their individual and combined responsibilities include:

- Develop/Revise Quality Assurance Project Plan (Matt).
- Assist with volunteer stream monitoring training sessions (All).
- Assist with volunteer stream monitoring field data collection sessions (All).

- Assist with macroinvertebrate identification review sessions for experts (Matt).
- Provide expert macroinvertebrate identification review (Matt).
- Assist with indoor macroinvertebrate identification sessions (All).
- Assist with data entry and analysis (All).
- Promote information on social media and LGROW webpages (All).

**Field Responsibilities:** Field sampling is performed by volunteers. Team Leaders and Collectors receive training in field data collection methods by Program Managers and LGROW staff.

1) Team Leaders organize a stream monitoring strategy and delegate monitoring roles of each team member. In the field, Team Leaders completely fill out data sheets, take depth and width measurements, and communicate with Collectors to ensure thorough biological sampling of the site. In addition, Team Leaders provide instruction and guidance to Pickers. After field days, Team Leaders are responsible for returning equipment, biological samples, and data sheets to the Program Managers. 2) Collectors sample all in-stream habitats that exist at the site and provide sample contents to Pickers. 3) Pickers are responsible for sorting through the samples collected by Collectors, picking out the macroinvertebrates from the sorting tray, putting them in a collection jar, and preserving them in alcohol for later identification.

**Corrective Action:**

1) Rachel Frantz

Rachel Frantz is the primary Program Manager and is responsible for initiating, developing, approving, implementing, and reporting corrective actions concerning data quality.

# A5. Problems Definition/Background

### General

The MiCorps Volunteer Stream Monitoring Program (VSMP) addresses the need to increase stewardship of aquatic resources through community involvement and education. As volunteers experience the ecosystems of local streams, they will be more likely to pay attention to local streams and spread the word about monitoring results. The monitoring program is designed to provide access to such information and to generate greater interest in the resource among the public. Volunteers, officials, and the general public will gain a deeper understanding of human impacts to aquatic ecosystems, resulting in greater attention to policies that protect water quality.

The Thornapple River Volunteer Stream Monitoring Program (TRVSMP) trains and utilizes local volunteers to collect baseline water quality data, characterize the current health of the streams and begin tracking changes that may result from human influence.

Using MiCorps stream monitoring protocols ensures the water quality data is scientifically credible and acceptable to both state and local decision makers. Data collected from the field are entered in the MiCorps Data Exchange Network and results are distributed at the local and regional level. Providing water quality data to government officials, planners, and others aids in the decision-making process during activities such as master planning and zoning, helping them be more effective at protecting aquatic resources. Stewardship organizations and the general public are able to use the data during educational activities that promote stewardship of aquatic resources, and to identify specific areas of concern. Problem areas uncovered by the monitoring efforts are addressed through collaboration between watershed managers and local, state, and federal aquatic resource professionals.

## Thornapple Problems Definition/Background

The Thornapple River Watershed (TRW), as considered/delineated in the Barry Conservation District (BCD) Thornapple River Watershed Management Plan (TRWMP),[1] is the largest subbasin of the Lower Grand River Watershed (LGRW) and is located in the southwestern portion of Michigan's Lower Peninsula. The TRW begins near Lansing, in Eaton County, extends through a large portion of Barry County, and ends in Ada where the Thornapple River empties into the Grand (Figure 1). The TRW is divided into two large management units – the Upper and Lower Thornapple – and five small management units – Mud Creek, Highbanks Creek, Fall Creek, Cedar Creek, and Glass Creek (Figure 1). The Coldwater River is a large tributary of the Thornapple River but has its own management plan and is considered as a separate watershed. In total, the TRW drains approximately 422,545 acres, includes 24 subwatersheds, and has nine designated trout streams. The TRW also contains "over 250 lakes totaling approximately 14,000 acres".[1] Thornapple Lake, one of the largest lakes within the watershed, is over 400 acres in size and at least 30 feet deep.[1] Larger lakes in the TRW "support seasonal residential communities and provide access for boating, water sports and fishing," and "[the] hundreds of smaller, less developed lakes sustain the rural quality of life sought by so many beyond the outskirts of larger cities…".[1]

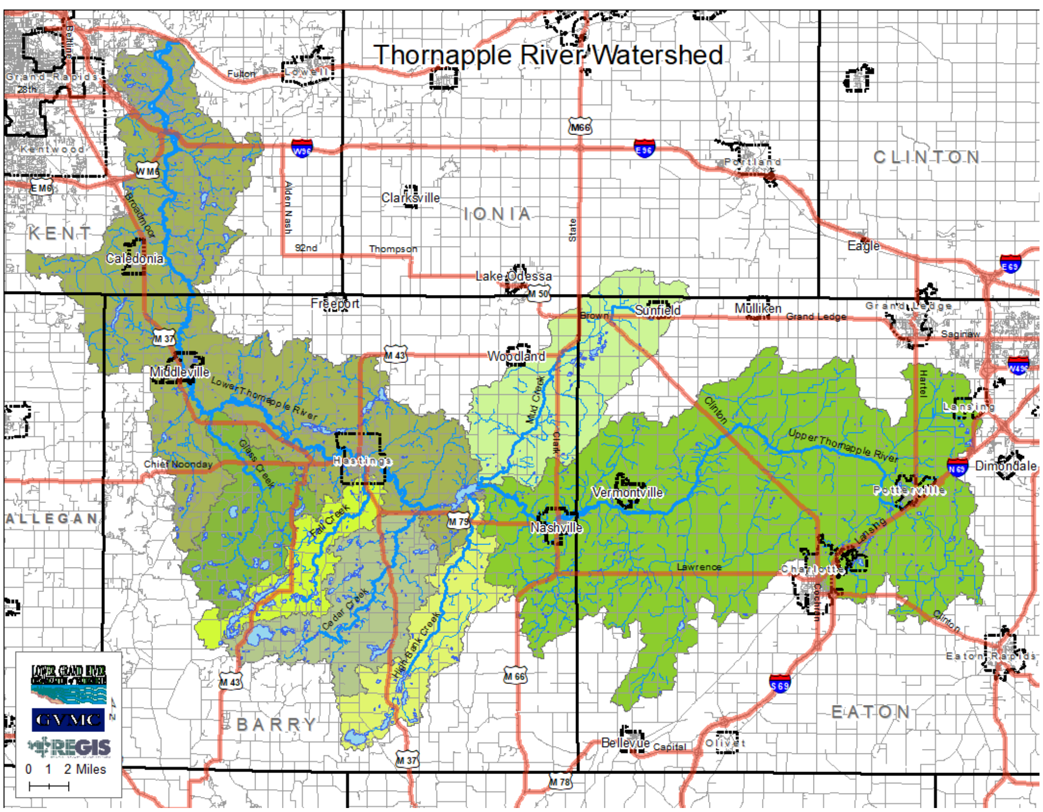


Figure 1. Management units of the Thornapple River Watershed

The TRW, like the majority of watersheds in Michigan's Lower Peninsula, is subject to historical and current water quality impacts; some of these impacts are ubiquitous in Michigan watersheds, while others are unique to the Thornapple. The major ubiquitous impact in the TRW is "historic wetland destruction" for the purposes of conversion to agricultural land.[2] It is estimated that 50% of presettlement wetlands have been converted to agricultural fields, livestock areas, and drainage ditches.[2] The loss of wetlands negatively impacts the aquatic ecosystems of a watershed by reducing fish habitat, constricting groundwater infiltration, increasing flashiness/velocity, and "erosive energy" during flood events. Dredging and straightening of streams channels – channelization – homogenizes habitats and reduces the diversity of fish and aquatic macroinvertebrates. Channelization also affects the ability of designated trout streams to support a coldwater fishery. This historic method of land conversion also removes natural buffers and adds excess nutrients and sediment to waterways. Excess nutrients cause eutrophication, especially in lakes; and sediment covers substrate essential to fish and macroinvertebrate ecologies. Aside from agriculture, residential and recreational use of waterways, especially lakes, impairs water quality. Currently, 35% of the lakes in the TRW are classified as degraded or very degraded.[1] Additionally, nitrates from septic systems, lawn "care," and agricultural sources have contaminated groundwater beyond potable standards in areas where groundwater is the only source of drinking water.[1]

Another major impact to consider, the TRW currently has five operating hydroelectric dams: Irving, Middleville, LaBarge (in Alaska), Cascade and Ada.[1] Dams alter the flow of rivers and streams, create barriers for fish passage, retain sediment and potentially concentrate toxic chemicals and substances. Impoundments or ponds often form upstream of river barriers. Impoundments upstream of each of the operational dams are characterized by eutrophication and sediment build-up. The operational dams on the Thornapple River also do not utilize fish ladders to permit fish passage. A sixth dam, the Nashville Dam just west of M-66 in Nashville, was removed in 2009. Formerly utilized for milling, the dam did not produce hydroelectric power. The dam's 60-acre impoundment was drained and now provides floodplain habitat along the river corridor. There are also at least 25 small dams on tributaries of the Thornapple River,[1] many historically constructed for small milling operations or for cattle watering facilities. Most are currently non-operational, providing impounded ponds used for private fishing areas. According to the EGLE, their structural conditions range from minor to major hazards.[1] One such dam, the Maple Hill Dam on Butternut Creek near downtown Charlotte, was removed in 2009.

In the last major EGLE water quality report for the TRW, 2015-2018,[2] Macroinvertebrate communities scored acceptable to excellent at all sampled sites, while habitat rated from marginal to excellent. This report also noted that, in 2013, the fish community was sampled at three sites (Quaker Brook, Duck Creek, and Pratt Lake Creek) and was not meeting the coldwater fisheries designated use at all three sites.[2] Future monitoring was recommended at the Little Thornapple River upstream of M-43 (080269), and Rush Road (080244) to evaluate recovery of those areas after drain modification activities that occurred in 2015. Biological surveys are also recommended in Messer Brook, due to drain activities that have occurred there.[2] A more recent round of water quality assessments was conducted by EGLE in 2023; however, the data is currently available in raw form only as EGLE is currently revamping their scoring procedure and indices (Personal Communication, Aaron Parker, 8/11/2024). Due to the EGLE constraint of a "5-Year Rotating Watershed System,"[3] and the limited capacity to sample relatively few sites within the largest subwatershed of the Lower Grand, there is a necessity for additional monitoring beyond what the State can provide. With funding from the BCD VSMP Implementation Grant, BCD, along with partners TRWC and LGROW, will work diligently to fill this monitoring/data gap.

1. Barry Conservation District. 2015. Thornapple River Watershed Management Plan. Barrycd.org. [accessed 8/8/2024]. https://static1.squarespace.com/static/649dad02ab782214bc47477a/t/64a8657d8b37d1245b41b9e1/1688757644445/TRWMP-reduced.pdf.

2. Michigan Department of Environment, Great Lakes, and Energy. 2021. Biological surveys and water chemistry sampling of selected stations in the Thornapple River watershed in Barry, Eaton, Ionia, and Kent Counties, Michigan:2015-2018. [accessed 8/8/2024]. MI/EGLE/WRD-21/014. https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/WRD/GLWARM/Monitoring-Watershed/Biosurvey/report-2018-thornapple-watershed.pdf?rev=cf0ffae051964ea7bf3c9120cc02fbac&hash=0634FAF49A6C530EE8D291F9B60B1B8A.

3. Michigan Department of Environment, Great Lakes, and Energy. 2024. Five-Year Rotating Watershed System. [accessed 8/8/2024]. https://www.michigan.gov/egle/about/organization/water-resources/glwarm/five-year-rotating-watershed-system.

# A6. Project Description

The overall goal of the volunteer program is to protect and improve the water quality in the Thornapple River Watershed (TRW).

The goals of the Thornapple River Volunteer Stream Monitoring Project are as follows:

1. Educate residents about threats to waters in the TRW. ‘Non-point source pollution’ should be in everyone’s vocabulary.

2. Recruit residents and new partners into a cohesive effort to identify threats to and monitor the health of TRW streams.

3. Acquire useful data through a series of spring and fall volunteer monitoring events in key watersheds and to make that data available to local governments and stakeholders, as well as incorporate it into LGROW’s data repository.

4. Ensure that the monitoring program is sustainable after the course of this MiCorps grant by providing adequate training, oversight, and motivation to volunteers and seeking new partnerships and funding.

To accomplish these goals, the Thornapple River Volunteer Stream Monitoring Project utilizes the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Procedures (Steen & Latimore 2020 (https://www.micorps.net/wp-content/uploads/2021/01/VSMP-MonitoringProcedures.pdf)). The MiCorps program was created through an executive order by Governor Jennifer M. Granholm to assist the Michigan Department of Environment, Great Lakes, and Energy (EGLE) in collecting and sharing water quality data for use in water resources management and protection programs. The program also provides standardized assessment and data recording procedures that can be easily used by trained volunteers. Specific objectives of this project include collecting baseline data, characterizing stream ecosystems, identifying water quality problems, determining water quality trends, and informing and educating the public about water quality issues and aquatic ecology. Volunteer stream monitoring activities will continue to be supported by BCD, LGROW, and the TRWC into the future.

The first goal of the Volunteer Stream Monitoring Program is to foster public awareness, stewardship, and surveillance of the Thornapple River Watershed and increase community participation in these efforts. Promotional work focuses on securing the sustainability of volunteer stream monitoring. Program Managers refer to the monitoring grant Work Plan (Appendix 1) to assure the objectives are met and the program stays on track.

Another goal is to generate baseline water quality data. The quality-assured data may be used by EGLE biologists to identify sites where more detailed assessment by the Department is needed. To accomplish this, program staff and volunteers conduct spring and fall monitoring sessions in each stream, monitoring a minimum of two sites in each watershed. The program furnishes the necessary equipment to sample benthic macroinvertebrates and conduct physical habitat assessments.

The procedures include two types of assessments: a Stream Habitat Assessment and a Stream Macroinvertebrate Assessment (See Sections II and III, respectively, of the MiCorps Volunteer Stream Monitoring Program Monitoring Procedures, Steen & Latimore 2020 (https://www.micorps.net/wp-content/uploads/2021/01/VSMP-MonitoringProcedures.pdf)). Each procedure has its own datasheet, which can be found in the appendices of this document (See Appendix C for the Habitat Assessment and Appendix D for the Macroinvertebrate Assessment). The stream habitat assessment is a visual assessment of stream conditions and watershed characteristics. The macroinvertebrate assessment/ sampling procedure is used in conjunction with the stream habitat assessment and provides a measure of stream health. The assessments cover approximately 300 linear feet of stream at each site.

Streams are sampled annually in the spring (mid-March to early May, preferably before leaf-out) and fall (late September or after leaf-drop). Sites are monitored more frequently if a population appears to be changing. The project is intended to continue indefinitely. New sites are added on an irregular basis, as volunteer and community interest occur, or problems are detected. Ideally, sites are sampled during the same two-week time frame each year to minimize seasonal variability in macroinvertebrate distribution or abundance; however, circumstances such as weather, volunteer schedules, staff illness, etc. may force extension of the ideal time frame.

Data collected by volunteers includes benthic macroinvertebrate diversity and physical habitat. Aquatic macroinvertebrates are the primary focus of this monitoring program. Aquatic macroinvertebrates are collected, identified to a hybrid order/family identification system created by MiCorps and tallied to determine diversity in the benthic community and gauge the health of the stream reach. Volunteers conduct a habitat assessment once a year every fall to get an indication of the physical characteristics of the stream reach.

The next step is to make results available to interested parties. Data are entered into the MiCorps database and results are analyzed using a statistical program (Microsoft Excel) and summarized for use by interested parties. Program staff and volunteers get the word out by making presentations to organizations and publishing informational brochures, reports in newspapers, newsletters, social and electronic media, and local broadcast news.

## A7. Data Quality Objectives

Precision/Accuracy: Accuracy is the degree of agreement between the sampling result and the true value of the parameter or condition being measured. Accuracy is most affected by the equipment and the procedure used to measure the parameter. Precision refers to how well you are able to reproduce the result on the same sample, regardless of accuracy. Human error in sampling techniques plays an important role in estimating precision.

The primary goal of this project is to gauge stream health by measuring the total diversity of macroinvertebrate taxa. 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) collections of the sampling sites, our goal for quality assurance is conservative. A given site's Water Quality Rating (WQR) score or total diversity (D) measure across macroinvertebrate taxa will be noted as "preliminary" until three spring sampling events and three fall sampling events have been completed. At least two of these six measures will be collected by different volunteer teams. The resulting measures of D and WQR for each site will be compared to the composite (median) results and each should be within two standard deviations of the median. If a group fails to meet the criteria above, program leaders will conduct side by side monitoring, described below:

To improve precision and accuracy, if necessary, designated Project Experts (usually a Project Manager and one or two team leaders) accompany teams to observe their collection techniques and note any divergence from protocols. The Project Expert(s) may also perform an independent collection (duplicate sample) no less than a week after the team's original collection and no more than two weeks later.

Techniques under review shall include:

- collecting style (must be thorough and vigorous)
- habitat diversity (must include all available habitats and be thorough in each one)
- picking style (must be able to pick thoroughly through all materials collected and pick all sizes and types of macroinvertebrates)
- variety and quantity of organisms (must ensure that diversity and abundance at site is represented in sample)
- transfer of collected macroinvertebrates from the net to the sample jars (specimens must be properly handled and jars correctly labeled).

Resulting diversity measures by teams are compared to expert results and each should have a relative percent difference (RPD) of less than 40%. This statistic is measured using the following formula:

RPD = [(Xe - Xv) / (mean of Xe and Xv)] x 100, where Xe is the expert measurement and Xv is the volunteer measurement for each parameter.

Volunteer teams that meet quality standards are allowed to conduct future field collection without expert oversight, though they are "recertified" after about every five sampling events. Teams that do not meet quality standards are retrained in the relevant methods and the Project Expert will re-evaluate their collection during the subsequent sampling event.

Macroinvertebrate samples are stored in alcohol to be identified at an indoor identification session. The accuracy of specimen identification is dependent upon the abilities of the experts aiding in the indoor identification session. Identifications made by volunteers that have not received course work or training in family level aquatic macroinvertebrate identification or better are reviewed by the Program Experts. At least 10% of the samples processed by experts in question are reviewed to verify results. If more than 40% of specimens were misidentified, then Program Managers review all the samples processed by that expert.

MiCorps staff conducts a method validation review with the program leaders to ensure their expertise, preferably prior to the first training session. This review consists of supervising the program leader's macroinvertebrate sampling and sorting methodology to ensure that they are consistent with MiCorps protocol. This review was held with Paul Steen (MiCorps) and Tamara Lipsey (EGLE) on 9/5/2024, with BCD properly demonstrating MiCorps procedures.

All cases of collecting deficiencies are promptly followed (during that visit) 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 also verifies a subset of the volunteer's identification. If a problem arises with the subset in review a thorough check may be requested.

Bias: Sites are sampled by different teams at least once every two years to examine the effects of bias in individual collection styles. An RPD between the new measure and the mean of past measures should be less than 40% for all parameters. Sites not meeting this data quality objective are evaluated as above by the Program Expert.

Completeness: Completeness is a measure of the amount of valid data actually obtained versus the amount expected to be obtained as specified in the original sampling design. It is usually expressed as a percentage. For example, if 100 samples were scheduled but volunteers sampled only 90 times due to bad weather or broken equipment, the completeness record would be 90 percent.

Following a QA/QC review of all collected and analyzed data, data completeness is 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 Manager consults with MiCorps staff to determine the main causes of data invalidation and develops a course of action to improve the completeness of future sampling events.

Representativeness: Representativeness is the degree to which collected data actually represent the stream condition being monitored. It is most affected by site location. Study sites for the program are selected following the methodology described in section B1. As indicated, all available habitats are sampled and documented to assure that the site is representative of other stream segments in the subwatershed. Resulting data from the monitoring program is used to summarize the biological conditions of the contributing subwatershed, as an initial screening mechanism. Since not enough resources are available to allow the program to cover the entire watershed, some subwatersheds are not initially represented. Additional subwatershed sites will be added as resources and volunteers allow.

Comparability: Comparability represents how well data from one stream or stream site can be compared to data from another. Most managers compare sites as part of a statewide or regional report on the volunteer monitoring program; therefore, sampling methods should be the same from site to site. To ensure comparability, all volunteers participating in the program follow the same sampling methods and use the same units of reporting. The methods are based on MiCorps standards, which increase comparability with other MiCorps programs. Periodic reviews of sampling events by the Program Expert ensure adherence to these standard methods.

## A8. Special Training/Certifications

The Program Managers coordinate trainings and ensure that all program personnel and volunteers are properly trained. Program Managers receive Volunteer Stream Monitoring Grantee Training provided by MiCorps staff. The training provides information about basic stream monitoring methods established by MiCorps. Topics covered include stream macroinvertebrate sampling and identification (to the hybrid order/family level), habitat assessment, data management and entry into the MiCorps database, attracting and retaining volunteers, and program evaluation. The training includes both indoor and field components and is currently conducted by Huron River Watershed Council staff. Program managers attended a training in August of 2024 and will attend refresher trainings at least every three years as scheduled by MiCorps staff.

Program Managers will have a side-by-side field training session with MiCorps staff prior to the first volunteer training and sampling event. The Program Managers then train volunteer Team Leaders in a one-day training session before their first fall or spring monitoring event. Team Leaders are required to attend re-training at least once every three years. The first part of the training day offers instruction on the following topics:

1. Goals of the monitoring program
2. Potential uses for the data
3. Quality assurance and data management
4. Introduction to macroinvertebrates
5. Team structure in volunteer stream monitoring
6. Field techniques
7. Explanation of MiCorps field data sheets
8. Stream habitat characteristics and assessment

After the informational session, participants visit a stream to practice assessing physical habitat characteristics, sampling of macroinvertebrates, and familiarity with identification to the hybrid order/family level. At the end of the training, volunteers fill out an evaluation assessing how they felt about the information presented. Program managers maintain a database of all trained volunteers with the date they completed the training.

Training in macroinvertebrate identification takes place in the morning of the indoor identification session. Volunteer Experts in need of review will be trained prior to indoor identification sessions. Volunteers trained in identification are included in a database to track trainings and ensure that experts have reviewed/learned all macroinvertebrate orders.

## A9. Documentation and Records

Volunteers are recorded in a separate database that tracks training and skills. Field data collected by volunteers is entered and managed in a Microsoft Access database. Data are uploaded to the MiCorps Data Exchange Network and stored indefinitely at the BCD office. Original field data sheets are filed at the BCD office. All electronic data are backed up regularly, and computer passwords provide data security.

# SECTION B: PROJECT DESIGN AND PROCEDURES

## B1. Study Design & Methods

Parameters: Our biological evaluation of stream water quality is based upon community diversity in that we attempt to include a complete sample of the different groups of macroinvertebrates present rather than a random subsample. Instead of assuming that a single collection represents all the diversity in the community, results are considered reliable only after repeated collections spanning at least three years.

During field data collection efforts, volunteers collect specimens from the benthic community from all habitats present at the site. At the indoor identification session, macroinvertebrates collected from the benthic community are identified to the hybrid order/family level and tallied to provide data for the calculation of diversity indices. Diversity scores are used to rate the health of the stream ecosystem and provide a basis for trend analyses. Results are compared with other data sets available through EGLE and other agencies/organizations for the site in question and compared with locations in the same river system included in this program.

Site selection: General guidelines

- Sites are distributed such that each subwatershed, and in turn their subwatersheds are assessed to provide a representative depiction of conditions found throughout the watershed.
- At least one site should be surveyed in each tributary, with the location of this site being near the mouth of the tributary.
- The distribution of sampling stations within the watershed should also achieve adequate geographic coverage.
- Consider establishing stations upstream and downstream of suspected pollutant source areas, or major changes in land use, topography, soil types, water quality, and stream hydrology (flow volume, velocity, or sinuosity).
- If the intent of monitoring is to meet additional, watershed-specific objectives, then additional data may be needed.
- In all cases, the site should:
    - be representative of the area of stream surveyed,
    - contain a diverse range of the available in-stream cover,
    - contain some gravel/cobble bottom substrates if possible
    - allow for the assessment of 300 feet of stream length if feasible.

Study Locations: Sample sites were chosen to assess water quality in areas of concern and to monitor various projects concerning streambed restoration and aquatic habitat recovery.

The Thornapple River Volunteer Monitoring Project Team will focus on the Thornapple River, a major tributary to the Grand River, and two of its larger subwatersheds, Glass Creek and High Bank Creek. (Fall Creek and Mud Creek currently have no safe, reliable access points for sampling, and Cedar Creek has a recently developed subwatershed management plan through Pierce Cedar Creek Institute (PCCI) (citation)). Additional monitoring sites include one near the confluence of the Coldwater, to gauge the impact of this tributary on the Thornapple River, and Trout Creek, a small creek near the mouth of the Thornapple which had previously been subject to discharges of "storm water associated with anti-icing and de-icing fluids" from the Gerald R. Ford International Airport (NPDES Permit No. MI0055735). In total the Thornapple River Volunteer Monitoring Project Team will monitor six sites in the watershed with the potential of expanding as more volunteers are trained. Four of these sites have been previously monitored using MiCorps protocols, though they used the pre-2020 Stream Quality Index (SQI) ranking. For these four sites, in addition to the newer WQR score, the Thornapple River Volunteer Monitoring Project Team will also calculate the pre-2020 SQI to allow for longer-term monitoring.

Frequency and timing: Macroinvertebrate communities are sampled annually in the spring (mid-March to early May, preferably before leaf-out) and fall (late September or after leaf-drop) for the first three years, after which the sites are monitored at a frequency between 1 and 2 years. Sites are monitored more frequently if a population appears to be changing. The project is intended to continue indefinitely. New sites are added on an irregular basis, as volunteer and personal community interest occurs, or problems are detected.

For each sampling event, monitoring by volunteers is completed within the same two-week period each year. However, factors such as weather, volunteer schedules, staff illness, etc. may force extension of this time frame. For example, a site may be temporarily inaccessible due to prolonged high water or unsafe levels of bacteria; in such cases, the monitoring time may be extended for two additional weeks. If the issue concerning inaccessibility is continued beyond the extended dates, then no monitoring data will be collected during that time and there will be a gap in the data. If a team is unable to monitor their site during the specified time, Team Leaders will contact the Program Managers as soon as possible and no later than the end of the first week in the sampling window in order for the Managers to arrange for another team to complete the monitoring. If no team is available, the Program Managers are responsible to see that the site is monitored unless sufficient redundancy has been included in the monitoring schedule that additional data is not needed.

Study Methods: The following is a list of study methods that will be used to measure the different parameters:

- Stream Habitat Assessment
- Macroinvertebrate Assessment
- Indoor Identification
- Data Storage

Procedure for Stream Habitat Assessment: Teams of at least three monitors arrive at the site, verify the location with GPS and record the stream name, location, date, start time, and monitoring team names on the datasheets. It is not necessary for the habitat assessment and macroinvertebrate collection to happen at the same time on the same event. Before teams begin to assess stream habitat, it is important to reference general safety guidelines promoted during the monitoring training (implement the buddy system, always use caution, note any floods or stream warnings, always carry a first aid kit, leave wildlife alone). Teams begin recording location information such as county, township, latitude, longitude, and GPS coordinates. A member of the team creates a site sketch including direction of flow, location of road or closest road-stream crossing, and any important landmarks such as an eroding bank, large tree, or deep pool. Photos are taken both upstream and downstream to best represent site conditions as teams work. Stream event conditions (high/low flow, days since last rain, temperature, color, type) are noted on the data sheet.

Teams record stream depth and width measurements of the site and categorize stream flow as dry, stagnant, low, medium, or high. Teams conduct a visual assessment of the stream's substrate and quantify the percent boulder, gravel, sand, detritus, and bedrock (substrate total to equal 100%). Teams also note the location's morphology to indicate the presence of riffles, pools, the type of channel, and the high water mark. A cross-section sketch is drawn to show the dimensions of the stream channel. Additional data that is collected on the stream habitat assessment sheet includes physical appearance (presence of algae, oil sheens, foam, trash), instream cover (undercut banks, overhanging vegetation, pools, boulders, woody debris), stream corridor (riparian width, severity of bank erosion, streamside land cover), adjacent land uses seen and potential sources of stream degradation.

Procedure for Macroinvertebrate Sample Collection: Before entering the stream, the Team Leader and a Collector inspect the sampling gear to ensure that it is clean. If there is debris or aquatic life on any of the equipment, use water withdrawn from the stream with a clean container to clean the equipment at a distance of not less than 100 feet from any water body.

At least one trained Collector wades the stream and use a D-frame kick net to get samples from each habitat type present at the site, including riffle, rocks or other large objects, leaf packs, submerged vegetation or roots, and depositional areas, making sure to thoroughly sample each habitat type. A Collector or a streamside assistant empties the contents of the nets into shallow white trays after each sample. Pickers remove debris and place samples into jars of ethanol. As the designated recorder, the Team Leader records all the information onto the MiCorps datasheets. Sites on small streams should be sampled for a minimum of 35-45 minutes by a single collector while those on large streams will be sampled for at least one hour; if an additional collector is used, the collection times must be halved respectively. The number of sites monitored each day depends on the number of trained volunteers available. The goal is to have enough teams of three or four to monitor all sites on a stream in one day and all sites in the project within a two-week period.

Volunteers pick aquatic organisms from the tray and place them in containers with 70% ethanol or isopropyl alcohol for later identification. Large/rare organisms may be an exception to this rule. Under the discretion of the Team Leader, large/rare organisms – for example, a giant stonefly or single hellgrammite whose identification is obvious to the Team Leader - may be digitally photographed by said Team Leader and released back into their proper habitat. The digital photograph of a large/rare organism serves as its voucher. Volunteer teams are encouraged to collect a minimum of 100 specimens, but an emphasis will be placed upon collecting a variety of aquatic organisms as opposed to quantity. The Team Leader instructs and assists team members in detecting and collecting macroinvertebrates in the sorting pans, including looking under bark and inside of constructions made of sticks or other substrates.

While at the monitoring site the Team Leader may make a site sketch depicting the locations and types of habitats sampled, though this is not required. The Team Leader marks the locations on the sketch and records on the datasheet the number of each habitat type sampled within the monitored reach. The team leader reads aloud the questions on the datasheet and writes the answer on the datasheet. At least one Collector provides information to the Team Leader in response to questions from the data sheet. The Team Leader and Collector/s work together to cite all habitats that are sampled, stream conditions, and any changes in methodology or unusual observations. Potential sources of variability such as weather, stream flow, turbidity, and erosion are noted on the data sheet during each field session and discussed in study results.

The field data sheet includes sections to record unusual procedures or accidents, such as losing part of the collection by spilling. Team Leaders report any variations in procedure or other issues possibly affecting data quality to program managers, who will follow corrective actions described below. Before leaving the site, a Collector thoroughly rinses the net to ensure that no organisms are transported to the next site. To avoid contamination or to ensure that bugs are no longer attached to the kick net, dip the net into the stream with the opening facing upstream. Take hands and clean off any debris clinging to the net. Make sure this is done after every monitoring event prior to leaving the site. The Team Leader inspects the site to make sure that no equipment or refuse is left behind.

Procedure for Decontamination: To help prevent the spread of invasive organisms, all equipment will be decontaminated before moving to a new body of water. Decontamination procedures involve the use of a bleach/chlorine solution (0.5%-2%) or Formula 409 on all equipment if the equipment is to be used in another water body within a period of five days from the previous “contamination.” If five days or greater will elapse before contaminated equipment is to be used in another water body, the following alternative procedure may be applied: bleach/chlorine solution, as above, or Formula 409 is used on wader boots, net staffs, and any plastic surfaces; a phosphate free detergent and hot water are used to wash the wader and net material; finally, all materials are left to dry for a period of five days or greater. This alternative procedure allows for the sustainability of sampling materials and is supportive of the limited funds many organizations have for water quality monitoring. Volunteers will be instructed in decontamination procedures and taught to properly clean gear before sampling to reduce the risk of accidental contamination of the watershed.

Procedure for Identification: Following the field data collection session an indoor identification session is held, bringing volunteers and aquatic scientists together to sort, identify, and tally specimens collected in the field. Volunteers sort preserved aquatic organisms into groups based on physical similarities. Aquatic scientists with macroinvertebrate taxonomic identification skills assist volunteers with the identification of specimens to the hybrid order/family level. All identifications are verified by qualified experts, including a cursory check of any digital vouchers. Volunteers record taxa names and the number of specimens belonging to each taxon on the ID data sheet. A subset (percentage of total in accordance with MiCorps standards) of the biological samples is sent to MiCorps staff for identification verification if requested by MiCorps.

Procedure for Data Storage: Data sheets along with collected specimens are returned to program leaders after each monitoring event; if photos were taken as vouchers for large/rare specimens, these are delivered, digitally (via text or email), to the program leader. Raw data are entered and managed in Microsoft Excel spreadsheets. All data are backed up weekly and tapes are kept offsite in a secure location. Computer passwords also provide data security. Electronic data are entered into the online MiCorps database by a Program Manager or Team Leader and stored and updated annually on the MiCorps database exchange system. Data sheets are filed at the BCD office for a period of at least five years.

Variability: Inconsistent macroinvertebrate scores or habitat assessments between monitoring sites or collection events may raise a red flag. It is the responsibility of Program Managers to take note of sources of variability such inconsistencies and address whether variability is due to human error or a recent environmental impact such as change in land use or the presence of non-point source pollutants.

Re-sampling is conducted if warranted and feasible, given that the deviation is noted soon after occurrence and volunteers are available.

Monitoring Equipment: Monitoring equipment was selected based on the recommendation of MiCorps and the suggested equipment needed for a successful program. Monitoring equipment is inventoried yearly by program staff or volunteers and tracked in an Excel spreadsheet (See Appendix 4).

Equipment Storage: All equipment is stored at the Barry Conservation District office and made available for pick-up by Team Leaders prior to sampling events. Equipment is maintained by BCD staff.

Sample Storage: Macroinvertebrates samples are preserved in 70% ethanol or isopropyl alcohol in perpetuity. Samples are checked yearly, and preservatives are changed every five years. Disposal: Old preservatives are diluted with water and emptied down drain.

Data Confirmation: A standardized data-collection form is used to facilitate spot checking to ensure that forms are completely and correctly filled out. A Program Manager or a single trained volunteer reviews the data before it is stored in a computer or file cabinet. After data has been compiled and entered into a computer file, it is verified with raw data from field survey forms. Biological monitoring results are confirmed by identification from trained entomologists. If necessary, experts may conduct identification with the aid of dissecting microscopes (with a maximum enlargement of 65x) and consultation with dichotomous keys (e.g., Aquatic Insects of Wisconsin by Hilsenhoff and Aquatic Insects of North America by Merritt et al).

Corrective Action: Volunteer Team Leaders make sure that quality assurance protocols are followed and report any issues possibly affecting data quality to program managers. If deviation from the QAPP is noted at any point in the sampling or data management process, the affected samples may be deleted from the data set. Resampling is conducted if warranted and feasible, given that 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 above, are documented and communicated to MiCorps.

## B2. Sample Handling and Custody

At the collecting site, all invertebrate sample jars receive a label written in pencil, stating date, location, name/s of collector/s, and number of jars containing the collection from this site. The label 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, securely closing the jars, and returning all jars and all equipment to program managers. When turned over to the Program Managers, the collections are checked for labels, the data sheets are checked for completeness and for correct information on the number of jars containing the collection from the site, and the jars are secured together with a rubber band and site label and placed together in one box. They are stored at the BCD office until they are examined and counted on the day of identification (one or two weeks later).

Data sheets are checked for completeness and to verify that the correct number of containers from the sample site is indicated on the data sheet. The data sheets are used on the identification day, after which they remain on file at the BCD office indefinitely. At the time of identifying the sample, the sample identifier checks 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 accompanies them.

For identification, volunteers sort all individuals from a single jar onto a specified tray or trays, and then are joined by an identification expert who confirms the sorting and provides identification of the taxa present. These identifications are then verified by the Program Expert. When identification of a sample is complete, preservative used in the field sample jars is discarded and the entire collection of identified specimens from each site will be stored in a single jar of fresh 70% ethanol or isopropyl alcohol, and sealed with a poly-seal cap. A label with sample ID (corresponding to database), sample site location, and date collected is placed inside the jar. For future reference, the samples are stored at the BCD office for at least five years; any digital photographs of vouchered specimens are maintained on the BCD server. The preserved samples are inspected yearly to guarantee long term storage, and the preservative is changed in the jars every few years.

## B3. Analytical Methods

Information collected on the datasheets is used to estimate abundance and calculate the MiCorps Water Quality Rating, allowing comparison between sites to help locate and identify impacts. All biotic diversity index scores are calculated in Microsoft Excel.

Macroinvertebrates: Additional metrics and statistical analyses used to analyze the aquatic community data are:

1. Percent Mayfly Composition. This is the ratio of the number of individuals in the order *Ephemeroptera* to the total number of organisms collected. As with the number of mayfly taxa, the percent abundance of mayflies in the total invertebrate sample can change dramatically and rapidly to minor environmental disturbances or fluctuations.

2. Percent Caddisfly Composition. This is the ratio of the number of individuals in the order *Trichoptera* to the total number of organisms collected. As with the number of caddisfly taxa, percent abundance of caddisflies is strongly related to stream size with greater proportions found in larger order streams. Optimal habitat and availability of appropriate food type seem to be the main constraints for large populations of Caddisflies.

3. Percent Contribution of the Dominant Taxon. This is the ratio of the number of individuals in the most abundant taxon to the total number of organisms collected. The abundance of the numerically dominant taxon is an indication of community balance. A community dominated by relatively few taxa for example, would indicate environmental stress, as would a community composed of several taxa but numerically dominated by only one or two taxa.

4. Percent Isopods, Snails, and Leeches. This is the ratio of the sum of the number of individuals in the order *Isopoda*, class *Gastropoda*, and class *Hirudinea* to the total number of organisms collected. These three taxa, when compared as a combined percentage of the invertebrate community, can give an indication of the severity of environmental perturbation present. These organisms show a high tolerance to a variety of physical and chemical parameters. High percentages of these organisms at a sample site are very good evidence for stream degradation.

Physical habitat assessment: The habitat assessment provides a subjective rating of habitat characteristics. Information from the datasheets allows for comparing results over time and is a good way to monitor change, examine variation between sample sites and indicate trends.

Note: All data generated by analytical methods are required to meet the Data Quality Objectives listed in Section A7 in order to be deemed acceptable for use in program reporting and the MiCorps Data Exchange. In the event that Data Quality Objectives are not met, MiCorps staff and/or local experts must be consulted (see Section C3 for further guidance).

## B4. Quality Control

**Equipment Quality Control:**

1. D-frame nets must be inspected for damage or holes and replaced if necessary.

2. All equipment must be cleaned, dried, and stored securely after each sampling event.

3. Check the equipment that requires batteries and replace them if necessary

**Field Procedures Quality Control:**

1. Repeat benthic macroinvertebrate sampling is performed when a new volunteer team starts monitoring and then every 3-5 years thereafter as a review.
2. A Program Manager or qualified expert accompanies the team and collects benthic Macroinvertebrate data to compare diversity indices that verify quality control in collection techniques and thoroughness.
3. Volunteer monitoring teams alternate streams and/or sample sites on a 2-3 year basis to maintain objectivity and minimize individual bias.

4. Analyze and review field records before submitting to the MiCorps database to minimize errors.

**Identification Quality Control:**

1. Macroinvertebrate specimens are checked by a Program Manager upon receiving them from a volunteer team to assure they contain labels, their lids are securely screwed to the jar, and are all placed together in one box. Any digital vouchers are likewise received and verified.

2. Field data sheets used by volunteers must be checked for completeness and to verify the correct number of containers from the sample site is indicated on the form.

3. Prior to identification, data sheets and jars must be checked to ensure that only jars from that collection are present prior to emptying them into a white pan for sorting.

4. Any specimens that are separated from the pan during identification are accompanied by a site label indicating where it came from.

5. All samples must be checked and verified by a qualified expert.

**Data Analysis Quality Control:**

1. Upon receiving data from volunteers, field records are reviewed by a program leader to minimize errors before entering it into the MiCorps Data Exchange Network.

2. Calculations for diversity and other variables will be calculated through a computer formula and verified with manual calculations by a program leader.

3. Data entered into the computer is reviewed by comparing hard copy printouts with field data sheets.

4. Data analysis methods are reviewed by qualified professionals on a five-year basis.

## B5. Instrument/Equipment Testing, Inspection, and Maintenance

D-frame nets are inspected before each sampling event to ensure they are intact. If holes are found in the netting, nets are replaced prior to use. If equipment has been damaged or is malfunctioning, replacements are provided by BCD. All equipment is stored in the BCD office.

## B6. Instrument/Equipment Calibration and Frequency

Not applicable

## B7. Inspection/Acceptance for Supplies and Consumables

The following is a list of supplies and consumables:

- Monitoring procedures and field data sheets
- D-Frame collection nets (mesh size = 500 µm)
- Sorting trays
- Forceps
- Magnifying glasses
- Eye droppers
- Preservative (70% ethanol or isopropyl alcohol)
- Jars and lids
- Measuring tape
- Yardsticks
- Clipboards
- Pencils
- Waders
- Map
- Camera

Optional equipment may also include GPS unit, communication plan, insect repellent, first aid kit, sunscreen, water, string, and stakes. For inventory purposes, an equipment inventory list, including the date of purchase (if applicable), projected date of replacement, and date of use will be developed in a Microsoft Excel spreadsheet and appended to the QAPP (Appendix 4). Supplies are maintained by Program Managers and stored in the BCD office. Upon retrieval, volunteers inspect the supplies for holes or damage. Any damaged or misused equipment is noted to the Program Managers and replaced if necessary.

## B8. Non-direct Measurements

Not applicable

# SECTION C: System Assessment, Correction and Reporting

## C1. System Audits and Response Actions

Program leaders make sure that quality assurance protocols are followed and report any issues possibly affecting data quality. Program Managers periodically accompany groups in the field to perform side-by-side sampling and verify the quality of work by the volunteer team through side-by-side sampling and identification. During side-by-side sampling, a team of volunteers and a field expert sample the same stream. Agreement in sample composition between the two should be 60% or greater (i.e., 40% discrepancy). A system audit is conducted following each spring and fall monitoring event to evaluate the process of the project, including on-site reviews of field sites and facilities where data is processed and analyzed. If deviation from the QAPP is noted at any point in the sampling or data management process, the affected samples will be flagged and brought to the attention of Program Managers and the team that collected the sample. Re-sampling is conducted as long as the deviation is noted soon after occurrence and volunteers are available. Otherwise, a gap must be left in the monitoring record and the cause noted. All corrective actions are documented and communicated to MiCorps.

Details of the process for assessing data quality are outlined in section A7. Response to quality control problems is also included in section A7.

## C2. Data Review, Verification, and Validation

A standardized data-collection form is used to facilitate spot-checking to ensure that forms are completely and correctly filled out. A Program Manager or a single trained volunteer reviews the data forms before they are stored in a computer or file cabinet. After data has been compiled and entered into a computer file, it is verified with raw data from field survey forms. Biological monitoring results are confirmed by identification from trained entomologists. Experts may conduct identification with the aid of dissecting microscopes (with a maximum enlargement of 65x), consultation with dichotomous keys.

Experts who assist in Macroinvertebrate identification quality control include:

1) Matt Bain, MS in Biology (Aquatics emphasis)
2) Eric Snyder, PhD Zoology (stream ecology emphasis)
3) Keith Piccard, MS in Biology (Aquatics emphasis)

## C3. Reconciliation with Data Quality Objectives

Data quality objectives are reviewed annually to ensure that objectives are being met. Deviations from the data quality objectives are reported to Program Managers and MiCorps for assessment and corrective action. Also, data quality issues are recorded as a separate item in the database and provided to Program Managers and data users. Response to and reconciliation of problems that occur in data quality are outlined in Section A7.

## C4. Reporting

Throughout the duration of this project, quality control reports are included with quarterly project reports that are submitted to MiCorps, when under an active grant. Data is submitted to the MiCorps data exchange for public sharing and use by EGLE. Quality control reports provide information regarding problems or issues arising in quality control of the project. These could include but are not limited to deviation from quality control methods outlined in this document relating to field data collection procedures, indoor identification, data input, diversity calculations and statistical analyses. Program staff generates yearly reports sharing results of the program with volunteers, special interest groups, and local municipalities. Data and reports are made available via BCD's web pages.

Appendix A – Work Plan

1. **<u>Increase Citizen Awareness and participation (10%)</u>**
    a. Work with LGROW and TRWC to recruit volunteers
    b. Promote monitoring events on social media
2. **<u>Train volunteers (15%)</u>**
    a. Attend one-day MiCorp Training in August 2024
    b. Conduct Training session before monitoring sessions
3. **<u>Collect and generate baseline water quality data for the Thornapple River (40%)</u>**
    a. Develop and submit QAPP to MiCorp Staff
    b. Conduct two monitoring sessions per year (spring and fall)
    c. Monitor preferably all sites (minimum three) in Thornapple River Watershed
    d. Provide needed equipment for macro sampling
    e. Enter monitoring results into MiCorps Data Exchange Network
4. **<u>Make results available to interested parties (15%)</u>**
    a. Create volunteers monitoring report
    b. Promote data results on website
    c. Participate in annual MiCorps conference
5. **<u>Administer the grant (5%)</u>**
    a. Develop and submit quarter reports
    b. Develop and submit final reports
    c. Provide copies of products and deliverables to needed partners
6. **<u>Evaluate the project (5%)</u>**
    a. Conduct side-by-side sampling evaluation sessions with MiCorps staff

Appendix B – Timetable

| | | | 2024 | | | | | | | | 2025 | | | | | | | | | | | | 2026 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Task** | **Responsible Party** | **Time (%)** | May | June | July | August | September | Octorber | November | December | January | February | March | April | May | June | July | August | September | Octorber | November | December | January | February | March | April | May | June |
| **Task 1: Grant Administration** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1 Develop QAPP | BCD/LGROW | 6% | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 1.2 Quarterly Reports | BCD | 12% | | | | | ■ | | | | ■ | | | ■ | | | ■ | | | ■ | | | ■ | | | ■ | | |
| 1.3 Data Entry | BCD | 3% | | | | | ■ | | | | | | | | ■ | | | | | ■ | | | | | | | ■ | |
| 1.4 Final Report | BCD | 5% | | | | | | | | | | | | | | | | | | | | | | | | | | ■ |
| **Task 2: MiCorps Training** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.1 MiCorps Training | Rachel - BCD | 2% | | | | ■ | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 MiCorps Conference | Rachel - BCD | 4% | | | | | ■ | | | | | | | | | | | | | | | | | | | | | |
| 2.2.1 Conference Presentation | Rachel - BCD | 3% | | | | | | | | | | | | | | | | | | ■ | ■ | | | | | | | |
| **Task 3: Volunteers** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1 Recruit Volunteers | All Partners | 10% | | | ■ | ■ | | | | | | ■ | ■ | ■ | | ■ | ■ | ■ | | | | | | | | | | |
| 3.2 Train Volunteers | BCD/LGROW | 10% | | | | ■ | ■ | | | | | | | | | | | | | | | | | ■ | ■ | ■ | | |
| **Task 4: Sampling Events** | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.1 EGLE Consult | BCD | 1% | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 4.2 Side by Side Sampling | BCD/MiCorps | 2% | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 4.3 Determine Sites | BCD | 5% | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| 4.4 Order Supplies | BCD | 5% | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 Schedule Events/Outreach | All Partners | 13% | | | ■ | ■ | | | | | | ■ | ■ | | | | ■ | ■ | | | | | | ■ | ■ | | | |
| 4.6 Hold Sampling Events | All Partners | 25% | | | | | ■ | ■ | | | | | | ■ | ■ | | | | ■ | ■ | | | | | | ■ | ■ | |
| | | 100% | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix C – Stream Habitat Assessment

## STREAM HABITAT ASSESSMENT

Michigan Clean Water Corps
Volunteer Stream Monitoring Program

### I. Stream, Team, Location Information

Site ID:__________________ Date:___________________ Time:____________________

Site Name:______________________________ Lat/Long ____________________________

Names of Team members:______________________________________________________

### II. Stream and Riparian Habitat

| **A. General Information**<br>*Circle one or more answers as appropriate* | | | | | | | Notes and Observations: Give further explanation when needed. |
|---|---|---|---|---|---|---|---|
| 1 | Average Stream Width (ft) | < 10 | 10-25 | 25-50 | >50 | | |
| 2 | Average Stream Depth (ft) | <1 | 1-3 | >3 | >5 | | |
| 3 | Has this stream been channelized? (Stream shape constrained through human activity- look for signs of dredging, armored banks, straightened channels) | Yes, currently | Yes, sometime in the past | No | Don't know | | |
| 4 | Estimate of current stream flow | Dry or Intermittent | Stagnant | Low | Medium | High | |
| 5 | Highest water mark (in feet above the current level) | <1 | 1-3 | 3-5 | 5-10 | >10 | |
| 6 | Which of these habitat types are present? | Riffles | Pools | Large woody debris | Large rocks | Undercut bank | |
| | | Overhanging vegetation | Rooted Aquatic Plants | Other: | Other: | Other: | |
| 7 | Estimate of turbidity | Clear | Slightly Turbid (can partially see to bottom) | | Turbid (cannot see to bottom) | | |
| 8 | Is there a sheen or oil slick visible on the surface of the water? | No | Yes | | | | |
| 9 | If yes to #8, does the sheen break up into pieceswhen poked with a stick? | Yes (sheen is most likely natural) | | No (sheen could be artifical) | | | |
| 10 | Is there foam present on the surface of the water? | No | Yes | | | | |
| 11 | Does the foam smell soapy and look white and pillow like or look gritty with dirt mixed in? | Soapy (foam could be artifical) | | Gritty (foam is most likely natural) | | | |
| The following are optional measurements not currently funded by MiCorps | | | | | | | |
| 8 | Water Temperature | | | | | | |
| 9 | Dissolved Oxygen | | | | | | |
| 10 | pH | | | | | | |
| 11 | Water Velocity | | | | | | |

MiCorps Site ID#:___________ Date:_________________

## II. Stream and Riparian Habitat (continued)

**B. Streambed Substrate**

Estimate percent of stream bed composed of the following substrate.

Leave blank if group will take transects and pebble counts (in Section IV).

| *Substrate type* | *Size* | *Percentage* |
|---|---|---|
| Boulder | >10" diameter | |
| Cobble | 2.5 - 10" diameter | |
| Gravel | 0.1 - 2.5" diameter | |
| Sand | coarse grain | |
| Silt/Detritus/Muck | fine grain/organic matter | |
| Hardpan/Bedrock | solid clay/rock surface | |
| Artificial | man-made | |
| Other (specify) | | |
| Can't see | | |

*You may wish to take photos of unstable or eroded banks for your records. Record date and location.*

**Comments:**

**C. Bank stability and erosion.**

Summarize the extent of erosion along each bank separately on a scale of 1 through 10, by circling a value below. Left/right banks are identified by looking downstream.

| Excellent | Good | Marginal | Poor |
|---|---|---|---|
| Banks Stable. No evidence of erosion or bank failure. Little potential for problems during floods. < 5% of bank affected. | Moderately stable. Small areas of erosion. Slight potential for problems in extreme floods. 5-30% of bank in reach has areas of erosion. | Moderately unstable. Erosional areas occur frequently and are somewhat large. High erosion potential during floods. 30-60% of banks in reach are eroded. | Unstable. Many eroded areas. > 60% banks eroded. Raw areas frequent along straight sections and bends. Bank sloughing obvious. |
| LEFT BANK 10 - 9 | LEFT BANK 8 - 7 - 6 | LEFT BANK 5 - 4 - 3 | LEFT BANK 2 - 1 - 0 |
| RIGHT BANK 10 - 9 | RIGHT BANK 8 - 7 - 6 | RIGHT BANK 5 - 4 - 3 | RIGHT BANK 2 - 1 - 0 |

2

MiCorps Site ID#:___________ Date:________________

**II. Stream and Riparian Habitat (continued)**

**D. Plant Community**

What percentage of the stream is covered by overhanging vegetation/tree canopy?

<10% 10-50% 50-90% >90%

Using the given scale, estimate the relative abundance of the following:

| *Plants in the stream:* | | *Plants on the bank/riparian zone:* | |
|---|---|---|---|
| Algae on Surfaces of Rocks or Plants, or floating | Filamentous Algae (Streamers) | Shrubs | Trees |
| Macrophytes (Standing Plants) | **0= Absent 1= Rare 2= Common 3= Abundant** | Herbaceous plants | **0= Absent 1= Rare 2= Common 3= Abundant** |
| Identified species (optional) | | Identified species (optional) | |
| | | | |
| | | | |

**E. Riparian Zone**

The riparian zone is the vegetated area that surrounds the stream. Right/Left banks are identified by looking downstream.

*1. Left Bank*

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Mowed Grass Park Shrubby/Grassy Field Agriculture
Construction Commercial Industrial Highways Golf Course Other___________

*2. Right Bank*

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Mowed Grass Park Shrubby/Grassy Field Agriculture
Construction Commercial Industrial Highways Golf Course Other___________

3. Summarize the size and quality of the riparian zone along each bank separately on a scale of 1 through 10, by circling a value below.

| Excellent | Good | Marginal | Poor |
|---|---|---|---|
| Width of riparian zone >150 feet, dominated by vegetation, including trees, understory shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. | Width of riparian zone 75-150 feet; human activities have impacted zone only minimally. | Width of riparian zone 10-75 feet; human activities have impacted zone a great deal. | Width of riparian zone ,10 feet; little or no riparian vegetation due to human activities. |
| LEFT BANK 10 - 9 | LEFT BANK 8 - 7 - 6 | LEFT BANK 5 - 4 - 3 | LEFT BANK 2 - 1 - 0 |
| RIGHT BANK 10 - 9 | RIGHT BANK 8 - 7 - 6 | RIGHT BANK 5 - 4 - 3 | RIGHT BANK 2 - 1 - 0 |

3

MiCorps Site ID#:___________ Date:_________________

### III. Sources of Degradation

1. Does a team need to come out and collect trash?

2. Based on **what you can see** from this location, what are potential causes and level of severity of any degradation at this stream?

| (Severity: S – slight; M – moderate; H – high) (Indicate all that apply) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Crop Related Sources | S | M | H | Land Disposal | S | M | H |
| Grazing Related Sources | S | M | H | On-site Wastewater Systems | S | M | H |
| Intensive Animal Feeding Operations | S | M | H | Silviculture (Forestry) | S | M | H |
| Highway/Road/Bridge Maintenance and Runoff | S | M | H | Resource Extraction (Mining) | S | M | H |
| Channelization | S | M | H | Recreational/Tourism Activities (general) | S | M | H |
| Dredging | S | M | H | • Golf Courses | S | M | H |
| Removal of Riparian Vegetation | S | M | H | • Marinas/Recreational Boating (water releases) | S | M | H |
| Bank and Shoreline Erosion/ Modification/Destruction | S | M | H | • Marinas/Recreational Boating (bank or shoreline erosion) | S | M | H |
| Flow Regulation/ Modification (Hydrology) | S | M | H | Debris in Water | S | M | H |
| Invasive Species | S | M | H | Industrial Point Source | S | M | H |
| Construction: Highway, Road, Bridge, Culvert | S | M | H | Municipal Point Source | S | M | H |
| Construction: Land Development | S | M | H | Natural Sources | S | M | H |
| Urban Runoff | S | M | H | Source(s) Unknown | S | M | H |

Additional comments:

Michigan Clean Water Corps

4

MiCorps Site ID#:___________ Date:_________________

## IV. Optional quantitative measurements

### A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 10 transects of your stream reach. Required equipment: tape measure long enough to stretch across the stream, and graduated rod or stick to measure water depth. Data sheet is on the next page.

Directions:
1) Determine stream width.
2) Use the rod to measure depth (D) and substrate (S) at more than 10 but less than 20 regular intervals along the entire transect. (For streams less than 10 feet wide, measure every ½ foot, for streams about 10 feet wide, measure every foot, etc.)
3) At every depth measurement, identify the single piece of substrate that the rod lands on. If it is a mix of substrates, randomly pick one of them, and the next time you find a similar grouping, pick the other(s).
4). For every measurement, enter the reading on the tape measure, the depth, and the substrate on the data sheet on the next page.

Data use: The depth and tape measure reading can be used to produce stream cross-section profiles. The pebble count can be used to give a more accurate percentage breakdown of the stream substrate than simply making an eyeball estimate (see Section II-B).

### B. Bank Height

Vertical banks higher than 3 feet are usually unstable, while banks less than 1 foot, especially with overhang, provide good habitat for fish. While doing the transects, measure bank heights and record the angle of the bank (right, acute, or obtuse) as indicated on the data sheet. Left/right banks are identified by looking downstream.

Data use: Calculate the percentage of banks with right, obtuse, and acute angles. Right angles indicate higher erosive potential, while acute angles improve the habitat structure of a stream.

## V. Final Check

This data sheet was checked for completeness by: ________________________________

Name of person who entered data into data exchange: ____________________________

Date of data entry:_________________________________________________________

## VI. Credits

This habitat assessment was created for the MiCorps Volunteer Stream Monitoring Program from a combination of habitat assessments from the Huron River Watershed Council, the Friends of the Rouge River, and the Michigan Department of Environmental Quality. Version 1.0, June 2009. Version 2.0, November 2020.

MiCorps Site ID#:__________ Date:________________

Michigan Clean Water Corps

**STREAM TRANSECT DATASHEET**

B: Boulder -- more than 10"
C: Cobble -- 2.5 - 10"
G: Gravel – 0.1 – 2.5"
S: Sand -- fine particles, gritty

F: Fines: Silt/Detritus/Muck
H: Hardpan/Bedrock
A: Artificial
O: Other (specify)

T= Reading on tape
D = Depth
S = Substrate

| | EXAMPLE | | | Transect # | | | Transect # | | | Transect# | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stream Width | 13.3 feet | | | | | | | | | | | |
| | T | D | S | T | D | S | T | D | S | T | D | S |
| Beginning Water's Edge | 1.5 | | | | | | | | | | | |
| 1 | 2.5 | 0.4 | G | | | | | | | | | |
| 2 | 3.5 | 0.4 | G | | | | | | | | | |
| 3 | 4.5 | 0.4 | G | | | | | | | | | |
| 4 | 5.5 | 0.2 | C | | | | | | | | | |
| 5 | 6.5 | 0 | S | | | | | | | | | |
| 6 | 7.5 | 0.6 | S | | | | | | | | | |
| 7 | 8.5 | 0.7 | G | | | | | | | | | |
| 8 | 9.5 | 0.7 | G | | | | | | | | | |
| 9 | 10.5 | 0.6 | C | | | | | | | | | |
| 10 | 11.5 | 0.7 | B | | | | | | | | | |
| 11 | 12.5 | 0.4 | G | | | | | | | | | |
| 12 | 13.5 | 0.3 | F | | | | | | | | | |
| 13 | 14.5 | 0.2 | F | | | | | | | | | |
| 14 | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | |
| Ending Water's Edge | 14.8 | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Bank Side | L | R | | L | R | | L | R | | L | R | |
| Bank Height | 1.7 feet | 0.5 feet | | | | | | | | | | |
| Does the bank have an undercut? | N | Y | | | | | | | | | | |
| If so, how wide is it? | | 1 ft | | | | | | | | | | |
| Bank Angles: Sketch | | | | | | | | | | | | |

Sketch examples:

Undercut (Acute) Obtuse Right

6

Appendix D – Stream Macroinvertebrate Data Sheets

MiCorps Site ID#:_______________

Michigan Clean Water Corps

## 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 5 4 3 2 1 Not very confident

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

MiCorps Site ID#:________________

Michigan Clean Water Corps

**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 | |

| | |
|---|---|
| | **Total Abundance** |

| | |
|---|---|
| **Sum of (Count x Sensitivity):** | |

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 |

**Water Quality Rating =**

**Sum of (Count x Sensitivity)**
**Divided By**
**Total Abundance**

= ____________________

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

MiCorps Site ID#____________________ Sample Date_______________

**FAMILY LEVEL IDENTIFICATION AND ASSESSMENT**

Instructions: If you choose to identify macroinvertebrates at the family level, fill out the front page of the order-level Macroinvertebrate datasheet with the location and sample information, don't fill out the back with the simpler identification scheme, and then staple this to it. The Water Quality Index score can be calculated in a similar manner as in the simpler identification, though due to improved resolution of identification, you will see improved accuracy in assessing the water quality.

| Count | Name | Sensitivity Rating | Count x Sensitivity |
|---|---|---|---|

**ANNELIDA-Segmented Worms**

| | | | |
|---|---|---|---|
| | Hirudinea | 10 | |
| | Oligochaeta | 10 | |

**COLEOPTERA- Beetles**

| | | | |
|---|---|---|---|
| | Curculionidae | 5 | |
| | Dryopidae | 5 | |
| | Dytiscidae | 5 | |
| | Elmidae | 4 | |
| | Gyrinidae | 5 | |
| | Haliplidae | 5 | |
| | Hydrophilidae | 5 | |
| | Lampyridae | | |
| | Noteridae | | |
| | Psephenidae | 4 | |
| | Ptilodactylidae | 3 | |
| | Scirtidae | 5 | |
| | Staphylinidae | 8 | |

**DIPTERA- True Flies**

| | | | |
|---|---|---|---|
| | Athericidae | 2 | |
| | Blephariceridae | 0 | |
| | Ceratopogonidae | 6 | |
| | Chaoboridae | 8 | |
| | Chironomidae | 6 | |
| | Culicidae | 8 | |
| | Dixidae | 1 | |
| | Dolichopodidae | 4 | |
| | Empididae | 6 | |
| | Ephydridae | 6 | |
| | Muscidae | 6 | |
| | Psychodidae | 8 | |
| | Ptychopteridae | 9 | |
| | Sciomyzidae | 6 | |
| | Simuliidae | 6 | |
| | Stratiomyidae | 8 | |
| | Syrphidae | 10 | |
| | Tabanidae | 6 | |
| | Tipulidae | 4 | |

| Count | Name | Sensitivity Rating | Count x Sensitivity |
|---|---|---|---|

**CRUSTACEA- Crustaceans**

| | | | |
|---|---|---|---|
| | Amphipoda | 4 | |
| | Decapoda | 6 | |
| | Isopoda | 8 | |

**EPHEMEROPTERA- Mayflies**

| | | | |
|---|---|---|---|
| | Ameletidae | 0 | |
| | Ametropodidae | | |
| | Anthropleidae | | |
| | Baetidae | 4 | |
| | Baetiscidae | 3 | |
| | Caenidae | 7 | |
| | Ephemerellidae | 1 | |
| | Ephemeridae | 4 | |
| | Heptageniidae | 4 | |
| | Isonychiidae | 2 | |
| | Leptohyphidae | 3 | |
| | Leptoplebiidae | 2 | |
| | Metretopodidae | 2 | |
| | Neoephemeridae | | |
| | Polymitarcyidae | 2 | |
| | Potamanthidae | 4 | |
| | Pseudironidae | | |
| | Siphlonuridae | 7 | |

**GASTROPODA- Snails, Limpets**

| | | | |
|---|---|---|---|
| | Ancylidae | 6 | |
| | Bithyniidae | 8 | |
| | Hydrobiidae | 6 | |
| | Lymnaeidae | 6 | |
| | Physidae | 8 | |
| | Planorbidae | 7 | |
| | Pleuroceridae | 6 | |
| | Pomatiopsidae | | |
| | Valvatidae | 6 | |
| | Viviparidae | 6 | |
| | Unidentified Snail | 6.5 | |

| Count | Name | Sensitivity Rating (0-10) | Count x Sensitivity |
|---|---|---|---|

**HEMIPTERA- True Bugs**

| | | | |
|---|---|---|---|
| | Belostomatidae | 10 | |
| | Corixidae | 10 | |
| | Gelastocoridae | | |
| | Gerridae | 5 | |
| | Hydrometridae | | |
| | Mesoveliidae | | |
| | Naucoridae | 5 | |
| | Nepidae | 8 | |
| | Notonectidae | | |
| | Pleidae | | |
| | Saldidae | 10 | |
| | Veliidae | 6 | |

**LEPIDOPTERA- Moths and Butterflies**

| | | | |
|---|---|---|---|
| | Cosmopterigidiae | | |
| | Nepticulidae | 5 | |
| | Noctuidae | | |
| | Pyralidae | 5 | |
| | Tortricidae | | |

**MEGALOPTERA**

| | | | |
|---|---|---|---|
| | Corydalidae | 0 | |
| | Sialidae | 4 | |

**ODONATA- Damselflies, Dragonflies**

| | | | |
|---|---|---|---|
| | Aeshnidae | 3 | |
| | Calopterygidae | 5 | |
| | Coenagrionidae | 9 | |
| | Cordulidae | 2 | |
| | Cordulegastridae | 3 | |
| | Gomphidae | 1 | |
| | Lestidae | 9 | |
| | Libellulidae | 9 | |
| | Macromiidae | 3 | |

**PELECYPODA-bivalves**

| | | | |
|---|---|---|---|
| | Corbiculidae | 6 | |
| | Dreissenidae | 8 | |
| | Sphaeriidae (aka Pisidiidae) | 8 | |
| | Unionidae | 6 | |

Note: MiCorps was not able to locate a tolerance value of every taxa listed here; in those cases, it was left blank. If you can aid our research with tolerance values, please email psteen@hrwc.org . If you find taxa with a missing tolerance value during your identification, record their Count but leave their "Count x Sensitivity" column blank and don't add the count into the Total Abundance, essentially leaving them out of the Water Quality Rating score.

| Count | Name | Sensitivity Rating (0-10) | Count x Sensitivity |
|---|---|---|---|

**PLECOPTERA- Stoneflies**

| | | | |
|---|---|---|---|
| | Capniidae | 1 | |
| | Chloroperlidae | 1 | |
| | Leuctridae | 0 | |
| | Nemouridae | 2 | |
| | Perlidae | 1 | |
| | Perlodidae | 2 | |
| | Pteronarcyidae | 0 | |
| | Taeniopterygidae | 2 | |

**TRICHOPTERA- Caddisflies**

| | | | |
|---|---|---|---|
| | Apataniidae | 3 | |
| | Brachycentridae | 1 | |
| | Dipseudopsidae | 5 | |
| | Glossosomatidae | 1 | |
| | Goeridae | 3 | |
| | Helicopsychidae | 3 | |
| | Hydropsychidae | 4 | |
| | Hydroptilidae | 4 | |
| | Lepidostomatidae | 3 | |
| | Leptoceridae | 4 | |
| | Limnephilidae | 4 | |
| | Molannidae | 6 | |
| | Odontoceridae | 0 | |
| | Philopotamidae | 3 | |
| | Phryganeidae | 4 | |
| | Polycentropodidae | 6 | |
| | Psychomyiidae | 2 | |
| | Rhyacophilidae | 0 | |
| | Sericostomatidae | 3 | |
| | Uenoidae | 3 | |

**OTHER GROUPS**

| | | | |
|---|---|---|---|
| | HYDRACARINA Water mites | 6 | |
| | COLLEMBOLA springtails | 5 | |
| | PLATYHELMINTHES-Turbellaria/Flatworms | 4 | |

## WATER QUALITY RATING

| | | |
|---|---|---|
| | ←Add up the Count columns on both sides (Total Abundance)<br><br>Add up the "Count x Sensitivity" column for both sides → | |

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 =**

**Sum of (Count x Sensitivity)**
**Divided By**
**Total Abundance**

=

Appendix E – Team Roles

**Roles of People on the Team**

Team Structure: Each team includes a Team Leader, at least one Collector, and generally 1-3 Pickers.

1. The Team Leader is responsible for ensuring they have received all necessary equipment from the Program Manager before going to their site. The Team Leader is also responsible for recording data on the data sheet and can explain about the monitoring program, and each team member's role in it.
2. A Collector is a person who has been trained to collect samples with the net from all the different habitats in the creek.
3. Pickers sort through the samples, usually sitting on the bank, though they may also assist Collectors during sampling by holding/carrying buckets.

   Note: The Program Manager is responsible for inventorying each Team's equipment and delivering that equipment to each Team. If necessary equipment is found missing by the Team Leader, the Program Manager is responsible for retrieving necessary equipment and delivering it to the sample site.

**Team Leader:**

- The Team Leader instructs the team and is responsible for filling out the data sheets, labeling the jars, and reminding the Collector/s which habitats still need to be found.
- Requires a one-hour training, usually offered three weeks before the monitoring day.

**How to be Successful:**

- Tell people about the study before there is too much to do.
- Show people how a little water can encourage the bugs to move. Encourage them to look long enough to find the slow movers and tiny creatures.
- Fill in every blank on the data sheet.

**Collector:**

- Collectors must attend a full training session in order to learn the techniques for sampling in the river.
- Collectors are the only people that enter the water (unless there is an Assistant). They are responsible for sampling all of the habitats and bringing the samples to the rest of the team to sort through.

**How to be Successful:**

- Do not rely on anyone else to collect.
- Listen to the Leader in order to be thorough.
- Use your net aggressively.
- Be sure someone picks every bug off of the net before leaving the first site.

**Picker:**

- New volunteers typically start out as Pickers. This job does not necessarily require getting into the stream; however, it is helpful to have at least one Picker in waders assisting the Collector/s by holding the bucket while the sample is taken. Picking is a good way to get introduced to monitoring and the interesting creatures that live in the stream.
- No training is required to be a Picker.
- Pickers are responsible for sorting through the samples collected by the Collector/s, picking out the macroinvertebrates from the rocks and leaves and putting them in a collection jar.

**How to be Successful:**

- The challenge is to learn to see small creatures hidden in the debris and clinging to rocks and leaves. Your Team Leader or Collector/s will help you learn to have patience until they start to move and to recognize what may be in a clump of pebbles.
- Keeping everything in the jar seems easy, but it will turn over if you put it down.

**Manager:**

- The Manager is a person who is willing to take responsibility for the equipment and will check the list to be sure everything leaves each site with the team and that it all returns to the Barry Conservation District office.

**How to be Successful:**

- Take the manager's sheet with you and use it to check that all the equipment is taken from each site.
- Follow the instructions for handling the equipment when you return.

Appendix F – Survey Sites

| Site Name | MiCorps ID | River | Site Description | Latitude | Longitude |
|---|---|---|---|---|---|
| Barry-6 | Barry-137 | Unnamed Tributary/Trout Creek | Tricklewood Dr. | 42.9010 | -85.5035 |
| Barry-5 | | Coldwater River | Whitneyville Park | 42.7739 | -85.4566 |
| Barry-4 | | Thornapple River | Irving Dam | 42.6894 | -85.4257 |
| Barry-3 | Barry-118 | Glass Creek | DNR/MI Audubon | 42.61 | -85.39 |
| Barry-2 | Barry-50 | High Bank Creek | Camp Thornapple | 42.6240 | -85.1825 |
| Barry-1 | Barry-201 | Thornapple River | DNR/Nashville | 42.6084 | -85.0939 |