

**Quality Assurance Project Plan for:  
Upper-Central Muskegon River & Upper Manistee River Watersheds Stream  
Monitoring Program**

**A1. Title and Approval Sheet**

Date: February 8, 2021

Version # 2

Organization: Missaukee Conservation District

QAPP Prepared by: Michelle Hill

Title: Program Coordinator

Signature: \_\_\_\_\_

Other responsible individual: Sherry Blaszak

Title: District Manager

Signature: \_\_\_\_\_

(Other signatures may be added as necessary)

<b>MiCorps Staff Use</b>	
Tracking Number: _____	
MiCorps Reviewer: _____	
<input type="checkbox"/> Approved <input type="checkbox"/> Returned for modifications	
Signature of reviewer	Date

## **SECTION A: PROGRAM DESCRIPTION AND QUALITY OBJECTIVES**

**A1. TITLE AND APPROVAL SHEET 1**

**A2. TABLE OF CONTENTS 2**

**A3. DISTRIBUTION LIST 3**

**A4. PROGRAM ORGANIZATION 3**

**A5. PROBLEM DEFINITION/BACKGROUND 4**

**A6. PROGRAM DESCRIPTION**

**A7. DATA QUALITY OBJECTIVES**

**A8. SPECIAL TRAINING/CERTIFICATIONS**

## **SECTION B: PROGRAM DESIGN AND PROCEDURES**

**B1. STUDY DESIGN AND METHODS**

**B2. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE**

**B3. INSPECTION/ACCEPTANCE FOR SUPPLIES AND CONSUMABLES**

**B4. NON-DIRECT MEASUREMENTS**

**B5. DATA MANAGEMENT**

## **SECTION 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 1: UPPER MANISTEE WATERSHED NATURAL RIVER MANAGEMENT PLAN**

**APPENDIX 2: STREAM HABITAT ASSESSMENT & SITE SKETCH**

**APPENDIX 3: MACROINVERTEBRATE IDENTIFICATION**

**APPENDIX 4: WATERSHED MAP & SAMPLING LOCATIONS**

### **A3. Distribution List**

Michelle Hill, Program Coordinator, Missaukee Conservation District (MCD)

Sherry Blaszak, District Manager, MCD

Andrea Mayer, Education Coordinator, MCD

Paul Steen, MiCorps Program Manager, Huron River Watershed Council

### **A4. Program Organization**

#### **Management Responsibilities:**

**Michelle Hill, Program Manager.** Missaukee Conservation District, 6180 W. Sanborn Rd., Lake City, MI 49651.  
Office: 231.839.7193; michelle.hill@macd.org.

Michelle, or the MCD Program Coordinator, is the Program Manager for the volunteer stream monitoring program. The Program Manager is responsible for maintaining quality assurance oversight (QA manager) and reports to the District Manager. Additional responsibilities include:

- Develop, implement, and maintain oversight of the Quality Assurance Project Plan.
- Attend an 8-hour training session provided by MiCorps.
- Promote volunteer stream monitoring programs and recruit volunteers.
- Research necessary equipment needed for stream monitoring collection events.
- Coordinate volunteer stream monitoring training sessions.
- Coordinate volunteer stream monitoring data collections.
- Debrief Stream Team Lead Volunteers before and after data collections.
- Coordinate macroinvertebrate identification sessions.
- Conduct habitat assessments of stream monitoring collection sites.
- Implement database development, data entry and analysis.
- Promote program at conservation district events, meetings, and through various media outlets.
- Develop quarterly narrative reports.
- Attend MiCorps Conferences annually.
- Develop and submit Maintenance Grant proposals annually as available through MiCorps.

**Andrea Mayer, Education Coordinator.** Missaukee Conservation District, 6180 W. Sanborn Rd., Lake City, MI 49651.  
Office: 231.839.7193; andrea.mayer@macd.org.

Andrea, or the Education Coordinator, will assist with sampling and education as outlined:

- Assist with community outreach and education through local library and school partnerships
- Attend stream leader training to be used as a back-up or regular stream team leader as the project needs.
- Assist with stream monitoring and identification events as needed.

**Sherry Blaszak, District Manager.** Missaukee Conservation District, 6180 W. Sanborn Rd., Lake City, MI 49651.  
Office: 231.839.7193; sherry.blaszak@macd.org.

Sherry, or the District Manager, provides administrative and budget oversight for the program and assists the Program Manager when necessary. Responsibilities include:

- Assist with budget oversight and development of quality financial reports.
- Purchase equipment needed for sampling and keep records of items.

- Assist with coordination of volunteer stream monitoring collection events.
- Assist with the development and submission of Maintenance and other MiCorps grants as available.

### **Field Responsibilities:**

Oversight of all field activities will be the responsibility of the Program Manager. Individual field roles are as follows:

**Stream Team Leaders:** Volunteers trained in MiCorps collection protocols and methods. Responsible for leading a volunteer group through monitoring procedures at one sampling site during each monitoring event. Team Leaders are also responsible for returning all equipment, biological samples, and data sheets to the Program Manager.

**Volunteers:** Participate as collectors and pickers under the direction and oversight of Stream Team Leaders during monitoring events.

*Collectors* sample all in-stream habitats that exist at the site and provide sample contents to Pickers.

*Pickers* are responsible for sorting through the samples collected by the Collector, picking out the macroinvertebrates from the sorting tray, putting them in a collection jar, and preserving them in alcohol for later identification.

### **Laboratory Responsibilities:**

The Program Manager will assume all identification responsibilities. Missaukee Conservation District will provide laboratory space, equipment, and identification tools. Paul Wiemerslage, Environmental Education Coordinator for the AuSable Institute of Environmental Studies, will act as the expert during identification events to assist volunteers and the Program Manager.

### **Corrective Action:**

Program Manager will assume the role of initiating, developing, approving, and implementing corrective actions. Reports to the District Manager.

## **A5. Problem Definition/Background**

The Muskegon River, located in north-central Michigan, incorporates over 2,350 square miles of land. The river is 212 miles long, with a 575-ft. drop in elevation between the source and the mouth at Lake Michigan. Missaukee County is one of the eight counties within which the Muskegon watershed is contained. Approximately 94 tributaries flow directly into the mainstem and two primary tributaries-- West Branch of the Muskegon River and Clam River--flow through Missaukee County. Nutrient and chemical pollution peaked in the mid-1900s having a significant effect on the watershed. Today, sedimentation from uplands is a significant pollutant. Water quality is good, overall, in most of the watershed with the majority of pollution issues located around cities and below dams. These areas of concern are not as prevalent in the Upper-Central area of the watershed. Comprehensive invertebrate studies are not available for this watershed.

The Upper Manistee River and its tributaries are prized as cold-water trout habitats. Thermal influences from man-made and natural dams may affect fish communities within the watershed. Other negative influences include unconsolidated sand deposits which have lowered the stream channel rating. As with the Muskegon River watershed, the Upper Manistee is a quality watershed, overall. No comprehensive invertebrate studies have been conducted in the watershed. Wetlands and forest cover made up the majority of land cover in the watershed in 1992, however, in a 2003 report (Appendix 1) the area of forests and wetlands had significantly decreased while agricultural lands increased dramatically. The transition in land use has made monitoring more important as streamside buffers are removed and water drawn for irrigation increase. Few agricultural areas exist in Missaukee County, in the Upper Manistee Watershed. This fact raises the importance of monitoring at the lower end of the watershed. The Lucas road-stream crossing has been identified as one of 14 critical areas in the watershed.

Water quality monitoring is a primary goal of the conservation district. The Upper Manistee River watershed is part of

the Natural Rivers Act and all streams and rivers fall under our concern as enforcers of the Soil Erosion and Sedimentation Control program for the county.

## **A6. Program Description**

In 2015 and again in 2018, MCD received millage support from voters to increase conservation and stewardship efforts across the county. As water quality is important to our constituents and the mission of our agency, we seek to create a community water quality monitoring effort in the form of aquatic macroinvertebrate surveys. As we monitor both the Upper Manistee and Upper-Central Muskegon watersheds, it is our intent to collaborate and share data findings with other organizations involved with stream monitoring in the lower areas of each watershed.

The overall goal of the volunteer monitoring program is to protect and improve the water quality in the streams of Missaukee County through the MiCorps Volunteer Stream Monitoring Program. The MiCorps program was created through an executive order by Governor Jennifer M. Granholm to assist the Michigan Department of Environmental Quality in collecting and sharing water quality data for use in water resources management and protection programs and 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 the conservation district into the future

Overall program goals are thus:

1. Educate citizens of Missaukee County and raise awareness about water quality.
2. Promote stewardship and monitoring of Missaukee's water resources: The Upper Manistee River and Upper-Central Muskegon River watersheds with a special focus on tributaries of the Muskegon River. Establish baseline conditions to monitor changes over time.
3. Create a sustainable volunteer monitoring program and encourage county residents to expand monitoring to lakes, road-stream crossings, and cleanup efforts.
4. Identify problem areas where degradation has occurred and where best management practices or remediation may be implemented.

Missaukee County is a highly agricultural area. An extension of the stream monitoring program will include chemical water monitoring near or downstream of croplands. In partnership with our Michigan Agriculture Environmental Assurance Program (MAEAP) technician, based in the MCD office, we wish to engage and educate local farmers about water quality issues. Educational outreach will include working with local schools and libraries to promote stream monitoring and water quality. Our Education Coordinator will be heading the majority of educational activities through those outlets. Stream Leaders will also become part of educational outreach through sportsman's clubs and district held events.

MCD will utilize the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Procedures to establish baseline conditions along with the chemical monitoring. Sampling periods will happen twice a year within a two-week window: May and September/October. Stream monitoring will consist of at least two stream locations in each watershed. MCD will furnish all necessary monitoring equipment to volunteers. The procedures and data forms include two types of assessments: stream habitat assessment (Appendix 2) and macroinvertebrate identification and assessment (Appendix 3). The stream habitat assessment is a visual assessment of stream conditions and watershed characteristics. The macroinvertebrate 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.

## **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. The purpose 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 multiple independent (duplicate) collections of the sampling sites, our goal for precision and accuracy 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 three fall sampling events have been completed. Precision and accuracy will be maintained through following standardized MiCorps procedures. The Program Manager must be trained in MiCorps procedures at the annual MiCorps training led by MiCorps staff. MiCorps staff also conduct a method validation review (the "side-by-side" visit) with the Program Manager to ensure their expertise, preferably prior to the first volunteer leader training session. This review consists of supervising the Program Manager's macroinvertebrate sampling and sorting methodology to ensure that they are consistent with MiCorps protocol. 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 may also verify the accuracy of the program's macroinvertebrate identification. If a problem arises with a subset of macroinvertebrates, a thorough check may be requested. (The side-by-side visit was held on 8.23.2017 with MiCorps Program Manager Paul Steen).

Precision and accuracy will be maintained by conducting consistent volunteer team leader training. Volunteer team leaders will be trained up joining the program, and retrained every three years (at a minimum). Techniques under Volunteer Stream Monitoring Quality Assurance Program Plan Guidance Version 4 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).

Precision and accuracy will be maintained through careful macroinvertebrate identification. Volunteers may identify macroinvertebrates in the field, but these identifications and counts are not official. All macroinvertebrate samples are stored in stream water and identified live the same day and then stored in alcohol for long-term preservation. If ID cannot be completed the same day, samples will be placed in alcohol immediately. Volunteers can be designated as identification experts as determined by the judgment of the Program Manager. All field identifications and counts will be checked by an expert with access to a scope, keys, and field guides. The Program Manager will check at least 10% of the specimens processed by experts to verify results (with a concentration on hard to identify taxa). If more than 10% of specimens checked were misidentified, then the Program Manager will review all the specimens processed by that expert and reassess if that person should be considered an expert for future sampling events.

#### **Bias:**

At every sample site, a different team will sample there at least once every three years to examine the effects of bias in individual collection styles. Measures of D and SQI for these samples 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, then the Program Manager needs to conduct a more thorough investigation to determine which team or individuals are likely at fault. The Program Manager will accompany teams to observe their collection techniques and note any divergence from protocols. The Program Manager 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 after.

The following describes the analysis used for the Program Manager's duplicate sampling:

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

$$\text{RPD} = [(X_m - X_v) / (\text{mean of } X_m \text{ and } X_v)] \times 100, \text{ where } X_m \text{ is the Program Manager measurement and } X_v \text{ is the volunteer measurement for each parameter.}$$

Teams that do not meet quality standards are retrained in the relevant methods and the Program Manager will reevaluate their collection during the subsequent sampling event.

It is also possible that the Program Manager can conclude that all sampling was valid and the discrepancy between Volunteer Stream Monitoring Quality Assurance Program Plan Guidance Version 4 samples is due to natural variation (such as the site changing over time or unrepresentative sampling conditions).

#### **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%.

Following a quality assurance 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 will consult with MiCorps staff to determine the main causes of data invalidation and develop a course of action to improve the completeness of future sampling events.

#### **Representativeness:**

Study sites are selected to represent the full variety of stream habitat types available locally. 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 watershed.

Sampling after extreme weather conditions may result in samples not being representative of the normal stream conditions. The Program Manager 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 (though can be included in an "outlier" database.).

#### **Comparability:**

Comparability represents how well data from one stream or study site can be compared to data from another. To ensure data comparability, all volunteers participating in the monitoring program follow the same sampling methods and use the same units of reporting. The methods for sampling and reporting are based on MiCorps standards that are taught at annual trainings by MiCorps staff. The Program Manager will train volunteers to follow those same methods to ensure comparability of monitoring results among other MiCorps programs. To the extent possible, the monitoring of all study sites will be completed on a single day, and certainly within a two-week time frame.

If a Program Manager leaves the position and a new Program Manager is hired, the new hire will attend the next available training given by MiCorps staff.

### **A8. Special Training/Certifications**

Program Manager: Required to attend MiCorps training session with the state Project Manager as well as the identification sessions held at the annual conferences.

Stream Team Lead Volunteers: Must attend a MiCorps training session *or* a daylong water quality training session prior to leading sampling efforts in the field. The daylong training will be led by the Program Manager and/or qualified Stream Team Lead Volunteer. The training will certify volunteers in MiCorps stream monitoring procedures including macroinvertebrate collection methods and data sheet information collection. Training will also cover MCD specific program goals, objectives, quality assurance practices, and field safety. Stream Team Lead Volunteers will be required to attend at least one water quality training every two years. Training will be offered 1-2 times a year, prior to the sampling window, based on interest and current number of Stream Team Lead Volunteers.

Identification Expert: Special training is not required. However, in the event that a new identification expert is needed the replacement should have at least one college course aquatic entomology.

## **SECTION B: PROGRAM DESIGN AND PROCEDURES**

### **B1. Study Design and Methods**

Our biological evaluation of stream water quality is based upon community diversity, in an attempt to include a complete sample of the different groups of macroinvertebrates present rather than a random subsample. Instead of assuming 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 order 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 DEQ and other agencies/organizations and compared with locations in the same river system included in this program and others.

#### **Site Selection:**

Sites were chosen based on the following criteria

- Site-level concerns such as problem road/stream crossings, recreational impacts, nutrient run off, or below dam sites. Distinct segments were determined by differences in adjacent and/or upstream land use.
- Public accessibility

In all cases the site should:

- Be representative of the stream surveyed
- Contain a diverse range of habitats
- Allow for the assessment of 300 feet of stream length

#### **Study Locations:**

MCD will sample and assess six to ten stream locations within two watersheds: Upper Manistee and Upper Central Muskegon Rivers. Sampling efforts in the Upper-Central Muskegon River Watershed will focus mainly on the Clam River, one of the major tributaries of the mainstem. The Clam River is also an area of concern as it travels through agricultural operations and town centers.

#### **Sampling sites in the Upper Manistee River Watershed:**

1. **UMAN01**: Hopkins Creek at Lucas Rd (44°28'15.49"N, 85°17'11.98"W). This road/stream crossing has been identified in the *Upper Manistee River Watershed Management Plan* as one of the 14 sites within the watershed as a critical area.
2. **UMAN02**: Ham Creek at Lanning Rd (44°29'20.61"N, 85°15'28.72"W). Road/stream crossing site on state forest land. Identified as having moderate erosion by the Conservation Resource Alliance (CRA).
3. **UMAN03**: Morris Creek at East 12 Rd/West Simpson Rd (44°25'54.68"N, 85°17'33.73"W). Road/stream crossing identified as having moderate erosion by the CRA.



### Sampling sites in the Upper-Central Muskegon River Watershed:

1. **UC-MUS01:** Clam River at Cadillac Pathways Trail (44°17'2.31"N, 85°20'3.34"W). This section of the Clam River is located within a well-used recreational area, just outside the city of Cadillac. The site is often used as a campsite and non-motorized boat launch.
2. **UC-MUS02:** Mosquito Creek at MSU Research Station (44°18'24.13"N, 85°12'6.77"W). This is a partner site with the research station. The main use of land at the research station is pasture land for cattle. This site is also below the dam used to raise/lower the lake levels of Lake Missaukee.
3. **UC-MUS03:** Clam River Campground @ Dickerson Rd (Pending Site – 44°16'37.86" N, 85°06'55.08" W). This is a road-end township park often used for fishing. This site was chosen for usage and ease of accessibility.
4. **UC-MUS04:** Ransom Property @ Blue Rd (Pending Site – 44°16'11.74" N, 84°57'49.66" W). This site is on private property belonging to a MCD Board Director who has given their permission for use. The site was chosen for ease of access and proximity to the main branch of the Muskegon River.
5. **UC-MUS05:** M-55 Crossing @ River Dr (Pending Site – 44°20'57.48" N, 84°55'32.30" W). Road/stream crossing identified as having moderate erosion by the CRA.
6. **UC-MUS06:** Young Rd/N. 13-Mile Rd (Pending Site – 44°21'34.49" N, 84°57'08.32" W).

**Frequency and Timing:** Macroinvertebrate communities are sampled annually in the spring (mid-May) and fall (late-September/early October) as long as accessibility doesn't become an issue. Sites are sampled during the same two-week time frame each year to minimize seasonal variability in macroinvertebrate distribution or abundance. New sites are added as volunteer and personal community interest occurs or problems are detected. For each sampling event that is not completed in one day, monitoring by volunteers will be completed within the same two-week period each year. If a site is temporarily inaccessible, due to factors such as prolonged high water, 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 Manager as soon as possible and no later than the end of the first week in the sampling window for the Managers to arrange for another team to complete the monitoring. If no team is available, the Program Manager and/or Conservation Educator will, if feasible, sample the site. Otherwise, the site will go unmonitored for that season.

### Study Methods

**Stream Habitat Assessment:** Streamside Leaders and Collectors, with Pickers assisting as well, or the Program Manager, will complete a Habitat Assessment once a year during the fall season immediately following the macroinvertebrate sampling or at least within two weeks of the sample event. The Habitat Assessment will follow the procedure and datasheet given in Appendix 2. A site sketch will accompany the assessment (Appendix 2).

The Habitat Assessment is a critical piece of the monitoring process and will be used to monitor changes in stream habitat over time, which may result in changes in water quality and corresponding macroinvertebrate diversity. As many of the parameters within the Habitat Assessment are qualitative, personal bias is inherent. To account for bias and personal discrepancies, Streamside leaders will have on hand a copy of MiCorps Stream Monitoring Procedures, which details the qualitative criteria, and helps clarify questions. Streamside leaders will read questions aloud to their group and form consensus on question answers. Since the information reviewed in the Habitat Assessment holds considerable educational value for volunteers and the goals of the MiCorps program, it is important that Streamside Leaders inform other group members of the purpose of the Assessment and encourage feedback from the group. However, final decisions on the scoring remains the responsibility of only those team members who have undergone the volunteer training and have been certified by the Program Manager. All final Habitat Assessment data sheets will be reviewed by the Project Manager for correctness and completeness. There are places on the data sheet to record unusual procedures or accidents. Any variation in procedure should be explained on the data sheet.

As a critical role of the Habitat Assessment is to inform us of any areas of habitat degradation that could impact water quality, any concerns noted in the data sheet will be reviewed by the Project Manager and appropriate action will be taken to resolve and/or address noted concerns including informing appropriate authorities.

**Macroinvertebrate Sampling:** The benthic population is sampled within a 2-week period in mid-May and mid-October. All equipment to be used for this sampling is listed in under B2. To sample the benthic community, multiple collections will be taken from each habitat type present at the site including riffle, rocks or other large objects, leaf packs, submerged vegetation or roots, and depositional areas, while wading and using a D-frame kick net as outlined in the MiCorps Survey/Sampling Techniques which will accompany each sampling team. The trained Collector will transfer the material from the net into buckets. The remaining volunteers (Pickers) will pick through samples, sorting into trays and preserving them in jars of either stream water for same-day ID or 70% ethyl alcohol for later identification. During the collection, the Collector will provide information to the team Streamside Leader in response to questions on the data sheet that review all habitats to be sampled, the state of the creek, and any changes in methodology or unusual observations. The Streamside Leader will instruct and assist other 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. 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. There are places on the data sheet to record unusual procedures or accidents, such as losing part of the collection by spilling. Any variations in procedure should be explained on the data sheet. (Appendix 3.)

At the collecting site, all invertebrate sample jars receive a label written in pencil or printed with a label maker, stating date, location, name of collector, and number of jars containing the collection from this site, which is placed on the jar. The data sheet also states the number of jars containing the collection from this site. The Streamside Leader is responsible for labeling and securely closing the jars, and returning all jars and all equipment to the Program Manager. Upon return to the Program building, 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 in the central office until they are examined and counted on the day of identification (same day if possible or within one to two weeks). The data sheets are used on the identification day, after which they remain on file indefinitely.

**Macroinvertebrate Identification:** The identification session will be held indoors at the Health Department Community Room. Together volunteers, Stream Team Leaders, and aquatic macroinvertebrate experts will sort, identify, and count specimens collected at sampling locations. 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. Volunteers will sort presented specimens into groups based on physical similarities, which will be further sorted and identified by the Program Manager/expert to order level. All identifications are verified by the Program Manager. When 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 room temperature at the MCD office indefinitely. The alcohol is carefully changed (to avoid losing small specimens) in the jars every few years. Old alcohol will be watered down and drained down the sink. Data is recorded on the corresponding site-specific MiCorps order level macroinvertebrate data sheet (Appendix 3).

As 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 subsample. 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 has been sampled in the same way. All collectors attend an instream training session, and most sites are sampled by different collectors at different times to diminish the effects of bias in individual collecting styles. Samples where the diversity measures diverge substantially from past samples at the same site are resampled by a new team within two weeks. 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 orders have been collected.

### **Equipment Quality Control:**

- Check to make sure equipment is in working order and not damaged
- Clean equipment after field use
  - Conduct a visual inspection of gear before and after any sampling; thoroughly inspect and remove all plants, dirt and mud, and any other visible debris like seeds, shoots, animals, insects, and eggs from clothing and equipment.
  - If going to another site on the same sampling day, disinfect with dilute bleach and allow to sit for 10 minutes before rinsing with tap water and towel dry all equipment before leaving the site.
  - After sampling is done for the day, let dry for at least 5 days before using gear again.
  - If necessary, Team Leaders should use high pressure hot washes to clean monitoring equipment if areas are known to be infected by invasive species.
  - Be on the lookout for New Zealand mud snails.
  - Additional details can be found in the MiCorps Volunteer Monitoring Invasive Species Prevention Kit Use Guide which is located with monitoring supplies, or at <https://www.hrwc.org/volunteer/decontaminate/>.
- Maintain a detailed inventory of equipment including dates of purchase, dates of last usage, and any repairs made
- All equipment replacements and storage is the responsibility of the Program and District Managers and MCD.

### **Data Analysis Quality Control**

- Field datasheets and labels will be verified by volunteers in the laboratory
- Macroinvertebrate identification will be completed by trained volunteers
- Taxa identification will be verified by the Program Manager
- Counts will be verified by at least two volunteers
- Calculations will be completed by at least two volunteers and verified by the Program Manager
- Hard copies of data will be reviewed for errors by comparing to field data sheets

**Variability:** Possible sources of variability in data include team leader experience, volunteer commitment, and the subjective nature of some evaluations. Inconsistent macroinvertebrate scores and/or habitat assessments will be addressed by the Program Manager. Re-sampling may be conducted if assessments result in inadequate sampling procedures.

## **B2. Instrument/Equipment Testing, Inspection, and Maintenance**

**Sampling Equipment:** Stream Team Leader will acquire equipment needed for macroinvertebrate sampling from the Program Manager at the district office. Each kit will include:

- Clipboard and writing equipment
- Map, directions, and GPS coordinates for their sampling site(s).
- MiCorps Macroinvertebrate Data Sheet.
- MiCorps Stream Habitat Data Sheet, fall only, if they agree to conduct the assessment. • 2 laminated identification sheets
- 1 laminated MiCorps Survey/Sampling Techniques and volunteer role descriptions. • Sampling tools: buckets, D-nets, waders (if needed), and rinsing bottle
- Collection tools: forceps, eye droppers, magnifiers, sorting trays, collection jars, and 70% ethanol
- First Aid kit
- Travel table

All equipment will be inspected and maintained by the Program Manager. All critical instruments will be tested before each sampling event to ensure proper function. Critical equipment includes D-nets, collection jars, narrow point forceps, collection buckets, sorting trays, and waders. Also, datasheets, labels and pencils are required for documentation. In the

event the Program Manager finds equipment insufficient for sampling, they will be responsible for repairing or replacing equipment prior to use in the field. Problems encountered in the field or laboratory will be noted and resolved accordingly. All equipment will be stored at the MCD office.

### **B3. Inspection/Acceptance for Supplies and Consumables**

Prior to the sampling event, the Program Manager will organize all equipment and data sheets needed. Program Manager will determine when new supplies are needed or no longer useable and conduct repairs. New supplies will be ordered by the District Manager. Inspections, repairs, and re-ordering will be documented on equipment database.

### **B4. Non-direct Measurements**

Not applicable.

### **B5. Data Management**

Raw data will be entered and managed in Microsoft Excel workbooks by the Program Manager. Data will be entered into the database within a month of the collection data. All data is backed up on the district's external hard drive. Data will be entered from the database directly into the MiCorps online database by the Program Manager or a single trained volunteer. Hard copy data sheets will be filed at the MCD office for at least 5 years. Critical sites' data sheets will be kept indefinitely.

**Macroinvertebrates:** Data are summarized for reporting into four metrics: all taxa, insects, EPT (*Ephemeroptera* + *Plecoptera* + *Trichoptera*), and sensitive taxa. Units of measure are families counted in each metric. The Stream Quality Index (SQI) from the MiCorps datasheet is also computed. The method for calculating that metric is included in Appendix 3.

**Habitat:** specific measures are used from habitat surveys to investigate problem areas at each site. The percentage of stream bed composed of fines (sand and smaller particles) is calculated and changes are tracked over time as an indicator of sediment deposition.

**Data Analysis:** All calculations will be checked twice. Hard copies of all computer entered data should be reviewed for errors by comparing to field data sheets. Data analysis methods will periodically be reviewed by qualified professionals.

## **SECTION C: SYSTEM ASSESSMENT, CORRECTION, AND REPORTING**

### **C1. System Audits and Response Actions**

Volunteer Team Leaders trained by the Program Manager ensure that quality assurance protocols are followed and report any issues possibly affecting data quality. When significant issues are reported, the Program Manager may accompany groups in the field to perform side-by-side sampling and verify the quality of work by the volunteer team. In the event a group is determined to have done a poor job sampling, a performance audit to evaluate how people are doing their jobs of collecting and analyzing the data is accomplished through side-by-side sampling and identification. During side by side sampling a team of volunteers and an outside expert sample the same stream. The statistic for checking this side-by-side sample is given in the Bias section (A7).

A system audit is conducted following each spring and fall monitoring event to evaluate the process of the project. The system audit consists of the Program Manager, any other program leader, and one or two active volunteers, and is a start to end review of the monitoring process and how things could be improved for the next event.

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 the Program Manager 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 (two-week window). Otherwise, a gap must be left in the monitoring record and the cause noted. All corrective actions are documented and communicated to MiCorps staff.

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. The 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.

### **C3. Reconciliation and Data Quality Objects**

Data quality objectives are reviewed annually to ensure that objectives are being met. Deviations from the data quality objectives are reported to the Program Manager and MiCorps staff for assessment and corrective action. Also, data quality issues are recorded as a separate item in the database and are provided to the Program Manager 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 program, quality control reports are included with quarterly project reports that are submitted to MiCorps. 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 Manager generates annual reports sharing results of the program with volunteers, special interest groups, local municipalities, and relevant state agencies. Data and reports will be made available through the organization's website.

## **APPENDIX 1: UPPER MANISTEE RIVER NATURAL RIVER MANAGEMENT PLAN**

**APPENDIX 2:  
STREAM HABITAT ASSESSMENT AND SITE SKETCH**

**APPENDIX 3:  
MACROINVERTEBRATE IDENTIFICATION**

**APPENDIX 4:  
WATERSHED MAP AND SAMPLING LOCATIONS**