A1. Title and Approval Sheet

Quality Assurance Project Plan for
Upper Manistee River Watershed Volunteer Monitoring Program

Date: 4/21/2022

Version # 1

Organization: Mason-Lake Conservation District

QAPP Prepared by: Abbey Hull, Water Quality Intern, and Dani McGarry, Executive Director

Signature: ____

MiCorps Staff Use

Tracking Number:

MiCorps Reviewer:

☐ Approved ☐ Returned for modifications

____

Signature of reviewer Date

SECTION A: PROJECT DESCRIPTION AND QUALITY OBJECTIVES

A3. Distribution List

- Dani McGarry, Executive Director, Mason-Lake Conservation District (MLCD)
- Joyce Durdel, Volunteer Field Technician, Little Manistee Watershed Conservation Council (LMWCC)
- Paul Steen, MiCorps Program Manager Huron River Watershed Council

A4. Program Organization

Management Responsibilities:

Dani McGarry, Program Manager, Mason-Lake Conservation District, 655 N Scottville Road, Scottville Mi 49454, (231) 757-3707 ext. 5, mason-lake@macd.org

Dani is the Program Manager for the volunteer stream monitoring program and will oversee field activities. She is also responsible for maintaining quality assurance oversight (QA Manager) and reports to the Board of Directors. If the Conservation District employs a Water Quality Intern or Watershed Technician in any given year, data and field duties below will be delegated to that person. 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 activities and recruit volunteers.
- Research and purchase necessary equipment for performing stream monitoring activities.
- Coordinate and conduct volunteer stream monitoring training sessions for volunteer leaders.
- Coordinate volunteer stream monitoring field data collection sessions.
- Coordinate macroinvertebrate identification review sessions.
- Implement database development, data entry, and data analysis.
- Develop reports and make presentations for local governments, special interest groups, and lake/stream associations.
- Promote the program at regular Conservation District events and social media and Conservation District web pages.
- Develop quarterly narrative reports for open grants.
- Debrief with Field Technicians and volunteer Team Leaders after each sampling event.
- Attend MiCorps conferences in 2022 & 2023.
- Develop and submit a final report, following MiCorps guidance, at the end of the project

Joyce Durdel, Volunteer Field Technician, Little Manistee Watershed Conservation Council, 9182 West River Rd, Irons, MI 49644, 231-590-0046, whitepine50@gmail.com

Joyce Durdel is the volunteer Field Technician for the Lower Manistee River Watershed Volunteer Monitoring Program and has managed the Upper Little Manistee volunteer stream monitoring program for many years. Joyce also coordinates some management activities with the Program Manager and reports to the Program Manager. Responsibilities include

- Attend an 8-hour training session provided by MiCorps.
- Coordinate and conduct volunteer stream monitoring training sessions.
- Coordinate and implement volunteer stream monitoring field data collection sessions.
- Coordinate and implement macroinvertebrate identification review sessions
- Debrief with Program Manager and Team Leaders after each sampling event.
- Attend MiCorps conferences in 2022 & 2023.

Dani McGarry, Executive Director, Mason-Lake Conservation District, 655 N Scottville Road, Scottville Mi 49454, (231) 757-3707 ext. 5, mason-lake@macd.org

Dani provides administrative and budget oversight for the program and takes on the Program Manager role when necessary. Responsibilities include:

- Assist with volunteer recruitment, liaison, and retention.
- Assist with budget oversight and development of quality financial reports.
- Assist in the development and submission of final reports, following MiCorps guidance, at the end of the project.
- Submit a release of claims statement at the end of the project.

Field Responsibilities
Oversight of all field activities will be the responsibility of the Program Manager and the Field Technician. *Manistee Conservation District will loan all stream sampling equipment necessary.* 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. May assist stream Team Leaders in habitat assessment.

Laboratory Responsibilities
Program Manager will assume all identification responsibilities, seeking assistance from Field Technician and experienced volunteers. *Mason-Lake Conservation District will loan laboratory space and equipment.*

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

A5. Problem Definition/Background

The Manistee River watershed is a regionally important Lake Michigan tributary that supports a nationally recognized fishery. The health of the Manistee River watershed is essential to the local economy and way of life for the residents in this region. In a Conservation Needs Assessment (public survey) conducted in 2021 by the Mason-Lake Conservation District, local citizens overwhelmingly voted water resources as the most important conservation concern in Mason and Lake Counties, with groundwater and stream water quality ranking 2nd and 3rd highest priorities after invasive species (other options included pond/lake quality, wetlands, farm runoff, erosion, algae blooms, stormwater runoff).

Overall, the Manistee River watershed has good water quality but is degraded in many portions due to human activities. According to the Manistee River Assessment conducted by the Michigan Department of Natural Resources (MDNR) in 1998, the primary source of pollution in the watershed is sediment. Many of the road/stream crossings in this watershed are degraded, inadequately sized or improperly constructed causing sediment deposition and degradation of important instream habitat. Other threats to the watershed include non-point source pollution, residential development, sedimentation and bank erosion, potential oil and gas exploration, and recreational impacts. The presence of these threats makes it vital to implement frequent monitoring in the watershed.

Through the Upper Manistee River Watershed Volunteer Monitoring Program, the Mason-Lake CD will continue the work of the Little Manistee Watershed Conservation Council to produce water quality data for the upper portion of the watershed, as well as build long-term partnerships and foster stewardship of water resources. This program will also further the initiatives of local watershed and conservation groups including the Little Manistee Watershed Conservation Council, the Greater Bear Watershed, Portage Lake Watershed Forever, Little River Band of Ottawa Indians, and Manistee Conservation District, by implementing a sustainable stream monitoring program in the overall Manistee River watershed.

The specific goals of the Upper Manistee River Watershed Volunteer Stream Monitoring Program are as follows:

1. Foster stewardship by educating watershed residents on water quality issues and protection.
2. Engage local citizens and partners as stakeholders to monitor and identify threats to the health of the waterways.
3. Generate water quality and habitat data to identify problem areas within the Upper Manistee River watershed where quality has been degraded and best management practices can be implemented.
4. Create a sustainable monitoring project that will transcend the MiCorps funding period.

A6. Program Description

The Upper Manistee River Watershed Volunteer Stream Monitoring Program will utilize citizen science to collect water quality data for the Little Manistee River portion of the Manistee Watershed while also fostering stewardship of water resources. This program will serve as a tool to educate residents on water quality issues in the Little Manistee watershed. Volunteer participation is paramount to the success of the program and members from Little Manistee Watershed Conservation Council, as well as personnel from Manistee Conservation District, have pledged volunteer service. Volunteers are also recruited from the MLCD's volunteer team, dedicated to helping with conservation projects in Mason and Lake Counties. Additional volunteers are recruited from the local community via MLCD's newsletters, email announcements, web page, and Facebook page.

The Little Manistee River Volunteer Monitoring Program focuses on macroinvertebrate and stream habitat assessments on the Little Manistee River watershed (between US-131 and US-31). The upper portion of the Little Manistee River watershed was originally chosen for monitoring by the Little Manistee Watershed Conservation Council based on their desire to preserve the quality of the river, its cold water fisheries habitat, and its relation to current conservation goals of local watershed groups. The MLCD will sample and assess three locations of the Little Manistee River, located at Queens Hwy crossing, Old Grade Campground, and Indian Bridge.

Biological monitoring will be conducted twice per year, once in May and once in October. In addition to biological monitoring, habitat assessments will be conducted once per year during the fall. Training sessions for macroinvertebrates will be held twice per year, about two weeks before each sampling event. Stream Team Leaders are required to attend at least one training session prior to the sampling period where they will be trained in habitat assessment and macroinvertebrate collection and identification.

Data generated from monitoring will be added to the MiCorps Data Exchange platform to be utilized by non-profit, local, state, and federal agencies for prioritizing watershed restoration projects. If data indicate that any waterways have been degraded, MLCD will work with partners to pursue funds to implement restoration actions and Best Management Practices.

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 can 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 quality assurance is conservative. We have compiled past years' data from the Little Manistee Watershed Council and converted it to the new ranking system used by MiCorps to provide comparable data across many years for each site's Water Quality Rating (WQR) score or total diversity (D).
Precision and accuracy will be maintained by following standardized MiCorps procedures. The Program Manager must be trained in MiCorps procedures at the annual MiCorps training led by MiCorps staff. 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. Precision and accuracy will be maintained by conducting consistent volunteer Team Leader training. Stream Team Leaders will be trained when joining the program and retrained every two years (at a minimum). Techniques under review shall include:

- Collecting style (must be thorough and vigorous)
- Habitat diversity (must include all available habitats and be meticulous in each one)
- Picking style (must be able to pick methodically 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 alcohol to be identified at a later identification session. 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 at least once every three years to examine the effects of bias in individual collection styles. Measures of D and WQR for these samples will be compared to the median results from the past three years and each should be within 40% relative difference from the median. If the sample falls outside this range, then the Program Manager needs to conduct a more thorough investigation to determine which team is 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:

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

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

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

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 WQR for every sample will be compared to the median results from the past three years and each should be within 40% relative difference of the median. If the sample falls outside this range, it should not be included in 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 training sessions 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 be provided the QAPP and will attend the next available training given by MiCorps staff.

A8. Special Training/Certifications

Volunteers interested in becoming Stream Team Leaders must attend a daylong water quality training session prior to leading sampling efforts in the field. The purpose of these training is to certify volunteers in MiCorps stream monitoring procedures. Stream Team Leaders will be required to attend at least one water quality training every two years.

Training sessions will be offered twice a year, 2-3 weeks prior to that season's collection event. These trainings will consist of a morning session indoors discussing project background, goals, and procedures as well as aquatic macroinvertebrate identification practice. The afternoon session will take place at a nearby stream under the direction of the Program Manager and other certified Stream Team Leaders. The afternoon session will cover the following topics:

- Description of equipment and sampling kit
- Explanation of fields sheets (stream macroinvertebrate data sheet and stream habitat datasheet)
- Demonstration of macroinvertebrate collection using proper techniques, followed by identification and filling out macroinvertebrate datasheet.

The Program Manager will maintain all volunteer records ensuring that there are a sufficient number of Stream Team Leaders available for each collection event.

A9. Decontamination Procedure

Decontamination is of utmost importance in stopping the spread of invasive species and the transport of aquatic diseases. Team leaders will ensure the following decontamination steps are completed:

1. Conduct a visual inspection of gear before and after fieldwork.
2. If going to another monitoring site, thoroughly inspect and remove all plants, dirt, 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, every effort will be made to sample from upstream to downstream sites. Team Leaders will supervise the use of decontamination kits to disinfect all equipment with dilute bleach and allow it to sit for 10 minutes before rinsing with tap water and towel dry all equipment before leaving the site. (See section B1 for a list of the decontamination kit contents).
3. Remove plant and debris from equipment and let it dry for at least 5 days.
4. If necessary, Team Leaders should use high-pressure hot washes to clean monitoring equipment if areas are known to be infected by invasive species.
5. Be on the lookout for New Zealand mudsnails. Decontamination procedures will be part of all training and outreach events.

Section B: Program Design and Procedure

B1. Study Design and Methods

Site selection: Sites were chosen based on the flowing criteria:

a. Representation of segments along the river or stream that are substantially different from the rest of the watershed. Distinct segments were determined by differences in habitat types, fish communities, gradients, and large independent tributaries.
b. Site-level concerns such as problem road/stream crossings, former dam sites, or recreational impacts.
c. Public accessibility

Study Locations: The MLCD will sample and assess three locations within the upper portion of the Manistee River watershed, focusing on the Little Manistee River (watershed map showing all study site locations is included in Appendix 1).

The Little Manistee River originates from several swamps in eastern Lake County and flows through Mason and Manistee County. The Little Manistee River watershed drains 210 square miles which includes approximately 63 miles of river and ultimately flow into Manistee Lake. The watershed includes two permanent dams as well as several large wetland complexes. The Little Manistee River is surrounded by abundant hardwood and conifer forests and is relatively undeveloped. The combination of large stretches of undeveloped forests and ground-fed streams create one of the coldest and most stable streams in Michigan. All named tributaries of the Little Manistee River are Designated Trout Streams.

Sampling sites for the Little Manistee River watershed:

1. **LM04 - Little Manistee River at Indian Bridge** (44.089714,-85.90518).
2. **LM05 - Little Manistee River, Old Grade Campground in** (44.04186, -85.70262).
3. **LM06 – Little Manistee River at N Queens HWY** (44.04186, -85.70262).

Frequency and Timing: Macroinvertebrate communities are sampled twice per year, once in May and once in October. Sites are sampled within the same two-week time frame each year to minimize seasonal variability in macroinvertebrate distribution and abundance. New sites are added based on volunteer involvement or new problems within the watershed are detected.

For each sampling event that is not completed on a single day, monitoring by volunteers will be completed within the same two-week period. If a site is temporarily inaccessible, such as due to 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, the Stream Team Leader will contact the Program Manager as soon as possible and no later than the end of the first week in the sampling window in order for the Manager to arrange for another team to complete the monitoring. If no team is available, the Program Manager will, if feasible, sample the site. Otherwise, the site will go unmonitored for that season.

Macroinvertebrate Sampling Procedure: Before entering the stream, the Team Leader and Collector inspect all sampling gear to ensure that it is clean. If any aquatic life or debris on the equipment, volunteers will use water withdrawn from the stream with a clean container to clean the equipment at a distance of no less than 100 feet from any water body. The collector(s) will sample in the river for 30-45 minutes. The trained Collector wades the stream and uses a D-frame kick net to obtain 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. Meanwhile, the trained Streamside Leader will record the number of locations sampled within the monitored reach in each habitat type and note the locations sampled on a site map (Appendix 4). The Collector empties the contents of the nets into shallow white trays after each sample. The remaining volunteers (Pickers) pick out samples of all different types of macroinvertebrates from pans and put the samples into jars of ethanol for later identification. Potential sources of variability such as weather/streamflow differences, season, and site characteristic differences will be noted for each event and discussed in the study results. There are places on the datasheet to record unusual procedures or accidents, such as losing part of the collection by spilling. Any variations in the procedure should be explained on the datasheet (Appendix 4). A delineation of Stream Team Roles and Duties is included in Appendix 2.

Immediately following the 30-45 minute in-stream collection event, the Stream Side Leader, Collector, and Pickers will continue to transfer specimens from the Collector's collection bucket for an additional 30 minutes. All observed specimens within the timeframe of the collection event are transferred to sampling jars regardless of abundance.

Prior to the collection event, all macroinvertebrate sample jars receive a label written in pencil and placed inside the jar indicating the date, location, name of the collector, and the number of collection jars from the site. The datasheet also states the number of collection jars from the site. The Stream Team Leader is responsible for labeling and securely closing the jars in addition to returning all jars and all equipment to the Program Manager. Upon return to the MLCD office, the collections are checked for labels, the data sheets are checked for completeness and 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 MLCD office until they are examined and counted on the day of identification. The data sheets are used on the identification day; after which they remain on file for at least five years. Before leaving the site, Stream Team Leaders will make sure that all sampling equipment is clean of all debris and plant and animal life to avoid contamination if transported to another site. Sample jars and datasheets are to remain in the custody of Stream Team Leader at all times until transfer of custody is given to the Program Manager.

Macroinvertebrate Identification Procedure: The identification session will be held indoors at the MLCD office, bringing together volunteers, Volunteer Leaders, and aquatic macroinvertebrate experts together to sort, identity, and count specimens collected in the field. For identification, volunteers sort presented specimens into groups based on physical similarities, and then are joined by the Program Manager/expert who further sorts and identifies the taxa present to family 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 MLCD office indefinitely. Data is recorded on the corresponding site-specific MiCorps family level macroinvertebrate data sheet (Appendix 3).

Because 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 have 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 families have been collected.

Habitat Assessment Procedure (fall only): Stream Team Leaders and Collectors, with Pickers assisting, will complete a Habitat Assessment once (Appendix 4) once a year during the fall season immediately following the macroinvertebrate sampling or within at least two weeks of the sampling event. A Site Sketch (Appendix 4) will accompany the Assessment. 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, Stream Team Leaders will have on hand a copy of MiCorps Stream Monitoring Procedures (Appendix 5), which details the qualitative criteria, and helps clarify question aims. Stream Team Leaders will read questions aloud to their group and form a 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 Stream Team Leaders inform other group members of the purpose of the Assessment and encourage feedback from the group. However, the final decision on scoring remains the responsibility of only those Stream Team Members who have undergone Stream Team Leader Training and have been certified by the Program Manager to do so. All final Habitat Assessment data sheets will be reviewed by the Program Manager for correctness and completeness. There are places on the datasheet to record unusual procedures or accidents. Any variations in the procedure should be explained on the datasheet.

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 datasheet will be reviewed by the Program Manager and appropriate action will be taken to resolve and/or address noted concerns including informing appropriate authorities.

Equipment Quality Control:

A. Check to make sure equipment is in working order and not damaged
B. Clean equipment before and after taking it into the field
C. Maintain a detailed inventory of equipment including dates of purchase and dates of last usage
D. Check the batteries of all equipment that requires them

Field Procedures Quality Control

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

Data Analysis Quality Control

e. Field data sheets and labels will be verified by volunteers in the laboratory
f. Specimen identification will be completed by trained volunteers
g. Taxa identification will be verified by the Program Manager
h. Counts will be verified by at least two volunteers
i. Calculations will be completed by at least two volunteers and verified by the Program Manager
j. Hard copies of computer entered 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. Variances will be considered on a case-by-case basis to determine the effect the variability may have on results. Should problems with the program arise, the Program Manager and the MCD Administrator will meet to discuss and formulate corrective measures/actions to be taken.

B2. Instrument/Equipment Testing, Inspection, and Maintenance

Equipment: The program Manager will pick up the equipment at the Manistee Conservation District office to loan for sampling days. All equipment will be stored at the MCD office. In the event that MLCD receives its own equipment, it will be stored at the MLCD office. Each team will receive a sampling kit consisting of:

a. Clipboard
b. Folder containing directions and GPS coordinates of sampling sites and emergency contact sheet
c. MiCorps Macroinvertebrate Data Sheet
d. MiCorps Stream Habitat Data Sheet (Fall only)
e. 2 Laminated identification sheets
f. 2 Laminated MiCorps Survey/Sampling Tips Sheets
g. 2 White trays
h. 1 Ice cube tray
i. 2 Magnifying glasses
j. 1 Plastic cup/water bottle (for net rinsing)
k. 2 Eye droppers
l. 2 Forceps
m. 2 Pencils
n. 2 D-Nets
o. 2 Collection jars filled ¾ with 70% ethanol with site label including location, date, and group leader names
p. 1 5-gallon bucket
q. 1 Tape measure
r. Waders for team members
s. First aid kit

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-shaped collection nets, collection jars with poly-seal caps, narrow point forceps, collection buckets and trays, waders, and life jackets. Also, datasheets, labels, and pencils are required for documentation. In the case that 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

In the weeks prior to a monitoring or identification event, the Program Coordinator will check all equipment thoroughly. The Program Manager also maintains detailed records of all equipment including purchase date and when consumables should be replaced.

B4. Non-direct Measurements

Not applicable.

B5. Data Management

Macroinvertebrate and habitat assessment data will be entered by the Program Manager into MS Excel database for long-term storage. After each sampling event is completed, all new data will be entered into the MiCorps Data Exchange at www.micorps.net. Hard copies of the data sheets will be stored at the MLCD for a period of at least five years. All digital data will be backed up on an external hard drive and to Google Drive quarterly.

Macroinvertebrates: Data are summarized with one score based on all taxa found. Units of measure are families counted in each metric. The Water Quality Rating (WQR) 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 streambed composed of fines (sand and smaller particles) is calculated and changes are tracked over time as an indicator of sediment deposition.

Data Analysis Quality Control: All calculations will be checked at least twice. Hard copies of all computer entered data are reviewed for errors by comparing them to field datasheets. Data analysis methods and results are periodically 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 that 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. Agreement in sample composition between the two should be 60% or greater.

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 Coordinator, 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 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 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 which are created by the Program Manager and are submitted to MiCorps. Quality control reports provide information regarding problems or issues arising in the 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 annual reports sharing results of the program with volunteers, special interest groups, local municipalities, and relevant state agencies. Data and reports are made available via the organization's web page.

Appendix 1

Watershed Map with Sampling Sites

Map of study sites for the Little Manistee Watershed Volunteer Stream Monitoring Project

Appendix 2

Stream Team Roles

Techniques for Stream Macroinvertebrate Collecting

Team Roles

Every person on the team needs to have a role so they know their responsibilities and how they should be participating. Every river group is welcome to hold training events for all volunteer roles as they see fit, but the Huron River Watershed Council suggests that training should not be required for pickers and collector assistants, in order to boost beginner volunteer participation. Here are several suggested roles:

Picker:

t. New volunteers typically start out as Pickers. This job does not require getting into the stream and is a good way to get introduced to monitoring and the interesting creatures that live in the stream.
u. No training is required to be a Picker.
v. Pickers are responsible for sorting through the samples collected by the Collector, picking out the macroinvertebrates from the rocks and leaves and putting them in a collection jar.

Collector Assistant:

w. On a large site it is helpful to have one team member in waders assisting the Collector by carrying the trays to the team and the empties back to the Collector.
x. The only training required to be an Assistant is experience wading in moving water on slippery rocks.

Collector:

y. Collectors should attend training sessions in order to learn the techniques for sampling in the river.
z. The Collector is the only person that enters the water (unless there is an Assistant).
aa. They are responsible for sampling all of the habitats, and bring the samples to the rest of the team to sort through.

Streamside Leader:

bb. The Leader instructs the team, keeps the team together, locates the sampling site, is responsible for filling out the data sheets, labeling the jars, and reminding the Collector which habitats still need to be found.
cc. Should require a training event.

Equipment Manager:

i. 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
ii. This position should be a secondary job of one of the pickers.

When you get to the site- instructions for the streamside leader

1. Make sure you're at the right site!
2. Scout out a nice place for your team to sit on the bank and sort through samples.
3. Orient your team to what they are looking for. Explain that:
   - We want to collect samples of all the different macroinvertebrates.
   - Be patient when sorting; it may take a little time to see the tiny creatures that are there.
4. Make sure that each habitat gets sampled.
5. Let the team know about what you see in the creek, such as types of habitats that are missing and any evidence that the force of storm flow has affected the stream.

Collecting Hints- instructions for the collector

1. Always start downstream and work upstream to avoid disturbing where you're about to collect.
2. The most important thing is to get some of each type of creature.
3. Please note that some clams are endangered or threatened. Don't collect large clams, just make a note that you observed them.
4. You should spend approximately 45 minutes collecting at a small stream, and up to 1 hour collecting at a large river site (or 2 collectors spend 30 minutes in a river). Please collect as long as you need to thoroughly sample every different kind of habitat. The goal is to find as many types of macroinvertebrates as possible.
5. Sample a number of times in each habitat. Use three samples as a guideline but collect enough that you feel you got all of the different animals living in each habitat.
6. Remember - BE AGGRESSIVE- the animals are holding on tight to rocks, branches, and leaves to avoid being carried downstream and you want to shake them loose!

Collecting Techniques

It is very important that you begin at the downstream end of your collecting site and work upstream, to minimize disturbance to the site. Collect from the various habitats in the order they come to you as you work your way upstream (and not necessarily in the order on the data sheet).

Riffle:

Note: When selecting a riffle, keep in mind that flow has a big impact on the types of animals that can live there. Two riffle samples, one in the fastest part (white water present, larger rocks) and one in the slowest part (no white water, smaller gravel sized rocks) will likely yield different animals.

1. Put the net on the bottom of the stream, stand upstream, hold the net handle upright.
2. Use kicking/shuffling motion with feet to dislodge rocks. You are trying to shake organisms off rocks as well as kick up organisms that are hiding under the rocks. Dig down with your toes an inch or two. Do a lil' dance. Some people use their hands to rub organisms off rocks, but beware of sharp objects on the stream bottom.

Quiet Place/pool:

1. Scoop some sediment up in your net. Some animals burrow into the muck.

Tip: When your net is full of muck, it is very heavy. To clean the excess muck out of your net: keep the top of the net out of the water to avoid losing animals, then sway the net back and forth, massaging the bottom of the net with your hand. When choosing a soft bottom area try to find one that contains silt since it is a far more productive habitat than just sand.

Undercut Bank/Overhanging Vegetation or Roots:

1. Jab the net into the undercut bank while pulling the net up. Move in a quick bottom to surface motion to scrape the macroinvertebrates from roots. Do this several times.
2. If you notice roots or overhanging vegetation, put the net under the bank at the base of the plants. Shake the vegetation using your net, trying to shake off the animals clinging to these plants. Feel free to use your hands if you are sure the plants are not poisonous.

Submerged or emergent vegetation:

1. Keeping the net opening pointed upstream, move the net through vegetation trying to shake the vegetation and catch any animals.
2. Use your hands to agitate the vegetation and dislodge the animals into the net.

Rocks/Logs:

1. Small logs and rocks can be pulled out of the water and given to the team to search for animals.

Hint for Logs: Be sure to check under bark.

Hint for Rocks: Caddisfly homes often look like small piles of sticks or clumps of small gravel attached to rocks.

Leaf Packs:

1. Look for a decomposing leaf pack. A "good" leaf pack has dark brown-black skeletonized leaves. Slimy leaves are an indication that they are decaying. Scoop a few into your net and let the team pull them apart and look for animals.
2. Tip: Sometimes a little water in the pan with the leaves will help dislodge the animals.

Finishing up

1. Remember to rinse the net and pans before leaving the site to avoid transporting animals or plants between sampling sites.
2. Have the Streamside Leader double check that the data sheet is completely filled out and that all habitats have been sampled.

Appendix 3

MiCorps Macroinvertebrate Data Sheets

Macroinvertebrate Data Sheet: Order Level

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
____Rocks
____Aquatic Plants
____Runs
____Backwater areas
____Leaf Packs
____Pools
____Undercut banks/Overhanging Vegetation
____Submerged Wood

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

= ________________________

Macroinvertebrate Data Sheet - Family Level

MiCorps Site ID#___________________ Sample Date_______________

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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) 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 4

MiCorps Habitat Assessment Data Sheet

STREAM HABITAT ASSESSMENT

I. Stream, Team, Location Information

Site ID:______________________ Date:______________________ Time:______________________

Location:____

Name(s):____

II. Stream and Riparian Habitat

	A. General Information *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						

II. Stream and Riparian Habitat (continued)

B. Streambed Substrate

Estimate percent of stream bed composed of the following substrate.

If the group will take transects and pebble counts (in Section IV), check this box and record the measured percentages.

Substrate type	*Size*	*Percentage*
Boulder	>10" diameter	
Cobble	2.5 - 10" diameter	
Gravel	0.1 - 2.5" diameter	
Sand	coarse grain	
Fines: Silt/Detritus/Muck	fine grain/organic matter	
Hardpan/Bedrock	solid clay/rock surface	
Artificial	man-made	
Other (specify)		

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 banks affected.	Moderately stable. Small areas of erosion. Slight potential for problems in extreme floods. 5-30% of banks in reach have 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% of 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

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

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II. Stream and Riparian Habitat (continued)

D. Plant Community

Estimate the percentage of the stream covered by overhanging vegetation ________%

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	Filamentous Algae (Streamers)	Shrubs	Trees
Macrophytes (Standing, Floating Plants)	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**	Grasses	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**
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 Residential Lawn Park Shrub, Old 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 Residential Lawn Park Shrub, Old 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

III. Sources of Degradation

1. In what ways is this stream degraded, if any?

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

3. Based on what you can see from this location, what are the potential causes and level of severity of this degradation? Only judge what you can see from the site.

(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:

IV. Optional quantitative measurements

A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 5-10 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 (can be arbitrary).
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 the 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.

MiCorps Site ID#: Date:

Michigan Clean Water Corps

STREAM TRANSECT DATASHEET

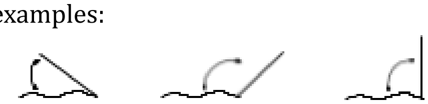
B: Boulder -- more than 10”
C: Cobble -- 2.5 - 10”
G: Gravel – 0.1 – 2.5”
S: Sand -- fine particles, gritty

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 Obtuse Right

MiCorps Site ID#:____________________

Michigan Clean Water Corps

Site Sketch

Stream Name:__________________________________Location:___________________________

Date:______________________ Drawn by:____

Draw a bird's-eye view of the study site. Include enough detail that you can easily find the site again! Include the following items in the sketch:

- Direction of water flow
- Which way is north
- Large wood in the water
- Vegetation
- Bank features
- Areas of erosion
- Riffles
- Pools
- Location of road
- Trees
- Fences
- Parking lots
- Buildings
- Any other notable features

0 feet

150 ft

300 ft

Appendix 5

MiCorps Volunteer Stream Monitoring Standard Operating Procedures

MiCorps Volunteer Stream Monitoring Program:
Monitoring Procedures

Updated December 2020

Prepared by:

Paul Steen, MiCorps Staff, Huron River Watershed Council

Jo Latimore, MiCorps Staff, Michigan State University

Adapted from:
"Stream Crossing Watershed Survey Procedure, April 27, 2000"

Prepared by:
Charlie Bauer, Saginaw Bay District
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I. Overview

A. OBJECTIVES

This set of stream monitoring forms is intended to be used as a quick screening tool to increase the amount of information available on the ecological quality of Michigan's streams and rivers, and the sources of degradation to the rivers. This document is designed to provide standardized assessment and data recording procedures that can be used by trained volunteers participating in the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Program.

This stream monitoring procedure is designed to address several general objectives:

• Increase the information available on the ecological quality of Michigan rivers and the sources of pollutants, for use by state biologists, local communities, and monitoring groups.

• Provide consistent data collection and management statewide.

• Serve as a screening tool to identify issues and the need for more thorough investigations.

B. TRAINING

All MiCorps Volunteer Stream Monitoring Program leaders must have received basic training in the stream assessment methods described below from MiCorps staff. Trained program leaders are then qualified to train their owm volunteers in these procedures.

C. GENERAL CONCEPTS

The procedures and data forms provided below include two types of assessment: Stream Habitat Assessment and Macroinvertebrate Sampling.

The Stream Habitat Assessment is a visual assessment of stream conditions and watershed characteristics. The assessment should include approximately 300 feet of stream length. Only observations that are actually seen are to be recorded. No "educated guesses" are to be made about what should be there or is probably there. If something cannot be seen, it should not be recorded. The one exception is if a significant pollutant source or stream impact is known to be upstream of a particular site, a comment about its presence can be made in the comment section of the form.

The Macroinvertebrate Sampling procedure should be used in conjunction with the Stream Habitat Assessment because each approach provides a different piece of the stream condition puzzle. Because of their varying tolerances to physical and chemical conditions, macroinvertebrates indicate the ecological condition of the stream, while the habitat assessment provides clues to the causes of stream degradation, Macroinvertebrate data is used to calculate the Water Quality Rating (WQR), which provides a straightforward summary of stream conditions and can be used to compare conditions between study sites.

D. SURVEY DESIGN

1. Selecting Monitoring Sites

One of the basic questions in planning stream monitoring is the location of study sites: how many stream sites should be surveyed within a watershed to adequately characterize it, and where should they be located? That depends on a variety of factors including the heterogeneity of land use, soils, topography, hydrology, and other characteristics within the watershed. Consequently, this question can only be answered on a watershed-by watershed basis.

A general EGLE guideline is to try to survey 30% of the stream road-crossing sites within a watershed, with the sites 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.

When beginning a MiCorps monitoring program, it is likely not possible to get to 30% coverage of stream road-crossing sites due to volunteer numbers and budget constraints. MiCorps will require at least 6 sites to qualify for receiving a grant. Place these as close to the mouth of different tributaries as you can, with at least two on the main branch of your system, if you have one, on public land or land you have permission to access. As your program grows, you can grow your monitoring reach to new locations.

In all cases, the site should be representative of the area of stream surveyed, it should contain a diverse range of the available in-stream cover, and it should contain some gravel/cobble bottom substrates if possible. Remember that each study site should allow for the assessment of 300 feet of stream length.

2. Time of Year and Monitoring Frequency

The time of year in which monitoring is conducted is important. For comparisons of monitoring data from year to year, data should be collected during the same season(s) each year. Ideally, macroinvertebrate sampling should take place in spring and again in early fall. Different macroinvertebrate communities are likely to be encountered during these different seasons, and sampling twice a year will provide a more complete picture of the total stream community. All sampling must be conducted within a two-week window, and preferably, all on the same day. To provide comparable results from year to year, sampling should be conducted at approximately the same time each year.

Habitat Assessment should be done in early spring before leaf-out, or in the fall after streamside vegetation dies back, allowing visual assessments of stream characteristics. Stream habitat assessments should not be conducted when there is snow on the ground or ice on the water because important features may be hidden from view. Surveys conducted during or shortly after storm runoff events may help to identify sources of pollutants, but high water obscures bank conditions and increased stream turbidity may make assessment of instream conditions difficult. Furthermore, all sites within a single watershed should be surveyed as closely together in time as possible to facilitate relative data comparisons among stations surveyed under similar stream flow and seasonal conditions.

MiCorps recommends repeating habitat assessment every 1 to 5 years, depending on the level of your concern for changes or impacts.

II. Stream Habitat Assessments

A. GENERAL INSTRUCTIONS

With your team (3-5 members preferably, though it can be done with 2 people), slowly walk the length of the 300 foot station length, taking in the stream's features as you go. It will be helpful to have each member be familiar with the datasheet ahead of time, so that the team knows what to look for. After observing the creek, start answering the questions together, with one member reading the questions and the other team members giving their opinions. The datasheet is filled out in a democratic method, attempting to come to agreement on the answer. If a majority agreement can't be reached, record both answers on your datasheet or where appropriate, take an average result.

Always take photos while conducting the Stream Habitat Assessment. Photographs are useful for interpretation of Stream Habitat Assessment data and for later comparisons among different sites. Site photos should show the bank conditions and some of the riparian corridor. Additional photos may be taken to highlight a particular item of concern in the stream or upland landscape. Be sure to document photos as they are taken, to simplify identification later.

As the team walks and afterwards fills out the assessment, one team member is in charge of drawing a site sketch (there is no MiCorps template for this; you can choose your methodology). The goal of a site sketch is to make the location understandable for anyone who has never been there, to make it easier to plan future outings, and to track long term changes. Draw a bird's eye view of the study site. It is important to include a north arrow, the direction of water flow, both sides of the stream channel, upland areas, parking location, and roads in the sketch, if applicable.

B. DATA SHEET

1. Stream, Team, Location Information

<u>MiCorps Site ID#</u>: You should create a unique numbering system for your sites. A suggested approach would be to use your organizations abbreviations and combine it with a

number. For example, HRWC-1. You want to pick a numbering system that won't accidently copy another organization's numbering system. MiCorps staff will contact you if your numbering system is not unique.

Date: Record the month, day and year.

Time: Record the time when the monitoring activity began.

Site Name: Use a combination of the stream name and location from which you access the study site. For example, Arms Creek at Walsh Road.
Stream name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area and note also the local name if it is different. For tributary streams to major rivers, record the tributary stream name here, not the major river name. If the tributary is an unnamed tributary, record as "Unnamed Tributary to" followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as "Unnamed Tributary to Hogg Creek".
Location: This is often the name of the road from which you access the study site, or name of the public park. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. "Green Road between Brown Road and Hill Road").

Location Information: Record the latitude and longitude coordinates of the study site. Ideally, these coordinates will correspond to the midpoint of the stream study reach. Google Maps now allows for very easy latitude/longitude identification. Just right click on the map and these coordinates will be given.

Names of Team members: Record the name of all the team members participating in the assessment, and circle the one recording the data, in case questions come up later.

2. Stream and Riparian Habitat
A. General Information

1. Avg. Stream Width (ft): Circle the range that represents the average stream width in feet. This can be a best guess, or you can choose to take width measurements of the stream at several points along the 300-foot assessment area, and indicate the average width here. These measurements are also useful in creating the Stream Site Sketch.

2. Avg. Stream Depth (ft): Circle the appropriate depth range in feet. Take depth measurements at several points within the 300-foot assessment area and take the average depth. This observation is for the average depth of the stream that is consistently observed. For example, if the stream is generally shallow (<1ft), but has a pool that is 3ft deep, circle the <1ft category since a pool is not representative of the average depth of <1ft observed over most of the stream.

3. Has this stream been channelized? Stream shape constrained through human activity look for signs of dredging, armored banks, straightened channels.
Yes, currently: You see active construction, or vegetation removal, or scraping of banks, and the river lacks turns and meanders.

Yes, sometimes in the past: The river lacks turns and meanders, but there are signs of water flow induced erosion, and vegetation has recovered from any construction at the site.

No: The stream has bends and meanders and you do not see the signs noted above. (note that you might only notice bends and meanders in small creeks; rivers bend and meander at a much higher geographic scale)

4. Estimate of current stream flow: All of these pieces of information can help you make this determination. 1) The volunteers knowledge of recent weather conditions (e.g. how much it has rained recently). 2) Visual stream observations (look for event related conditions water running off the land into the stream, fast stream water velocity, increased water turbidity, an increase in the amount of debris being carried by the stream), 3) The teams knowledge (or best guess) of what is typical flow for that (or a similar) stream, in that geographic area, for that season of the year.

Dry = No standing or flowing water, sediments may be wet.
Stagnant = Water present but not flowing, can be shallow or deep.
Low = Flowing water present, but flow volume would be considered to be below average for the stream.
Medium = Water flow is in average range for the stream.
High = Water flow is above average for the stream.

5. Highest water mark (in feet above the current level): Look for signs that the water was once higher: debris trapped against bridges, or trees, and erosion along banks above the water level.

6. Which of these habitat types are present?

Good quality streams have a wide variety of habitat available to fish and macroinvertebrates to: (1) protect them from predators, (2) avoid certain stream conditions such as fast flow velocities or direct sunlight, and 3) provide surfaces and structure on which food grows, collects, or tries to hide. Circle all the habitat types on the data form that are present in the stream reach for your 300 foot station. Types of habitat include the following:

Riffles: Riffles are areas of naturally occurring, short, relatively shallow, zones of fast moving water, typically followed by a pool. The water surface is visibly broken (often by small standing waves) and the river bottom is normally made up of gravel, rubble and/or boulders. Riffles are not normally visible at high water and may be difficult to identify in large rivers. The size of, and distance between, riffles is related to stream size. In large mainstream reaches, such as the Manistee or Muskegon rivers, riffles may be present. in the form of rapids.

Pool: Pools are areas of relatively deep, slow moving water. The key word here is “relatively”. Water depth sufficient to classify an area as a pool can vary from around 8 inches in small streams, to several feet in wadable streams, to tens of feet in large rivers. Pools are often located on the outside bend of a river channel and downstream of a riffle zone or obstruction. The water surface of a pool is relatively flat and unbroken. The presence of pools in large rivers may be difficult to identify because of an increase in relative scale, and an often-limited ability to see to the bottom of deep or turbid stream reaches.

Large woody debris: Logs, branches, and roots both above and below the water surface.

Large rocks: rocks that are 10 inches in diameter or larger.

Undercut Banks: Stream banks that overhang the stream because water has eroded some of the material beneath them.

Overhanging Vegetation: Terrestrial vegetation that extends out from shore over the surface of the stream within a foot or two of the water surface (includes trees, shrubs, grasses, etc.). This category also includes sweeping vegetation, which is terrestrial shoreline vegetation that extends into the water itself (such as low hanging branches on shrubs) and is therefore often "swept" in a downstream direction by the current.

Rooted Aquatic Plants: Aquatic macrophytes provide breaks in water flow, cover, and a food source, becoming good habitat for both fish and macroinvertebrates.

7. Estimate of turbidity: Water appears cloudy—it is rarely transparent, and the level of the cloudiness is called turbidity. Turbidity is caused by suspended particulates such as silt, sand, algae, or fine organic matter. Highly turbid water is opaque to varying degrees, preventing the observer from seeing very far into it. Note that water can have a color to it that is not turbidity, such as the brown transparent water often associated with swampy areas.

8. Is there a sheen or oil slick visible on the surface of the water?

9. If yes to #8, does the sheen break up when poked with a stick?

An oily appearing sheen on the water surface caused by petroleum products. A thin sheen will often have a rainbow of hues visible. The sheen can be distinguished from bacterial sheens by remaining viscous when poked with a stick or otherwise physically disturbed, whereas bacterial sheens break into distinct platelets.

10. Is there foam present on the surface of the water?

11. If yes to #10, does the foam smell soapy and look white and pillow like or look gritty with dirt mixed in?

Naturally occurring foam often looks like soap suds on the water surface and can be white, grayish or brownish. Foam is produced when water with dissolved organic material is aerated and can range in extent from individual bubbles to mats several feet high. Foam is typically produced in streams when water flows through rapids or past surface obstructions such as logs, sticks and rocks. Simple wave action can produce foam in lakes. This naturally occurring foam is quite common. If the suds are a bright white color, billowy and pillow-like, soapy, or smell perfumed, it is not natural foam. Volunteers used to touch the foam to feel for grittiness, but MiCorps does not advise that anymore as the foam could be PFAS, which you should not handle.

The following are optional measurements not currently funded by MiCorps
(water temperature, dissolved oxygen, pH, water velocity)

B. Streambed Substrate

Substrate is the material that makes up the bottom of the stream. In general, good quality substrates (from an aquatic habitat perspective) contain a large amount of course aggregate material—such as gravels and cobbles—with a minimal amount of fine particles surrounding or covering the interstitial pore spaces. These stable materials provide the solid surfaces necessary for the colonization of attached algae and the development of diverse macroinvertebrate communities.

Using the particle size and composition guidance provided below, identify the percent areal extent of each substrate type present. The composition estimate should include the entire area of the stream bottom in the study site (typically, 300 feet of stream). Sometimes it is not possible to determine the substrate type all the way across a river because it is too deep or the water is turbid. In these cases, assign the appropriate percentage amount to the "unknown" category.

<u>Substrate Type and Sizes</u>
Boulder: Rocks 10 inches diameter or larger.

Cobble: Rocks 2.5 inch to 10 inches in diameter.

Gravel: 0.1 -2.5 inch diameter

Sand: Coarse grained, <.1 inch diameter particles

Silt-Muck-Detritus: Silt is usually clay, very fine sands, or organic soils, 0.004 to 0.06 millimeters in diameter. Muck is decomposing organic material of very fine diameter. Detritus is small particles of organic material such as pieces of leaves, sticks, and plants.

Hardpan-Bedrock: Solid surface. Hardpan is usually packed clay. Bedrock is a solid rock surface (the tops of buried boulders are not bedrock).

Artificial: Human made, such as concrete piers, sheet piling or rock riprap (that portion of shoreline erosion protection structures that extends below the water surface is considered substrate).

Other (specify): If something doesn't fit into the above categorizes, it goes here.

Can't see: The portion of the stream bottom for which a substrate type determination cannot be made because the bottom cannot be seen due to water depth or turbidity.

C. Bank stability and erosion

Bank erosion may occur as a result of natural flow conditions, or may be caused by human activities. Determine the severity of erosion that has taken place through the

explanations given for the categories excellent, good, marginal, and poor, and then circle one of the numbers in that category to give a more specific rating.

Excellent: Banks Stable. No evidence of erosion or bank failure. Little potential for problems during floods. < 5% of bank affected.

Good: Moderately stable. Small areas of erosion. Slight potential for problems in extreme floods. 5-30% of bank in reach has areas of erosion.

Marginal: Moderately unstable. Erosional areas occur frequently and are somewhat large. High erosion potential during floods. 30-60% of banks in reach are eroded

Poor: Unstable. Many eroded areas. > 60% banks eroded. Raw areas frequent along straight sections and bends. Bank sloughing obvious.

D. Plant Community

Estimate the percentage of the stream covered overhanging vegetation/tree canopy? Circle one: <10%, 10-50%, 50-90%, >90%. These are very wide windows because a general sense of the situation is all that is needed. Is the stream fully exposed to the sun, fully shaded, or somewhere in between? The level of sun exposure will affect how biota hides and water temperature fluctuations.

For the various type of plants listed, rate each group as absent, rare, common, or abundant. The groups are:

<u>Plants in the Stream:</u>
Floating Algae: The abundance of suspended algae (single celled organisms that may or may not form colonies) or algae on the surface or rocks or plants should be recorded here.

Filamentous Algae: Algae that appear in stringy or ropy strands, such as Cladophora. The strands may or may not be attached to other objects in the waterbody.

Macrophtyes: This category refers to aquatic plants. By definition, macrophytes are any plant species that can be readily seen without the use of optical magnification. However, the usage here is directed primarily toward <u>aquatic vascular plants</u>—plants with a vascular system that typically includes roots, stems and/or leaves. This includes duckweed, as it is a floating vascular plant. Certain large algae species that superficially look like vascular plants, such as Chara, can be recorded here as well. If the person conducting the survey is knowledgeable about aquatic plants, the particular type or species of plant(s) can be noted in the comment section at the end of the form. Floating, suspended, or filamentous algae species should be recorded in one of the algae categories and not here.

<u>Plants on the bank/riparian zone</u>
Shrubs: Woody, low lying plants.
Trees: Woody, tall plants.
Herbaceous: Non-woody plants including grasses, forbs, and so on.

E. Riparian Zone

The riparian vegetative width is the width of the streamside natural vegetation zone along the stream banks. The width is measured from the edge of the stream to the end of the contiguous block of natural vegetation. Natural vegetation is defined as including trees, shrubs, old fields, wetlands, or planted vegetative buffer strips (often used in agricultural areas and stormwater runoff control). Agricultural crop land and lawns are not considered natural vegetation for the purposes of this question. A stream with grass mowed to the very edge is said to have no riparian zones. A stream set in a deep forest will have a riparian zone that spreads further than you can even see.

For both the left and right bank (which is determined by looking downstream), circle the landuse types that you can see along your 300 foot stretch.

Then, rate the riparian zone from excellent to poor, and then circle one of the numbers in that category to give a more specific rating, similar to how you rated bank erosion in C.

Excellent: 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.

Good: Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.

Marginal: Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.

Poor Width of riparian zone ,10 feet; little or no riparian vegetation due to human activities.

III. Sources of Degradation

The intent of this section is to evaluate the relative importance of potential sources in terms of <u>pollutant contribution</u> to the waterbody at a given site in the watershed. The evaluation assesses the <u>potential for pollutant inputs</u> at the site, <u>NOT</u> pollutant impacts, or the potential for pollutant impacts. Pollutant impacts, as indicated by visual manifestations (like erosion, changes to substrate, oil, foam, etc) were evaluated previously.

Evaluating potential sources of pollutants to a waterbody is a <u>three step process</u>: identification of potential sources, evaluation of pathways for pollutants to get to the waterbody, and finally evaluation of the severity (magnitude) of this pollutant input or loading. The three steps of this process will result in scoring identified sources on the survey sheet as Slight, Moderate, or High Priority in terms of the severity or amount of their pollutant contribution to the waterbody at the site being surveyed.

(1) <u>Source Identification</u>

Visually evaluate the various land use/land change activities at the site for potential sources of pollution. Note all potential sources for the area that can be seen (choosing from among the list of sources on the data sheet). For example, is there evidence of soil disturbance at the site, or land uses such as residential lawns, agricultural fields, parking lots, urban areas, etc., near the waterbody? Use the source definitions provided to help identify what potential sources may exist. If it is known that a significant source exists upstream of the study site, such as a wastewater treatment plant, it may be important to note the presence of that source, but it should be recorded in the comments section since it was not visible at the site.

(2) Pollutant Pathway

Next, for each potential source that has been identified, evaluate how pollutants could get from the source to the water. An evaluation of likely pathways for pollutants to enter the waterbody provides information regarding the potential for the identified sources to contribute pollutants. The following provides a quick outline of some visual observations to consider in evaluating pollutant pathways. Pay particular attention to likely water runoff patterns at the site that may occur during rainfall or snowmelt events.

• Gully/rill erosion provides a direct pathway for pollutants to enter the stream in a concentrated flow when the land slopes toward the stream. Pollutants associated with eroding soils will vary depending on the type of land use activity.

• Tile/pipe discharges are potential direct pathways for pollutants.

• Bare soils near the edge of a waterbody provide a likely pathway for sediment to get to the waterbody.

• Maintained lawns to the edge of a waterbody provide a likely pathway for nutrients and pesticides to the waterbody.

• Land disturbance/use activities to the edge of a waterbody provide a likely pathway for various pollutants to the waterbody.

• Open areas of disturbed soils and/or bare soils devoid of vegetation provide a potential pathway for pollutants via wind erosion.

• Steep streambanks (steeper than a 2:1 slope) devoid of vegetation are likely pathways for sediment.

• No canopy over the waterbody is a pathway for dramatic thermal increase in water temperature during the day.

• Impervious surfaces (parking lots, roads, roof tops, etc.) provide a likely pathway for various pollutants, and may increase flows in the watershed causing flashiness.

• Culverts/bridges may not be aligned with the stream, or may be undersized, and could provide a likely pathway for flow to create streambank erosion both upstream and downstream of the culvert or bridge.

(3) Severity Ranking

Finally, for each source for which a pathway has been identified, evaluate how severe the pollutant loading is. Rank each source identified as Slight, Moderate or High severity for the contribution of pollutants, based on the magnitude or quantity of pollutants likely to be delivered to the stream. The surveyor must use their judgement on assigning a slight, moderate, or high rating.

The severity ranking is based only on pollutant inputs from the specific source at the site, not on visible stream impacts or impacts the pollutant may cause downstream. The pollutant loads from the identified source(s) may or may not have an impact at the site.

Evaluation of the source, location and pathways can provide a reasonable assessment of the severity of the pollutant loading. The following provides a quick outline of some visual observations to consider in evaluating the severity of pollutant loading.

• Proximity to waterbody – generally the closer the use, or land disturbance activity, is to the waterbody, the greater the likelihood for pollutant delivery.

• Slope to waterbody – generally the steeper the slope/topography to the waterbody, the greater the likelihood of overland pollutant delivery.

• Conveyance to waterbody (ditch, pipe, etc.) – generally a conveyance from the use, or land disturbance activity, increases the likelihood of pollutant delivery.

• Imperviousness – impermeable surfaces reduce the amount of land area available for water infiltration and increase the potential for overland runoff. Additionally, if a watershed is greater than 10% impervious, it will start to show some systemic problems due to impacts from flow. If a watershed is greater than 25% impervious, the natural hydrology is generally heavily impaired.

• Intensity and type of use, or land disturbance activity – generally the more intensive the activity the greater the likelihood for the generation of pollutants. Certain activities may have specific types of pollutants associated with them.

• Size of erosion area – generally the larger the erosion area the greater the likelihood for sediment delivery.

• Soil type – clay is less permeable than sand, and therefore would create a greater potential for overland runoff of pollutants.

• Presence and type of vegetation – the greater the vegetative buffer around a waterbody, the better the filtration of pollutants from nearby land disturbance and use activities. Certain types of vegetative buffers work better than others and should be evaluated on a case-by-case basis.

Potential Source Category Definitions:

Source Category	**Use this Source Category if …**

Crop Related Sources	… there is a reasonably clear pathway for pollutants to enter the waterbody from the farmed area. Possible pathways: farming to the edge of the drain, gully/rill erosion off field, tile discharge, wind erosion off field.
Grazing Related Sources	… there is clear evidence that grazing of animals near or in the waterbody has resulted in the degradation of streambanks or stream beds, sedimentation, nutrient enrichment, and/or potential bacterial contamination.
Intensive Animal Feeding Operations	… there is a reasonably clear pathway for pollutants to enter the waterbody from either runoff from the operation or land application of animal manure. Possible pathways: overland flow, tile discharge.
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	… there is clear evidence that transportation infrastructure is creating increased flow, runoff of pollutants, or erosion areas in or adjacent to the waterbody.
Channelization	… there is clear evidence that the natural river channel has been straightened to facilitate drainage.
Dredging	… there is clear evidence that a waterbody has been recently dredged. Evidence might include: spoil piles on side of waterbody, disturbed bottom, disturbed banks.
Removal of Riparian Vegetation	… there is clear evidence that vegetation along the waterbody has been recently removed (within the last few years).
Bank and Shoreline Erosion/ Modification/Destruction	… there is clear evidence that the banks or shoreline of a waterbody have been modified through either through human activities or natural erosion processes.
Flow Regulation/ Modification (Hydrology)	… there is reasonably clear evidence that flow modifications in the watershed have created unstable flows resulting in streambank erosion.
Upstream Impoundment	… there is reasonably clear evidence that an upstream impoundment has contributed to impacts on downstream sites. Impacts may be: nuisance algae, increased temperatures, streambank erosion from unstable flows.
Construction:Highway/ Road /Bridge/Culvert	… there is clear evidence that on-going or recent construction of transportation infrastructure is contributing pollutants to the waterbody.
Construction: Land Development	… there is clear evidence that on-going or recent land development is contributing pollutants to the waterbody.
Urban Runoff (Residential/ Urban NPS)	… there is a reasonably clear pathway for pollutants to enter the waterbody from an urban/residential area. Possible pathways: gully/rill erosion, pipe/storm sewer discharge, wind erosion, runoff from lawns or impervious surfaces.

Land Disposal	… there is a reasonably clear pathway for pollutants to enter the waterbody from an area where waste materials (trash, septage, hazardous waste, etc.) have been either land applied or dumped. Possible pathways: gully/rill erosion, pipe discharge, wind erosion, or direct runoff.
On-site Wastewater Systems	… there is reasonably clear evidence of nutrient enrichment and/or sewage odor is present, and there is reason to believe the area is unsewered.
Silviculture (Forestry NPS)	… there is a reasonably clear pathway for pollutants to enter the waterbody from the forest management area. Possible pathways: logging to the edge of the waterbody, gully/rill erosion off site, pumped drainage, erosion from logging roads, wind erosion off site.
Resource Extraction (Mining NPS)	… there is a reasonably clear pathway for pollutants to enter the waterbody from the mined area. Possible pathways: gully/rill erosion off site, pumped drainage, runoff from mine tailings, wind erosion off site.
Recreational/Tourism Activities (general)	… you are unable to clearly identify the recreational source as related to a golf course, or recreational boating activity. Foot traffic causing erosion would fall into this category.
Golf Courses	… there is a reasonably clear pathway for pollutants to enter the waterbody from the golf course area. Possible pathways: overland runoff, gully/rill erosion off course, tile discharge, wind erosion off course.
Marinas/Recr. Boating (water releases)	… if you can reasonably determine that releases of pollutants to a waterbody such as septage or oil/gasoline are due to recreational boating activities.
Marinas/Recr. Boating (streambank erosion)	… you can reasonably determine that streambank erosion is due to wake from recreational boating activities.
Debris in Water	… debris in the water either is discharging a potential pollutant,or is causing in stream impacts due to modifications of flow. Possible examples: Leaking barrel, Refrigerator, Tires, etc. This does not include general litter (e.g. paper products).
Industrial Point Source	… there is reasonably clear evidence that an upstream industrial point source has contributed pollutants.
Municipal Point Source	… there is reasonably clear evidence that an upstream municipal point source has contributed pollutants.
Natural Sources	… there is reasonably clear evidence that natural sources are contributing pollutants. Possible examples: streambank erosion, pollen, foam, etc.
Source(s) Unknown	… if you see an impact but are unable to clearly identify any likely sources.

Additional Comments:

Any observations about the site that were not covered elsewhere on the survey form should be recorded in this section. If certain survey responses require clarification or elaboration, those should be described here as well. The comment section can also be used to add detail to the site characterization, such as listing the types of aquatic plants or algae present, if known.

In addition, any unique conditions or issues that arose or were observed during the assessment process should be noted here.

IV. Optional Quantitative Measurements

A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 10 transects of your stream reach. A transect is a measuring tape line stretched out perpendicularly across the stream, going from bank to bank. At 10-20 locations along this line, you will take depth measurements and record the substrate type.

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 <u>single</u> 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

Completeness: A volunteer team member other than the person who filled out the data sheets must check the data sheet for completeness before the team leaves the site. This verification of completeness should be noted at the bottom of each page.

Name of person who entered data into data exchange: This field is for use in case problems come up with the data entry.

Date of date entry: This field is for use in case problems come up with the data entry.

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

III. Stream Macroinvertebrate Monitoring Protocols A. TEAM

COMPOSITION

MiCorps macroinvertebrate collection is carried out by teams of staff and/or volunteers consisting of no fewer than 3 people and up to 6 or 7. More people than that is acceptable but as more join a team, crowding and equipment issues can hamper team effectiveness.

One team member is the Collector, who must be trained in collection techniques. This person is the only one to enter the water and use the net to pull out debris and macroinvertebrates. However, on larger rivers or streams with overgrown banks it is helpful to have a Collector's Assistant in waders assisting the Collector by carrying trays back and forth from the Collector to the Pickers.

There should also be a Team Leader, who has preferably been to a special training but at a minimum has participated in the monitoring previously. The Team Leader directs the rest of the team, the Pickers, who do not have to be trained ahead of time. On-site directions are sufficient as the Picker role is very easy and done under direct supervision of the Team Leader. The Pickers and Leader sit on the bank of the stream to pick insects out of the trays and put the specimens in the sample vials. The Team Leader also fills out data sheets, watches the time, and keeps the team organized.

B. SAMPLING

The sampling effort expended to collect benthic macroinvertebrates at each 300 foot site should be sufficient to ensure that all types of benthic invertebrate habitats are sampled in the stream reach. This generally will be about 35-45 minutes of total sampling time per station. You should be flexible on the timing for Collectors who move slowly in the water, because of either tricky wading and walking conditions or inexperience. If sampling goes slow, sample longer than 45 minutes at your discretion; the goal is to keep the total effort the same across all sampling outings.

Macroinvertebrate samples should be collected from all available habitats within the stream reach using a dip net with a 1-millimeter (mm) mesh, or by hand picking bigger items like logs and rocks.

Available habitat types can include but aren't limited to riffles, pools, cobbles, aquatic plants, runs, stream margins, leaf packs, undercut banks, overhanging vegetation, and submerged wood. Habitat and substrate types from which macroinvertebrates were collected (or collections were attempted) should be recorded on the form; include as many as possible. People on the bank can aid the Collector by reminding them of the different habitat types to sample.

As the Collector obtains debris in their net, the debris is dumped into white trays along the bank. The Pickers will then sort through the debris and place the macroinvertebrates into jar(s) of 70% ethanol preservative for later identification. The Team leader should show Pickers how to sort through the tray, and to inspect rocks and other debris, emphasizing hidden locations under bark and in caddisfly cases. The Team leader should stress patience. Use some water to get things moving as a dry sample is nearly impossible to pick through.

Be sure that every jar has a laser printer label (or handwritten with pencil) to avoid the ink running. Place labels inside the jar with the alcohol and not taped to the outside.

The Pickers should work for about one hour in total or until they have gone through all the debris provided by the Collector, whichever comes first. The team should set a timer or mark the start time in order to be accurate. The teams must strive to get at least 100 specimens. They are not expected to count it, but generally they should have a good sense as they go if they are meeting that benchmark. The Water Quality Rating (WQR) is designed to be most accurate with sample sizes of at least 100 specimens.

C. COLLECTING TECHNIQUES IN DIFFERENT HABITATS

General Techniques

1. Collecting should begin at the downstream end of the stream reach and work upstream.
2. Please note that many mussels are endangered or threatened. Don't collect mussels and clams; don't even take them out of the water or dislodge them. Make a note on the datasheet if they are found.
3. While crayfish are not endangered, they are too big usually to fit in sample jars. Make note of crayfish and them release them as well.
4. Remember - BE AGGRESIVE- the animals are holding on tight to rocks, branches, and leaves to avoid being carried downstream and you want to shake them loose! 5. Always point opening of net upstream so the current does not wash out your net. 6. Lift up carefully in sweeping motions to avoid losing organisms.

Riffles/Runs:

1. Keep in mind that flow has a big impact on the types of animals that can live there. Both riffles and runs are areas of faster moving water. A riffle (white water present, larger rocks) and a run (no white water, smaller gravel sized rocks) will likely yield different animals.
1. Put net on bottom of stream, stand upstream, hold net handle upright. 2. Use kicking/shuffling motion with feet to dislodge rocks. You are trying to shake organisms off rocks as well as kick up organisms that are hiding under the rocks. Dig down with your toes an inch or two. Some people use their hands to rub organisms off rocks, but beware of sharp objects on the stream bottom.

Quiet Place/pool:

1. Scoop some sediment up in your net. Some animals burrow into the muck. Tip: When your net is full of muck, it is very heavy. To clean the excess muck out of your net: keep the top of the net out of the water to avoid losing animals, then sway the net back and forth, massaging the bottom of the net with your hand. When choosing a soft bottom area try to find one that contains silt since it is a far more productive habitat than just sand.
2. Don't oversample muck. Not much will live here, and it is difficult to sort through. Process one or two nets worth and then don't go back to this habitat.

Undercut Bank/Overhanging Vegetation or Roots:

1. Jab the net into the undercut bank while pulling the net up. Move in a quick bottom to surface motion to scrape the macroinvertebrates from roots. Do this several times. 2. If you notice roots or overhanging vegetation, put the net under the bank at the base of the plants. Shake the vegetation using your net, trying to shake off the animals clinging to these plants. Feel free to use your hands if you are sure the plants are not poisonous.

Submerged or emergent vegetation:
1. Keeping the net opening pointed upstream, move the net through vegetation trying to shake the vegetation and catch any animals.
2. Use your hands to agitate the vegetation and dislodge the animals into the net.

Rocks/Logs:
1. Small logs and rocks can be pulled out of the water by hand and given to the team to search for
animals.
Hint for Logs: Be sure to check under bark.
Hint for Rocks: Caddisfly homes often look like small piles of sticks, clumps of small gravel, or even tiny circular pieces of algae attached to rocks.

Leaf Packs:
1. Look for a decomposing leaf pack. A "good" leaf pack has dark brown-black skeletonized leaves. Slimy leaves are an indication that they are decaying. Scoop a few into your net and let the team pull them apart and look for animals.
2. Sometimes a little water in the pan with the leaves will help dislodge the animals.

D. CLEANING YOUR GEAR

Remember to clean the net and pans before leaving the site to avoid transporting animals or plants. If you plan to use the gear again within the next month, air drying is not sufficient. In that case, you must clean out the treads of the waders, get all dirt of debris out of the equipment, and use a dilute bleach or similar disinfectant to sanitize the gear. For full instructions on decontamination processes, see https://www.hrwc.org/volunteer/decontaminate/.

E. IDENTIFICATION

Identification can be performed in the field or in an indoor setting (recommended), as desired by the monitoring organizations. Volunteers who lack identification experience must be overseen by an identification expert or program's scientific advisor; in any case, the final identification must be confirmed by this person(s).

The organisms in the collection should be identified to order, sub-order, or family, as indicated on the MiCorps datasheet, using taxonomic keys. The abundance of each taxon in the stream study site should be recorded on the datasheet.

F. STREAM MACROINVERTEBRATE DATASHEET

Front page

MiCorps Site ID#: You should create a unique numbering system for your sites. A suggested approach would be to use your organizations abbreviations and combine it with a number. For example, HRWC-1. You want to pick a numbering system that won't accidently copy another organization's numbering system. MiCorps staff will contact you if your numbering system is not unique.

Site Name: Use a combination of the stream name and location from which you access the study site. For example, Arms Creek at Walsh Road.
Stream name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area and note also the local name if it is different. For tributary streams to major rivers, record the tributary stream name here, not the major river name. If the tributary is an unnamed tributary, record as "Unnamed Tributary to" followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as "Unnamed Tributary to Hogg Creek".
Location: This is often the name of the road from which you access the study site, or name of the public park. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. "Green Road between Brown Road and Hill Road").

Date: Record the month, day and year.

Collection Start Time: Record the time when the monitoring activity began.

Major Watershed: Record the name of the major watershed where the study site is located (e.g., Grand River Watershed, St. Mary's River Watershed), and the corresponding HUC Code, if known.

Longitude and Latitude: Record the latitude and longitude coordinates of the study site. Ideally, these coordinates will correspond to the midpoint of the stream study reach.

Names of Team members: Record the name of all the team members participating in the assessment, and circle the one recording the data, in case questions come up later.

Stream Conditions: This section is important for interpreting the data after the collection and identification. If results are much worse than normal, this information will help the program manager conclude that conditions on the sample day were not representative of the stream's normal range of conditions and may flag the site for resample or strike the results from the long-term dataset.

Average Water Depth: This value can be taken from the Stream Habitat Assessment datasheet, if completed at the same time. Otherwise, to measure average water depth (ft), three measurements should be made at random points along the representative reach length being surveyed, and these values averaged for a mean depth.

Notable weather condition of the last week: Substantial rainfall or drought especially can cause fluctuations in macroinvertebrate results.

Are there are current site conditions that may impede normal macroinvertebrate sampling? This is left open for volunteers to comment on anything that would affect the study (for example, weather, flooding, poor visibility like high turbidity, difficult wading conditions, etc).

Habitat types: A list of stream microhabitat are provided so that the Streamside Leader can remind the Collector of what different places to sample. Sample as many of these as possible, checking them off as you go.

Did you see any crayfish or clams/mussels? Do not collect these, but record the number that you see so you can use them in your water quality rating.

Collection Finish Time and Picking Finish Time: Record the time the collector stops their work in the stream and the time when Pickers put the last specimen in the collection jars.

Identifications made/supervised: Record who was responsible for giving the final identification of the specimens.

Backpage:

Identification and Assessment:

MiCorps requires stream monitoring programs to identify macroinvertebrates to the Order level primarily, sometimes sub-Orders, and sometimes Family. This system was built to be a balance between scientific accuracy and ability of volunteers to learn how to identify insects with a moderate level of effort. While requiring genus-species level identification would be most scientifically accurate, it would prevent the program from being conducted as a volunteer program.

With counts and identifications complete, it is possible to produce a single score for the site. This scoring system is based on the Hilsenhoff Biotic Index, a scheme established by Dr. William Hilsenhoff, a famous (for this field) entomology professor from the University of Wisconsin Madison. Hilsenoff and those who took up his work afterwards have assigned pollution sensitivity ratings to most macroinvertebrate species, genera, and families. Using the sensitivity ratings, a type of weighted average can be calculated to generate the pollution tolerance rating (or water quality rating) for macroinvertebrate samples on a scale of 0 (very pollution sensitive) to 10 (very pollution tolerant).

In MiCorps protocols, we are not identifying macroinvertebrates to the lower taxonomic levels, so leeway had to be taken with Hilsenhoff's sensitivity score to produce an average sensitivity rating for each of the taxonomic groups on the datasheet. This was done by averaging the sensitivity ratings of the different families and assigning the result to the larger taxonomic group. For example, the sensitivity ratings for the eight families of stoneflies found in Michigan were averaged for a result of 1.1. Thus 1.1 is the sensitivity for MiCorps Stonefly group.

In other words, the sensitivity ratings that MiCorps uses are best estimates for that taxonomic order but are not perfect. Again, this lose of accuracy is because of the balance that needs to be met between identification and volunteer/program leader ability.

The final MiCorps score given to each site is called the WQR (Water Quality

Rating). To calculate the WQR, follow these steps:

1. As you identify your macroinvertebrates, record the number you found for each type in the left column marked “Count”. When you are done, add up all the “Count” column to get a total abundance.

2. Multiply the “Count” by the given Sensitivity Rating for each taxa group and record it in the column “Count x Sensitivity”. For example, if you found 30 mayflies you would multiply 30 x 3.4 and record 102 in the “Count x Sensitivity” column.

3. Add up all the values in the “Count x Sensitivity” column and record this in the box “Sum of (Count x Sensitivity).

4. Divide the “Sum of (County x Sensitivity)” by the “Total Abundance.” The result is the site’s Water Quality Rating (WQR). The lower the score, the more pollution sensitive insects are found, and the better the water quality.

5. Important Note about Abundance: This rating scale does not work when macroinvertebrate abundance is low, as a few sensitive taxa can pull the score down to very healthy levels, biasing the results. To correct for this, if abundance is less than 30, the site is automatically given a WQR of 10 (very poor). If the abundance is less than 60, the site is automatically given a WQR of 7 (poor rating). Teams should be striving to collect at least 100 specimens from each site. If the team collects from 60-99 specimens, then score the site as normal and input it into the MiCorps data exchange as normal but consider the rating to be somewhat tentative and strive for higher abundances in future visits.

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