Grass River Natural Area, Inc.
STREAM WATCH

Quality Assurance Project Plan

Emily Burke
12/20/22

The quality assurance project plan outlines Grass River Natural Area, Inc.'s commitment to provide accurate, reliable data that will be used to determine the water quality and overall health of the tributary streams contained within the boundaries of GRNA.

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A3. Distribution List

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Program Manager

Responsible for program management to include: training of volunteers, logistical aspects of monitoring, identification of macroinvertebrates, maintaining inventory, equipment checks, record keeping, corrective actions, etc. Maintains the laboratory space at the GRNA building for sample sorting and identification. Reports to Chairman of the Board of Directors.

Quality Assurance Manager

Responsible for ensuring proper control of sampling, correct methodology, accuracy and precision, updating the QAPP, etc. Reports to the Chairman of the Board of Directors.

Identification Consultants

On-call for proper identification of sample organisms if the Program Manager is unsure of a macroinvertebrate's identification. Reports to Program Manager.

Grass River STREAM WATCH Volunteer Roles:

Team Leader: Responsible for field assessment, data collection supervision, and decontamination supervision. Reports to Program Manager.

Collector: Participate in field assessments, data collections, and macroinvertebrate collections. Reports to Team Leader.

Team Member: Assists the team leader and collector on the stream bank and back at the GRNA building to pick through the sample. Reports to the Team Leader.

A5. Problem Definition/Background

The Grass River Natural Area (GRNA) is a 1,492 acre biodiversity reserve located in the heart of the Elk River Chain of Lakes Watershed in Antrim County. Grass River is a 2.5 mile river connecting Lake Bellaire and Clam Lake in the center of the 500 square mile watershed in northwest lower Michigan. Grass River's flow is 268 cubic feet per second, making it navigable by medium-sized powerboats. The Antrim Chain of Lakes provides 60% of the surface water flowing into Grand Traverse Bay in Lake Michigan.

Grass River is one of the most scenic spots along the Chain of Lakes. Forming a complex mosaic of both wetlands and uplands, Grass River Natural Area is home to 9 native plant communities, which are protected within the confines of the natural area. Containing a wide variety of plant species, the GRNA natural inventory lists more than 175 species of herbs; 81 species of grasses, sedges, and rushes; 26 species of ferns; 49 species of shrubs; 9 species of vines; and 25 species of trees. In addition, 50 mammal species, 33 reptile and amphibian species, 35 fish species, and 147 bird species have been identified within GRNA. Specifically, Lake Bellaire and Clam Lake support at least 4 pairs of common loons, a threatened species in Michigan, as well multiple other protected species of nesting waterfowl.

The Grass River Natural Area was established as a preserve for native wildlife and plants. Originally founded in 1969 as the Grass River Wildlife Project by a group of concerned citizens and community leaders, the nonprofit was officially incorporated in 1979 as Grass River Natural Area, Inc. The nonprofit's mission is to manage the Grass River Natural Area, conserve and protect its watershed, and provide opportunities that increase knowledge, appreciation, and community-wide stewardship of the natural environment. Antrim County owns most of the parcels included in the natural area, but they are fully managed by GRNA, Inc.

Stream monitoring of the Grass River's three major tributaries – Cold Creek, Finch Creek, and Shanty Creek – began in 2012 to establish a baseline level of stream health.. Since 2014, GRNA, Inc. has had an active stream monitoring program with monitoring events taking place twice annually. These streams, as well as the river, will continue to be the focus of the GRNA, Inc. Stream Watch program, using biological parameters to monitor the health of the waterways and track any changes in water quality.

The GRNA, Inc. Land Management Committee recently developed a revised Natural Resources Management Plan for 2020 – 2025, which has been approved by the Board of Directors as well as the Antrim County Board of Commissioners. Maintaining a comprehensive monitoring program is an essential part of the management plan. And specifically continuing to monitor the health of GRNA's water resources is central to our mission of conserving and protecting the Grass River watershed.

Using MiCorps standard protocols for data collection, entry, and reporting will ensure that stream monitoring data are reliable and accurate, and it will also enable comparison of results across years. With these comparisons, the Land Management Committee will be able to continue to assess trends and make targeted, specific recommendations for future conservation, management, and restoration efforts within the natural area.

Sharing information with and educating stakeholders is also an important component of GRNA, Inc.'s mission. By posting a summary of each year's stream monitoring data on the GRNA, Inc. website, on our social media pages, and in our monthly e-newsletter and sharing it with partner organizations, our supporters will be kept abreast of important water monitoring work happening at GRNA.

Threats to the water quality of Grass River were identified in the 2016 Elk River Chain of Lakes Watershed Management Plan. These threats include shoreline development and hardening, removal of native plants and natural buffers, increase boat traffic and wakes, streambank erosion and severe road-stream crossings over the river's tributaries, outdated septic systems, aquatic invasive species, small dams within tributaries, stormwater and agricultural runoff, and climate change. These threats are continuous, dynamic, and synergistic, and they pose a real risk to the integrity of the adjacent wetlands and uplands of GRNA. It is therefore imperative that the streams of GRNA be monitored to assess the severity of these threats on an ongoing basis.

Because a quality assurance plan will ensure the validity of the data that will guide GRNA, Inc.'s quantification of these threats, as well as GRNA, Inc.'s management recommendations and the informational content disseminated to our stakeholders, it is a critical element of GRNA Inc.'s monitoring efforts.

A6. Program Description

GRNA, Inc. Stream Watch is designed to provide highly valuable water quality information to track changes to the stream systems located within Grass River Natural Area. It also provides significant educational information and opportunities for the community. As with similar programs, Stream Watch is promoted through community involvement in which volunteers gain a sense of communal pride in caring for their local environment, as well as an opportunity to engage in fun, hands-on citizen science. The program educates adults and children on the issues pertaining to water quality. Also, it helps to develop a base for further education in watershed and stewardship topics.

Volunteer participation is the key to the success of the program. Recruitment of these volunteers is done year-round through advertising endeavors, and volunteer training for stream monitoring volunteers is provided in the spring of each year shortly before the spring sampling event. New volunteers are required to attend the training, which includes guidance on collecting and sorting macroinvertebrates, completing the datasheets, and decontaminating equipment. Team leaders are required to attend the training every year.

Twice-yearly sampling is conducted in a given stream in May and late September/early October. One stream is sampled every year, and streams are rotated each year so that each stream is sampled every three years (i.e., Finch Creek was sampled in the spring and fall of 2019, Cold Creek was sampled in the spring and fall of 2020, and Shanty Creek will be sampled in the spring and fall of 2021). Each of the streams have 3-4 sampling sites, scattered from the headwaters to the mouth. More sites may be added in the future as personnel and resources allow.

During the sampling session, each team is given a Stream Watch sampling kit to record data on the MiCorps Stream Monitoring datasheet(s) and collect and sort macroinvertebrates according to MiCorps protocols. During every spring sampling event only, each team also fills out a Stream Habitat Assessment form so that habitat data at each site is collected once every three years. Identification of benthic macroinvertebrates is performed by the Program Manager (who has managed GRNA Inc.'s Stream Watch program since 2019 and attended multiple MiCorps training sessions). If the Program Manager is unsure of an identification, two key volunteers are on-call to provide identification assistance. One of these volunteers is a retired U.S. Forest Service entomologist and Michigan State University professor and the other is a retired U.S. Geological Survey aquatic microbiologist focusing on stream health).

These key volunteers are referred to as the Identification Consultants.

The sampling sites are easily accessible within the confines of Grass River Natural Area or on upstream private property that we have permission to access. If a team will sample a site on private property, the Program Manager contacts the landowners at least a week beforehand to receive specific permission to sample that day. A map of the sampling locations is available. The team leader within each team is responsible for ensuring that protocols are followed by the volunteers.

After the sampling has been performed, the teams return sampling kits, documentation, and samples to the Grass River building and sort through the samples. During that time, any questions the teams may have are answered. Throughout the next week, the Program Manager identifies the sample organisms, along with on-call assistance from the Identification Consultants.

Following each sampling session, all data are entered into both the MiCorps database and GRNA Inc.'s in-house relational database and analyzed by the Program Manager. Brief biannual summary reports following sampling are produced and distributed in May and October by the Program Manager (see section C4). A final yearly report that includes year-end information and to-date trends is produced and distributed by the Program Manger to both internal and external stakeholders in November. (See section C4).

A7. Data Quality Objectives

The GRNA, Inc. Stream Watch program seeks to provide the most precise and accurate data within the confines of the equipment available.

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

The purpose of the GRNA, Inc. Stream Watch project is to gauge stream health by measuring the total diversity of macroinvertebrate taxa and related habitat characteristics. Since there is inherent variability in accessing the less common taxa in any stream site and program resources do not allow program managers to perform multiple independent (duplicate) collections of the sampling sites, our goal for precision and accuracy is conservative. A given site's Water Quality Rating (WQR) score or total diversity (D) measure across macroinvertebrate taxa will be noted as "preliminary" until three spring sampling events and three fall sampling events have been completed. (While this does not apply to most of our sites, which have been established for more than three years, it does apply to some of our more recently selected sites and will apply to any sites added in the future).

Precision and accuracy will be maintained through following standardized MiCorps procedures. The Program Manager has been trained in these procedures and in macroinvertebrate identification during several virtual trainings and at an in-person training session led by MiCorps staff in June 2022 in Ann Arbor. The Program Manager has also attended the 2019 in-person MiCorps conference, as well as the 2020, 2021, and 2022 virtual MiCorps conferences. 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. Volunteer team leaders will be trained upon joining the program, and retrained every year by attending the annual volunteer training. Techniques under review shall include:

- collecting style (must be thorough and vigorous);
- habitat diversity (must include all available habitats and be thorough in each one);
- picking style (must be able to pick thoroughly through all materials collected and pick all sizes and types of macroinvertebrates);
- variety and quantity of organisms (must ensure that diversity and abundance at site is represented in sample);
- transfer of collected macroinvertebrates from the net to the sample jars (specimens must be properly handled and jars correctly labeled);
- proper classification and quantification of stream habitat data (correctly filling out the Stream Macroinvertebrate and Stream Habitat Assessment datasheets);
- proper decontamination of equipment using a decontamination kit (see Sections B1 and B2).

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 brought back to the GRNA building after collection, sorted, and stored in ethanol to be identified at a later identification session by the Program Manager with a scope, keys, and field guides, in consultation with our Identification Consultants, two key volunteers who have been designated as identification experts, as determined by the judgement of the Program Manager.

Bias: At every sample site, a different team will sample there at least once every three years to examine the effects of bias in individual collection styles. Measures of D and WQR for these samples will be compared to the median results from the past three years and each should be within two standard deviations of the median. If the sample falls outside this range, then the Program Manager needs to conduct a more thorough investigation to determine which team or individual is likely at fault. The Program Manager will accompany teams to observe their collection techniques 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 Xm 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 before the next sampling event and the Program Manager will re-evaluate their collection during the subsequent sampling event.

It is also possible that the Program Manager can conclude that all sampling was valid and the discrepancy between samples is due to natural variation (such as the site changing over time or unrepresentative sampling conditions).

Completeness: Completeness is a measure of the amount of valid data actually obtained versus the amount expected to be obtained as a 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 develops a course of action to improve the completeness of future sampling events.

Representativeness: Study sites are selected to represent the full variety of stream habitat types available locally. All available habitats within the study site will be sampled and documented to ensure a thorough sampling of all of the organisms inhabiting the site. Resulting data from the monitoring program will be used to represent the ecological conditions of the contributing watershed.

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

Measures of D and WQR for every sample will be compared to the median results from the past three years and each should be within two standard deviations of the median. If the sample falls outside this range, it can be excluded from the long-term data record (though can be included in an “outlier” database.).

Comparability: Comparability represents how well data from one stream or study site can be compared to data from another. To ensure data comparability, all volunteers participating in the monitoring program follow the same sampling methods and use the same units of reporting. The methods for sampling and reporting are based on MiCorps standards that are taught at annual trainings by MiCorps staff. The Program Manager will train volunteers to follow those same methods to ensure comparability of monitoring results among other MiCorps programs. The monitoring of all study sites will always be scheduled for a single day. If extenuating circumstances arise and all sites cannot be sampled on a single day, all sites will be sampled within a two-week time frame.

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

A8. Special Training/Certifications

All volunteers are required to attend the annual training session presented by the Program Manager at least once. Of course, they are encouraged to attend every year, and they may also attend other related training sessions if desired. Team leaders are required to attend the annual training session every year in order to minimize drift from and provide regular realignment with MiCorps standards. The Program Manager is responsible for planning and implementing these trainings. If a team leader fails to attend an annual training session, the Program Manager will arrange an alternative re-training for them. If this is not possible, the team leader will be considered a regular-level volunteer until they attend another annual training.

The annual training is split into two different sessions, one in class and one in the field. The in-class session introduces the volunteers to stream monitoring, including program goals and outcomes. Topics that are covered include introductions to the parameters and tests used during data collection and their significance. Also covered are a primer on the biodiversity of proper benthic invertebrates, reptiles, amphibians, and fish, as well as their roles as indicator species.

The second session is conducted as field training at a stream location near the classroom, usually at Finch Creek, just steps from the GRNA building. Here the volunteers learn hands-on by performing a mock sampling with staff to understand the steps required of them. A description of the equipment and components of the sampling kit is first, followed by an explanation of the data collection forms (both the Stream Macroinvertebrate datasheet and the Stream Habitat Assessment datasheet). A walk-through of the steps required during sampling and documenting occurs, giving the volunteers a better sense of the process. They are then required to use the equipment and perform the collection of the data. Another essential component covers how to properly transport samples from the stream site back to the GRNA building for sorting and how to pick through the sample, ensuring that all animals are picked out with as little debris as possible, as well as proper decontamination of equipment. Because organisms are identified by the Program Manager in consultation with the Identification Consultants, volunteers are not trained on the details of identification.

The session allows volunteers to ask questions and practice with the help of staff to improve knowledge and comfort level in performing the monitoring actions. A test given at the end of the second session is used to evaluate the proficiency of the volunteers in collection, picking, and decontamination. If the volunteer is considered to lack the proficiency necessary to be deemed competent to perform tasks adequately, he/she will be allowed to take another test following a review of the content with which they experienced difficulty.

Training is the main quality control measure. Corrective actions will be in place to rectify any issues regarding training. If variability between years in high, then the QA Manager will attempt to determine the reasons for the variability (e.g. whether it is spread among all variables or is confined to one of a few variables). These issues will be addressed at the next training session. It is anticipated that variability among volunteers will continue to decrease as they gain more experience and confidence in the monitoring procedures.

A list of all volunteers who have completed the necessary training is maintained in GRNA Inc.'s volunteer database and is updated after each training session by the Program Manager.

The Program Manager will attend the yearly MiCorps training provided by MiCorps staff.

B1. Study Design and Methods

B1-i. Overall Timeline

March: Begin recruitment of volunteers for the Annual Training Day and Spring Sampling Event, including monthly publications that need 3 weeks lead time for announcements. Check that the equipment is in good repair and in sufficient numbers and that the ethanol has not expired.

April: Find new volunteers and invite experienced volunteers to participate in the Annual Training Day and Spring Sampling Event (and remind team leaders that their attendance at the Annual Training Day is required). The Annual Training Event will include training on macroinvertebrate collection, picking, and habitat data collection. Organize refreshments and recruit a volunteer staff to assist with the event. Conduct training.

May: Conduct Spring Sampling Event. Set-up equipment and picking stations, organize refreshments, and recruit a volunteer staff to assist with the event. Create small teams (at least three people) that include new and experienced volunteers (one of whom is a trained team leader). Upon the teams' return, pick through samples and have the Program Manager identify the benthic macroinvertebrates in consultation with the Identification Consultants. Enter data about the volunteers, macroinvertebrates, and habitat assessment, and produce and distribute a brief summary report. Place results on the GRNA, Inc. webpage and social media pages. Ensure proper storage of specimens after identification. Program Manager, QA Manager, and Identification Consultants perform system audit.

August: Begin recruitment of volunteers for the Fall Sampling Event, including monthly publications that need 3 weeks lead time for announcements. Check that the equipment is in good repair and in sufficient numbers and that the ethanol has not expired.

September: Find new volunteers and invite volunteers with any experience to participate in the Fall Sampling Event.

October: Conduct Fall Sampling Event in either late September or early October. Set up equipment and picking stations, organize refreshments, and recruit a volunteer staff to assist with the event. Create small teams (at least three people) that include new and experienced volunteers (one of whom is a trained team leader). Upon the teams' return, pick through samples and have the Program Manager identify the benthic macroinvertebrates in consultation with the Identification Consultants. Enter data about the volunteers and the macroinvertebrates and produce and distribute a brief summary report. Place results on the GRNA, Inc. webpage and social media pages. Ensure proper storage of specimens after identification. Program Manager, QA Manager, and Identification Consultants perform system audit.

November: Review and interpret data for both Spring and Fall Sampling Events, write year-end report and disseminate it to internal and external stakeholders, and improve the maps that teams use to locate the study sites.

B1-ii. Sampling Methods

Seasonal samplings are done semiannually in May and late September or early October. Each sampling season, GRNA, Inc. measures macroinvertebrate populations as the biological parameter to determine stream health and water quality using the Stream Macroinvetebrate datasheet and MiCorps benthic macroinvertebrate sampling procedures (see Appendices 1 and 3). Every spring season, GRNA, Inc. also collects stream habitat data using the MiCorps Stream Habitat Assessment datasheet and MiCorps habitat data collection procedures (see Appendices 2 and 3). Before teams are sent out to sample, the Program Manager will remind teams of key sampling protocols (like using the net vigorously, sampling every habitat available, beginning downstream and moving upstream) and will briefly review the datasheet parameters to see if there are any questions on how to accurately record stream conditions. (Volunteers will all have been previously trained on how to use these datasheets, but a review will be especially helpful during the spring when teams fill out both the Stream Macroinvertebrate datasheet and the Stream Habitat Assessment datasheet). This review will serve to clarify any lingering questions and improve the quality of the data collected.

Sampling sites have been selected based on [1] ease of access, [2] habitat representativeness, and [3] location to stream mouth or headwaters. Sites are marked with latitude/longitude coordinates. Each volunteer team is provided with clear and specific written directions to their sampling sites, including the coordinates, how to get to the site, whether to sample upstream/downstream, or both of the coordinate, etc. (See Appendix 4 for the sample site map, Appendix 5 for the list of sites with coordinates, and Appendix 6 for an example of volunteer directions and map to a site).

Should inclement weather arise on the chosen day, the sampling event will be rescheduled for the next week. If stream flow is inadequate for testing, documentation will be made and consideration will be taken to determine other potential testing times. Any other issues will be handled by the Program Manager and QA Manager on an individual basis. Should a team not be able to monitor their site on a sampling day, the site will be monitored within two weeks of the day it was supposed to be sampled. If the volunteer team is unable to sample a site, the Program Manager will monitor the site. If the Program Manager is unable to monitor within two weeks, the site will go unmonitored for that season, which will be noted in the documentation.

At this time, the focus of the Stream Watch program is to measure biological and habitat parameters. All variables are taken into consideration when looking at the health of the streams within GRNA. MiCorps protocols are followed that outline proper procedure for performing the monitoring. Team leaders pick up backpack monitoring kits from the GRNA building on the day of sampling. The Program Manager is responsible for ensuring that proper set-up is adhered to, that all buckets and jars are labeled legibly and correctly, and that all supplies and equipment are in working order and sufficient numbers for both sampling kit supplies and sorting phase supplies (including that the ethanol is not expired). The Program Manager is also responsible for ensuring that all sampling equipment and supplies are clean, free of debris, and that first aid and decontamination kits contain all necessary supplies. Sampling kits include:

- Clipboard case
- Field data collection packet (datasheets)
- Laminated sampling tips sheets
- Copy of MiCorps Stream Monitoring Procedures
- Site map and directions
- Field tape measurer
- 1 5-gallon bucket with tight-fitting lid and label
- 2 plastic cups

- 2 pencils
- 1 orange vest per team member during duck hunting season (fall sampling)
- Trash bag
- D-net
- Hip boots and waders for team members
- First aid kit
- Decontamination kit (including 3 gallon bucket and lid, MiCorps Volunteer Monitoring Invasive Species Prevention Use Guide, lint roller, 8 oz. spray bottle of diluted bleach, 16 oz. spray bottle of tap water, soft-bristled scrub brush, hoof pick, scrap towels, bleach wipes, eye wash solution, safety goggles, reusable latex gloves, 6 mL oral syringe, sample vials for mudsnails)

All of this equipment and supplies are stored in the stream monitoring filing cabinet in the GRNA building, with the exception of larger items (buckets, nets, and waders), which are stored in the storage room at the GRNA building.

The benthic macroinvertebrate assessment methods used have been developed by EGLE for volunteer monitoring programs. These methods are consistently used by MiCorps-related volunteer organizations throughout Michigan.

Samples of the benthic community are taken from every microhabitat present at the site. One "collector" uses a D-frame dip net to collect benthic organisms. In areas of fast water flow, the collector kicks at the substrate immediately in front of the net to free and collect macroinvertebrates. In areas of slow flow or by obstructions (like logs, undercut banks, and large rocks), the collector uses the frame of the net to scrape the substrate and sweep the net through the area. The collector also pulls out smaller rocks and logs and places them on the bank for other team members to pick organisms off of. The team leader supervises the collector, ensuring that all available habitat types are sampled. The collector collects in this manner for thirty minutes of "net in the water" time. (Time when their net is out of the water, like when transferring organisms to the bucket on the streambank, does not count toward the thirty minutes). Periodic transfer of collected material and organisms into a 5-gallon bucket occurs. In addition to picking through logs and rocks, other volunteers assist with moving the bucket along the stream so the collector can easily access it, as well as picking organisms out of the collector's net and putting them into the bucket.

The team leader supervises the completion of the field data collection packet, including the front side of the Stream Macroinvertebrate datasheet and, in the spring, the Stream Habitat Assessment datasheet, including a site sketch.

The Stream 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 Stream Habitat Assessment are qualitative, personal bias is inherent. To account for bias and personal discrepancies, team leaders will have on hand a copy of MiCorps Stream Monitoring Procedures, which detail the qualitative criteria and help to clarify questions. Team leaders will read questions aloud to their group and form consensus on answers. Since the information reviewed in the Stream Habitat Assessment hold considerable educational value for volunteers and the goals of the MiCorps program, it is important that team leaders inform other group members of the purpose of the Assessment and encourage feedback from the group. However, final decisions on the scoring remain the responsibility of the team leader.

Photographs will be taken of any parameters listed on the field data form that the field teams are unsure of. This is done to allow the Program Manager and QA Manager to double check data collected and spot potential errors.

During the collection, any accidents or abnormal procedures will be noted in the data packet, including accidental spills of collections, etc. Teams will determine whether extra time or a second sampling is required and will perform it at the time, again, documenting this in the space provided. Other potential sources of variability such as weather/stream flow differences, season, and site characteristic differences will be noted for each event and discussed in study results. Any variations in procedure should be explained on the appropriate datasheet.

After the collection has been completed, volunteers carefully examine the D-net and all other collection equipment (like plastic cups) to remove any clinging organisms or detritus. All of the "picked through" macroinvertebrates are placed in a the labeled 5-gallon bucket. The label includes the site ID, team, data, and time. (See Appendix 7 for the label form). Before moving the 5-gallon bucket from the sampling site (whether it is transported in a canoe, car, or on foot), the team leader will ensure that the lid is tightly fitted around the top of the bucket. The volunteer team returns the buckets, sampling kits, and data packets to the GRNA building.

Once teams return to the GRNA building, the Program Manager will check the datasheets for completeness. At this time, the team leader will notify the Program Manager of any aberrations from regular sampling protocols, as well as any photographs that need to be examined in order to complete the datasheets. As a critical role of the Habitat Assessment is to inform us of any areas of habitat degradation that could impact water quality, any concerns noted in the 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 like the Antrim Conservation District or relevant state agencies.

Once back at the GRNA building, the teams pick through the samples from the buckets. Each team has a pre-determined table with a pre-labeled jar filled with ethanol and a poly-seal lid (set up by the Program Manager). The jar's label is written in pencil to avoid ink smearing, affixed to the outside of the jar, and includes the MiCorps site ID, date, time, and team member names. (See Appendix 8 for the label form). The Program Manager will ensure that all teams are at the correct pre-assigned tables upon returning from sampling. The Program Manager is also responsible for ensuring that all sorting equipment and supplies are clean, free of debris, and have been dry and unused for at least 5 days prior to the sampling event.

Equipment used in the sorting phase includes, per team:

- 2 white trays
- 2 magnifying glasses
- Small plastic pipettes and/or a turkey baster
- Labeled collection jar with poly-seal lid, filled with ethanol
- 2 forceps
- 2 sets of tweezers
- 2 ice cube trays

All of this equipment is stored in the stream monitoring filing cabinet at the GRNA building.

The team picks through the entire sample bucket, preserving all of the invertebrates present by transferring them into the jar of ethanol. This will occur with both the supervision of the team leader and the Program Manager to ensure that all present orders have been picked out and preserved.

Once samples are fully picked through, organisms are identified by the Program Manager in consultation with the Identification Consultants, two retired scientists (one an entomologist, one an aquatic microbiologist focusing on stream health), who live locally. This may occur immediately after sorting or up to one week after the sampling/sorting event, but it will always take place at the GRNA building to avoid transfer of samples. The Program Manager will have access to multiple benthic macroinvertebrate identification resources, including several reference books in the GRNA building library (including *A Guide to Common Freshwater invertebrates of North America*, MiCorps identification materials, and laminated identification keys from the University of Wisconsin). Benthic organisms are identified down to order as determined by the backside of the MiCorps Stream Macroinvertebrate datasheet. The counts are recorded in the data packet and are used in the analysis of benthic stream health.

B1-iii. Sample Handling and Custody Requirements

Once collection has been completed, the samples are returned to the GRNA building. The buckets are labeled prior to heading into the field. The label will have the site ID, team, date, and time. Once they are returned to the building, samples are picked through by the team, and then analyzed by the Program Manager in consultation with the Identification Consultants for identification and count. The Program Manager checks each container for clear labels and a tight-fitting lid once teams are done picking through their sample, and again once identification has been completed. (Fresh ethanol will be added to the jars after identification).

Upon return to the GRNA building after sampling, the team leader reports to the Program Manager on the transport of the sample and datasheets. Documentation of transport and handling of samples and datasheets is maintained in GRNA Inc.'s in-house database by the Program Manager. If transport and handling of samples or datasheets is found to not be in compliance, the Program Manager deals with the issues on a case-by-case basis.

Identified samples are stored in the Grass River building in a filing cabinet at room temperature for at least 10 years. At least once a year, the Program Manager checks all sample jars to ensure adequate amounts of ethanol, and if necessary, tops off each jar with additional ethanol. After 10 years, samples will be properly disposed of in a manner that employs safety precautions.

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 sub-sample, We do not assume that a single collection represents all the diversity in the community, but rather we consider our results reliable only after repeated collections spanning at least three years. Our results are compared with other locations in the Elk River Chain of Lakes watershed that have also been sampled using MiCorps procedures. As discussed in section A7, a different team will be sent to a site at least once every three years at a minimum, but when possible, collectors will be sent to different sites every sampling event to diminish the effects of bias in individual collecting styles. Samples where the diversity measures diverge substantially (using the criteria in section A7) from past samples at the same site are resampled by a new team, including the Program Manager, within two weeks, if possible. The Program Manager will also accompany the team in question at the next sampling event to gauge if re-training is necessary.

B2. Instrument/Equipment Testing, Inspection, and Maintenance

See section B1 for full lists of sampling and sorting equipment. All equipment is stored in the GRNA building. Most equipment is stored in the stream monitoring filing cabinet, but some of the larger equipment (nets, waders, and buckets) is stored in the storage room.

The Program Manager checks all equipment prior to sampling events (in March for the spring event and in August for the fall event) to make sure it is in working order. This involves manually inspecting all equipment, including the following: checking nets for holes, ensuring that nets are securely attached to poles, ensuring that all tweezers and forceps are in good working order with tips that meet, and that all waders are clean and do not leak. If deficiencies are discovered, the Program Manager will attempt to repair the equipment (i.e., retightening screws that attach nets to poles with a screwdriver that is kept in the toolkit at the GRNA building). If the Program Manager is not able to repair equipment or if defective equipment will effect data quality (i.e. holes in a net), they will notify the Executive Director and will purchase replacement equipment. If resources do not allow for this, equipment in good working order will be temporarily borrowed from other stream monitoring organizations that GRNA, Inc. partners with in the area, such as Three Lakes Association, The Watershed Center of Grand Traverse Bay, and Tip of the Mitt Watershed Council. Records of equipment inspections, purchases, and borrowing will be kept in the Equipment folder in the stream monitoring filing cabinet in the GRNA building.

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 field work.
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, Team Leaders will supervise the use of a 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.

See section B1 for a full list of the contents of the decontamination kits.

B3. Inspection/Acceptance Requirements for Supplies and Consumables

See section B1 for full lists of sampling and sorting supplies. All supplies are stored in the GRNA building in the stream monitoring filing cabinet. Most supplies were purchased in 2014, with the exception of new collection jars with poly-seal tops, which were purchased in 2020.

Supplies are inspected twice yearly at the same time that equipment is inspected (see section B2), and records are kept of any damage encountered in the Equipment folder in the stream monitoring filing cabinet in the GRNA building. Damage could include scratched or faulty collection jars or lids and expired ethanol, and insufficient supplies may apply to trash bags, ethanol, and first aid kit items like bandages. Supplies will be replaced in 2026 (12 years after purchase) unless damaged. Any damaged supplies or equipment will be replaced as soon as is feasible, at least one month before the next sampling event. The Program Manager is responsible for all inspection and corrections, as well as all supply purchases (with approval from the Executive Director). Supplies will be sourced from mjspackaging.com (collection jars and lids), Amazon.com (ethanol), or a general merchandise store (goods like first-aid kit items and trash bags).

B4. Non-direct Measurements

Not applicable.

B5. Data Management

The team leader is responsible for the safety of the datasheets while in the field. The datasheets are collected by the Program Manager after return of the teams from sampling, who fills out the backside upon identification of sample organisms in consultation with the Identification Consultants.

The data are entered from datasheets first into the GRNA, Inc. Microsoft Access database by the Program Manager. Entered data are checked twice against field datasheets to ensure accuracy. Data are then entered into the online MiCorps database by the Program Manager after being checked within a month of data collection. The entering of data into the MiCorps database is checked by the QA Manager. All data are double-checked for accuracy and correctness.

Datasheets are filed at the GRNA building. They are also scanned and digitally stored on both the Program Manager's computer and the GRNA, Inc. staff Dropbox. Paper datasheets are kept for at least 5 years in the stream monitoring filing cabinet at the GRNA building, and the electronic records are retained indefinitely. A copy of the electronic data is saved every time new data is entered and this copy is stored on the Program Manager's computer, the GRNA, Inc. staff Dropbox, and on a USB flashdrive kept off premises. Computer passwords provide data security.

Data are summarized for reporting in both seasonal reports and in the end-of-year report into four metrics: all taxa, insects, EPT (Ephemeroptera, Plecoptera, and Trichoptera), and sensitive taxa. Units of measure are orders 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 1.

Specific measures are used from the habitat assessment to investigate problem areas at each site. These are included in both seasonal reports and in the end-of-year report. Because sedimentation is one of the principal threats to the biota of GRNA's streams – most of which is washed down into GRNA from upstream devegetated and developed land, as well as road-stream crossings lacking buffers – the percentage of stream bed composed of fines (sand and smaller particles) is calculated and changes are tracked over time as an indicator of sediment deposition. Qualitative ratings of the riparian corridor surrounding the stream site is also tracked to alert GRNA, Inc. staff to landscape changes that may require restoration or other remedial actions.

C1. System Audits and Response Actions

Multiple evaluations are conducted to evaluate the program. The sampling and sorting techniques of volunteers is evaluated at the Annual Training Day in the spring. Additionally, all team leaders convene once per year on the Annual Training Day, at which point problems and concerns are addressed by demonstrating proper techniques to individuals and pursuing corrective action to eliminate them, as well as reviewing decontamination procedures. Team leaders are required to attend the Annual Training Day, which helps to ensure that proper procedures are consistently followed.

Team leaders monitor team members for adherence to quality assurance methods during sampling and sorting and report any problems that may affect data quality to the QA Manager. 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 or recording accurate data, a performance audit to evaluate how people are doing their jobs of collecting the data is accomplished through side-by-side sampling and sorting. During side-by-side sampling, a team of volunteers and an outside expert sample the same stream. The statistic for checking this side-by-side sample is given in the discussion of bias in section A7.

A system audit is conducted following each spring and fall monitoring event to evaluate the process of the project. The system audit consists of the Program Manager, QA Manager, and the Identification Consultants 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 (within a 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 by the Program Manager.

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

The MiCorps standardized data collection forms for Stream Macroinvertebrates and Stream Habitat Assessment are used to facilitate spot-checking to ensure that forms are completely and correctly filled out. The Program Manager reviews the data forms upon teams' return to the GRNA building after sampling and before they are stored in a filing cabinet and in computer files.

All macroinvertebrates are identified by the trained Program Manager - in consultation with the Identification Consultants – to gather accurate and complete counts. The QA Manager determines whether data are accepted, rejected, or qualified, in conjunction with the Program Manager.

After data has been compiled and entered into a computer file, it is verified with raw data from field survey forms and the accuracy of the entered data is double-checked, including checking calculations.

Any errors found are corrected.

C3. Reconciliation with Data Quality Objectives

Data quality objectives are reviewed semi-annually by the QA Manager during the system audit (see section C1) 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 and are included in both the seasonal and year-end reports. Response to and reconciliation of problems that occur in data quality are outlined in section A7.

Data quality is expected to continue to improve over time as volunteers gain more experience and confidence in methods and interpretation. If a sample is rejected, mandatory retraining will be enforced before the next sampling event to avoid future rejections.

C4. Reporting

The Program Manager produces three reports annually regarding data collected and relevant information regarding the sampling. The first two reports are produced following each sampling event and reproduce the validated and calculated data, comparison to previous year’s season data, significant achievements, notable events, equipment issues and maintenance, supplies purchased and/or requested, quality assurance processing, volunteer issues/concerns, etc. The reports following spring sampling events also include information on habitat data collected and comparison of this data to previous years’ habitat data.

The final report is a year-end analysis to include: data collected that year, analysis of that data, analysis of all data collected up to that point over all program years, all relevant information from seasonal reports, how data were used by GRNA, Inc. and/or other agencies, financial information, evaluations, etc.

Both the seasonal reports and the year-end reports are created in a digital format (likely with Microsoft Publisher) and shared with volunteers, special interest groups, local municipalities, relevant state agencies, GRNA, Inc. supporters, and partner organizations.

Quality control reports are included with seasonal and year-end project reports that 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, diversity calculations, and statistical analyses.

MiCorps Site ID#:_______________

Stream Macroinvertebrate Datasheet

Site Name: ____

Date:_______________________________ Collection Start Time:_______________(AM/PM)

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

Latitude:______________________________ Longitude:_______________________________

Names of Team members: ____

Stream Conditions:

Average water depth:_______________________feet

Notable weather conditions of the last week:____

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

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

____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#:_______________

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
	Helgrammite (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)	Cuclidae, Syphridae, Stratiomyidae	8.7	
	Leech	Hirundinae	10.0	
	Aquatic Worm	Oligochaeta	10.0	

	Total Abundance

Sum of (Count x Sensitivity):	

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

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

Water Quality Rating =

Sum of (Count x Sensitivity)
Divided By
Total Abundance

= ______________________

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

STREAM HABITAT ASSESSMENT

I. Stream, Team, Location Information

Site ID:____________________ Date:______________________ Time:________________________

Site Name:___________________________________ Lat/Long ________________________________

Names of Team members:____

II. Stream and Riparian Habitat

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

MiCorps Site ID#:___________ Date:_________________

II. Stream and Riparian Habitat (continued)

B. Streambed Substrate

Estimate percent of stream bed composed of the following substrate.

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

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

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

Comments:

C. Bank stability and erosion.

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

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

MiCorps Site ID#:___________ Date:_________________

II. Stream and Riparian Habitat (continued)

D. Plant Community

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

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

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

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

E. Riparian Zone

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

1. Left Bank

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

Wetlands Forest Mowed Grass Park Shrubby/Grassy Field Agriculture

Construction Commercial Industrial Highways Golf Course Other___________

2. Right Bank

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

Wetlands Forest Mowed Grass Park Shrubby/Grassy Field Agriculture

Construction Commercial Industrial Highways Golf Course Other___________

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

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

MiCorps Site ID#:___________ Date:_________________

III. Sources of Degradation

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

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

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

Additional comments:

Michigan Clean Water Corps

MiCorps Site ID#:___________ Date:_________________

IV. Optional quantitative measurements

A. Transects and Pebble Counts

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

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

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

B. Bank Height

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

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

V. Final Check

This data sheet was checked for completeness by: ________________________________

Name of person who entered data into data exchange: ______________________________

Date of data entry:____

VI. Credits

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

MiCorps Site ID#:___________ Date:_________________

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

MiCorps Volunteer Stream Monitoring Program:
Monitoring Procedures

Updated December 2020

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Adapted from:
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Surface Water Quality Division
Michigan Department of Environmental Quality

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 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 a 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 growth 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:

Plants in the Stream:
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 aquatic vascular plants—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.

Plants on the bank/riparian zone
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) Source Identification

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 (e.g. septic 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.

<u>Additional Comments:</u>

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.

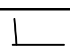
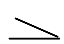
Date of date entry: This field is for use in case problems come up with the data entry.

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.

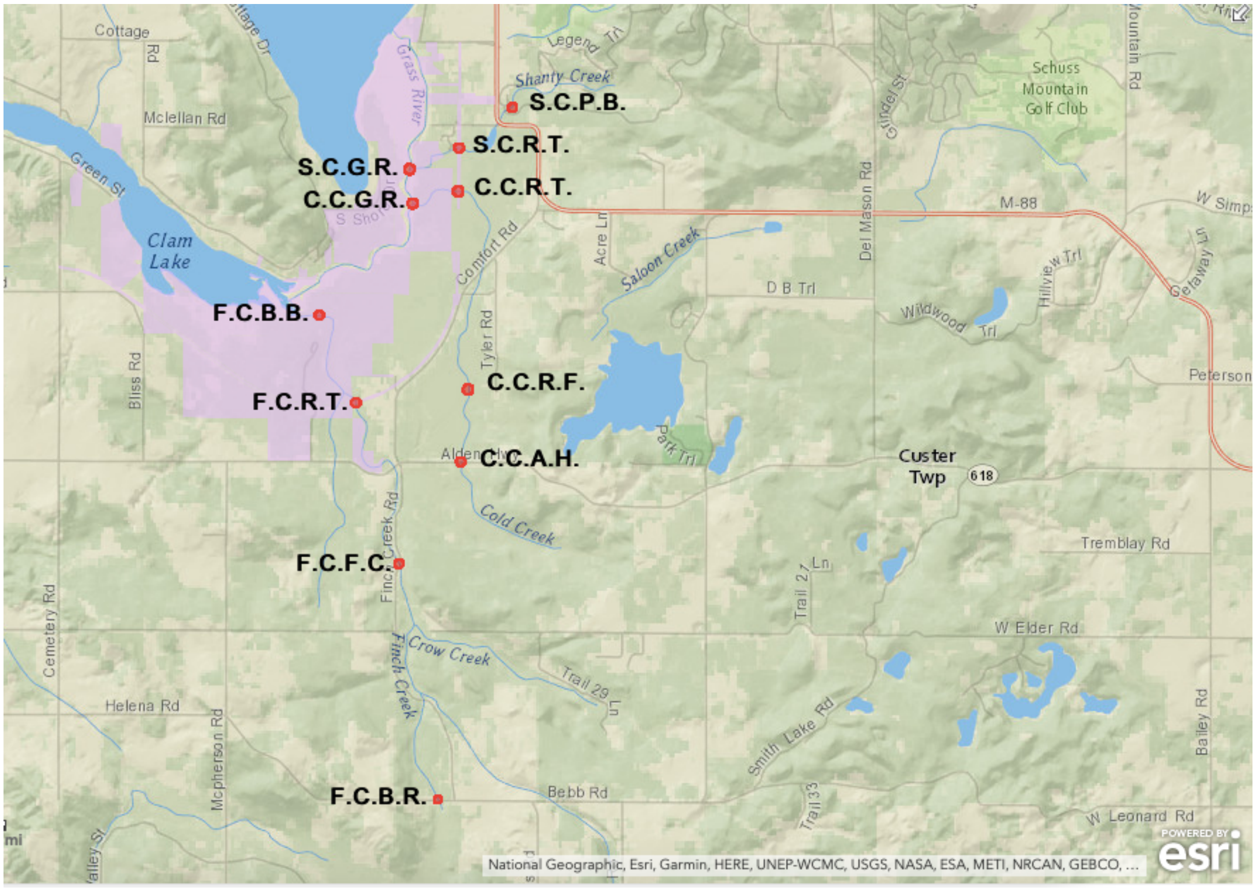
3. Add up all the values in the "Count x Sensitivity" column and record this in the box "Sum of (Count x Sensitivity).

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

Appendix 4: Sampling Sites Map



The lavender polygon indicates the boundaries of Grass River Natural Area. Sampling sites are indicated by red dots and are labeled with their MiCorps Site ID.

Appendix 5: Sampling Sites Coordinates

Stream	Site Name	Micorps Site ID	Latitude	Longitude
Finch Creek	Finch Creek Beaver Bridge	FCBB	44.915613	-85.221655
Finch Creek	Finch Creek Rail Trail	FCRT	44.907941	-85.21595
Finch Creek	Finch Creek Finch Creek Rd	FCFC	44.893977	-85.210472
Finch Creek	Finch Creek Bebb Rd	FCBR	44.87384	-85.205644
Cold Creek	Cold Creek Grass River	CCGR	44.925088	-85.208629
Cold Creek	Cold Creek Rail Trail	CCRT	44.926099	-85.203015
Cold Creek	Cold Creek Rob Fleet's	CCRF	44.907945	-85.202254
Cold Creek	Cold Creek Alden Highway	CCAH	44.902888	-85.202884
Shanty Creek	Shanty Creek Grass River	SCGR	44.928241	-85.208779
Shanty Creek	Shanty Creek Rail Trail	SCRT	44.929738	-85.203018
Shanty Creek	Shanty Creek Pine Brook	SCPB	44.935158	-85.194491

Appendix 6: Volunteer Directions and Map Example

Site Name: Cold Creek Alden Highway

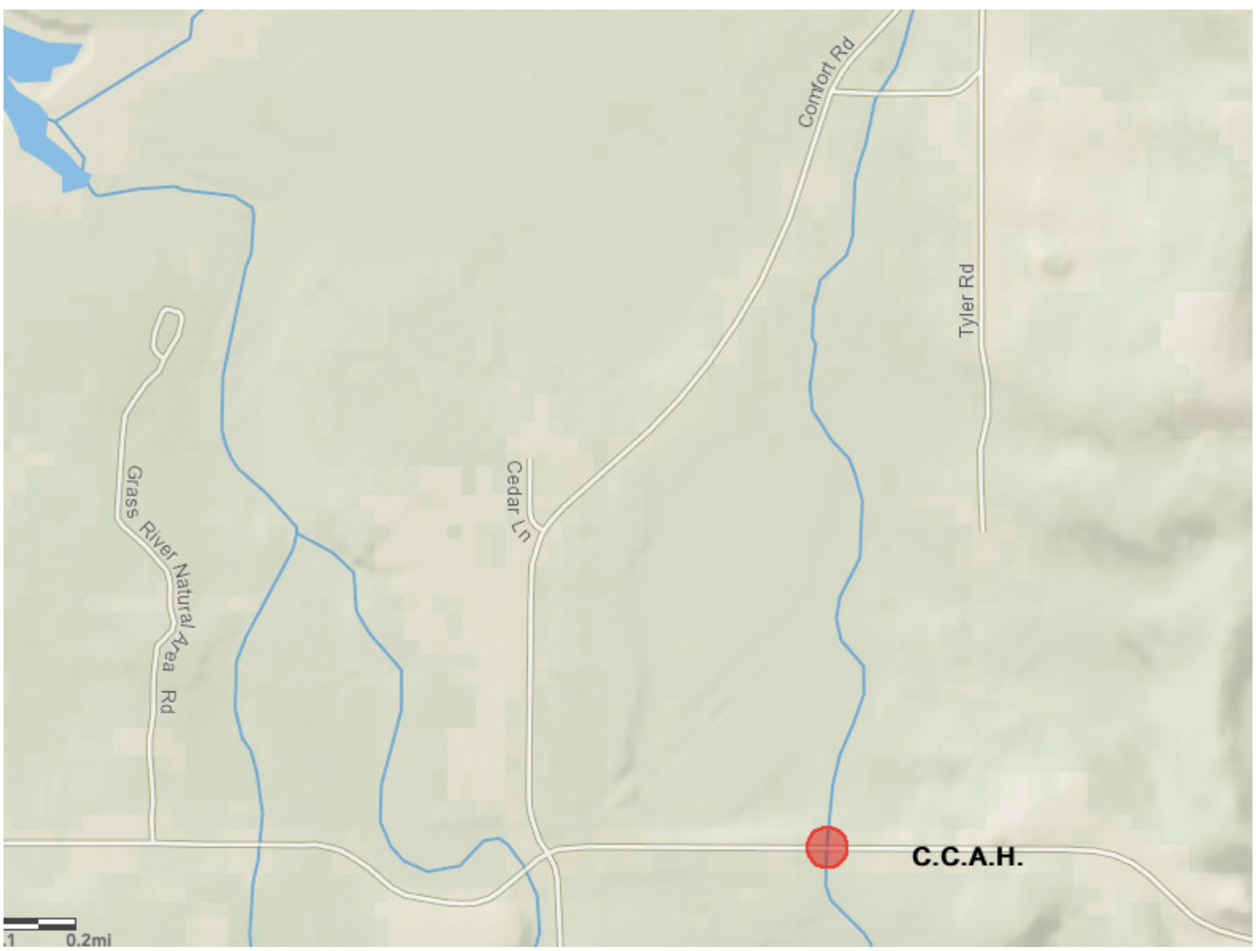
MiCorps Site ID: C.C.A.H.

Site Coordinates: 44.902888, -85.202254

Site Description: Cold Creek crossing with Alden Highway. Sample 100 yards downstream of crossing.

Site Directions: Turn left out of GRNA entrance road onto Alden Highway. Pass Comfort Rd and drive about ¼ mile further to creek crossing. Park at crossing.

Notes: This property is owned by Bonnie and Randy Johnson. We have permission from them to sample here today. If you need to contact them for any reason, Bonnie's number is (231) 883-9543 and Randy's is (231) 676-2564.



Appendix 7: Bucket Label Form

Site ID____

Team Members____

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Date____

Time____

Appendix 8: Collection Jar Label Form

MiCorps Site ID___________________
Date: ___________________________
Time____________________________
Team Members____________________
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____
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