A1. Title and Approval Sheet

Quality Assurance Project Plan for
Huron River Watershed Council's
Macroinvertebrate and Measuring and Mapping Monitoring

Date: 7/5/2022
Version #3
Organization: Huron River Watershed Council (HRWC)
Previous versions: 2001, 2008

Program and QAPP manager: Paul Steen
Title: Program and Quality Assurance Manager

Signature: ____

____

Signature upon approval:
MiCorps Reviewer: _______Paul Steen_________________________

7/22/2022

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

A2. Table of Contents

A3. Distribution List

Jo Latimore, Michigan State University

Tamara Lipsey, Michigan Department of Environment, Great Lakes, and Energy
Paul Steen, HRWC, QAPP Author
Jason Frenzel, HRWC
Kate Laramie, HRWC

A4. Project Organization

Management Responsibilities

1) Paul Steen, PhD. HRWC, psteen@hrwc.org
Paul is co-project manager and quality assurance manager for the project. His responsibilities include:

- Administration, grant writing, and accounting of grant funds.
- Develop and adhere to the Quality Assurance Project Plan.
- Research and purchase necessary equipment for performing stream monitoring activities.
- Coordinate and conduct volunteer stream monitoring training events.
- Coordinate volunteer stream monitoring field data collection events.
- Gain stream access permissions from local community.
- ID Expert: Lead on macroinvertebrate sorting and identification.
- Catalogue and store collected specimens.
- Database development, data entry, and data analysis.
- Write reports and update HRWC web with latest information on an annual basis to share with volunteers and the general public.
- Provision of products and deliverables to MiCorps. All data collected will be entered into the MiCorps database on an annual basis.
- Project evaluation.
- Responsible for initiating, developing, approving, implementing, and reporting corrective actions.

2) Jason Frenzel, HRWC, jfrenzel@hrwc.org. Jason is co-project manager and volunteer coordinator. His responsibilities include:

- Administration, grant writing, and accounting of grant funds.
- Promote volunteer stream monitoring activities and solicit volunteers and stream access permissions from local community.
- Coordinate and conduct volunteer stream monitoring training events.
- Coordinate volunteer stream monitoring field data collection events.
- Coordinate macroinvertebrate indoor sorting and identification sessions.
- Project evaluation.

3) Kate Laramie, HRWC, klaramie@hrwc.org. Kate's responsibilities include:

- Marketing of the events through social media, both pre- and post event.
- Prepare maps and other paperwork for team outings
- Assist coordinating the volunteer stream monitoring training and monitoring events.
- ID Expert: Assist Paul on insect identification
- Field and data manager of the Measuring and Mapping (M&M) program (habitat study)

- Lead M&M training and field teams
- Enter M&M data into HRWC databases

Field Responsibilities
Field sampling will be performed by volunteers. Team leaders and collectors will receive training in field data collection methods by HRWC staff and lead volunteers.

Project Volunteers. Most tasks of the field collection events will be done by volunteers recruited from partner groups and the community in general. Prior to the fall collection event, there will be at one training opportunity for volunteers to attend if they choose to be a leader or collectors.

Volunteers at field collection events may serve as collectors, runners, or pickers.

Collectors will sample all in-stream habitats that exist at the site and provide sample contents to pickers for processing.

Runners will take materials from the collectors in buckets and bring it to the pickers.

Pickers will pick macroinvertebrate specimens from sample contents provided by the Collector, presort the macroinvertebrates, and preserve at least 100 specimens per site in alcohol for later identification.

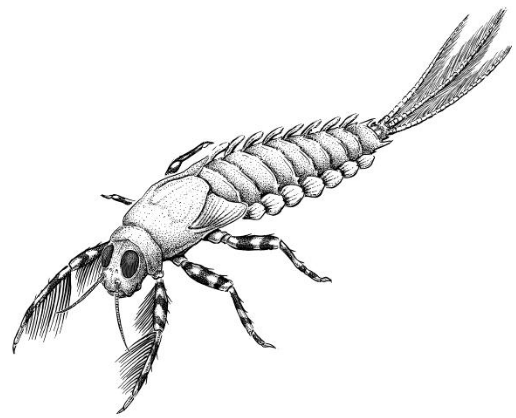
All leaders and collectors will be asked to retrain every 3 years, either through the in person training or through the recorded youtube video.

A5. Problem Definition/Background

In southeastern Michigan, the Huron River Watershed spans a land area of more than 900 square miles and drains water to the Huron River through hundreds of tributary creeks and streams. The river itself flows more than 125 miles from its headwaters at Big Lake, near Pontiac, to its mouth at Lake Erie. About 1200 miles of creeks and streams flow into the Huron's main branch. The river's drainage area includes seven Michigan counties (Oakland, Livingston, Ingham, Jackson, Washtenaw, Wayne, Monroe) and 60 municipal governments, serving six hundred and fifty thousand residents. The spectrum of land use and water environments ranges across remote natural preserves, cultivated farmland, urban and industrial centers, suburban sprawl. The Huron River and its tributaries match this diversity; there are near pristine streams in near pristine forests, there are heavily degraded streams in heavily degraded urban and agricultural areas, and there is everything in between.

The Huron River Watershed Council (HRWC) has existed since 1965 with the mission to protect, maintain, and restore this natural treasure. To meet this mission, HRWC needs data that represents the quality of our waters. Starting in the early 1990s, HRWC staff with the guidance of University of Michigan Natural Resource professors began conducting volunteer-based macroinvertebrate monitoring and associated habitat studies as a way of better understanding these communities and thus, the associated ecosystems.

Insects living in the creek compose the benthic macroinvertebrate population, along with clams and other mollusks, crayfish, and other taxa. Typically, monitoring focuses on insects (in aquatic stages of development) as they are representative of a variety of trophic levels, are sensitive to local environmental conditions and are easy to collect. Since the macroinvertebrate population depends on the physical conditions of the stream as well as water quality, its composition indicates the overall stream quality. Insect diversity indicates good stream quality and is measured by the number of different insect families. 87 benthic insect families are found in the Huron River Watershed.



*Brush-legged Mayfly (*Ephemeroptera isonychiidae*) drawing: Matt Wimsatt*

Macroinvertebrate data is collected through HRWC River Roundup event, formerly known as HRWC's Adopt-a-Stream, which relies on trained volunteers to monitor more than 80 sites in the Huron River watershed. Monitoring data has been gathered since as early as 1992 at some sites through annual spring and fall collection days, and a winter stonefly search each January. Measuring and Mapping was begun in the mid-1990s as a way to better understand why insect populations increase and decrease through understanding the physical habitat in which they live.

In 2004, MiCorps began and through it the Huron River Watershed Council staff began guiding other groups across Michigan in how to conduct similar monitoring. HRWC has continued its leadership of stream monitoring in MiCorps through the present day, with the result of over 50 organizations and thousands of people understanding the joy and value of insect and habitat monitoring.

A6. Project Description

The Huron River Watershed Council's Macroinvertebrate and Measuring and Mapping Monitoring focuses on biological and habitat monitoring as a tool to assess stream water quality and ecosystem integrity. Aquatic macroinvertebrates are collected and identified to determine diversity in the benthic community and the presence of pollution-sensitive macroinvertebrate families. The results of these collections are used to gauge the health of the stream reach. Biological monitoring will be conducted three times a year: full collections in the springtime and fall (called River Roundups) and focused collections on stoneflies in January (called Winter Stonefly Search).

In the summer, volunteers conduct a stream habitat assessment (called Measuring and Mapping) at each monitoring site which includes site sketches, photos, stream cross-sections, and descriptions of the habitats present. Habitat assessments will be conducted when a site is first brought into the program and every five years afterwards.

The procedures for both macroinvertebrate monitoring and Measuring and Mapping following the Standard Operating Procedures of the MiCorps program. (Appendix A). The Measuring and Mapping program also conducts the optional stream transect and pebble count described in these procedures.

There will be one macroinvertebrate volunteer training activity per year, and held prior to the fall event, when SE Michigan typically has the most reliable weather. Volunteers can be involved in the program to the extent that their interest, time, and expertise allow. It is hoped that some volunteers will be involved long-term and will increase their knowledge enough to take on leading roles in implementing the project and training new volunteers.

Measuring and Mapping volunteer trainings are held as their own event and occur in early summer prior to any monitoring.

The monitoring program focuses on the Huron River Watershed, located in Oakland, Livingston, Washtenaw, and Wayne Counties. The number of samples taken depend on the amount of volunteers participating, and for the macroinvertebrate monitoring this ranges between 40 and 50 site each season. The sampling scheme is discussed in B1.

A7. Data Quality Objectives

Precision/Accuracy:
Streams monitored in this program are assessed by examining aquatic macroinvertebrate community diversity. Quality control during field data collection, to guarantee precision and accuracy, is accomplished first of all by the trained team leader who accompanies teams to observe their collection techniques and note any divergence from protocols. Furthermore, the Program Managers talk to the volunteer teams as they return from the monitoring to understand challenges they face and if these would reduce the accuracy of the collection. Procedures on following up on these is in this section, below.

For macroinvertebrate monitoring, leaders and collectors must first go through an approximately 3 hour long training session in which they get in the river and practice with a sampling net. Techniques reviewed at training events and in the field include [1] collecting style (must be thorough and vigorous), [2] habitat diversity (must include all habitats and be thorough in each one), [3] picking style (must be pick thoroughly through all materials collected and pick all sizes and types) [4] variety and quantity of organisms (must ensure that diversity and abundance at site is represented in sample), and [5] the transfer of collected macroinvertebrates from the net to the sample jars (specimens must be properly handled and jars correctly labeled).

For Measuring and Monitoring training, participants must first go through an approximately 2-hour long training in which they get into the river to fill out the habitat form and take at least one practice substrate/water depth transect.

After the River Roundup events, a second event is held 1-2 weeks later to identify the samples. Most of the insect sorting is conducted by volunteers, with HRWC staff sorting the remainder of the samples that the volunteers don't have time to do. The regular volunteers do not conduct insect identification. Paul Steen, Kate Laramie, and a few hand-selected local ID experts conduct all of the insect identification. Paul Steen, the head ID expert, the Program Manager verifies all identifications again before the identifications are considered final.

HRWC has 6 measures of concern in regards to the River Roundup events.

- Total Abundance—total number of specimens kept
- WQR- Water Quality Rating, the Hilsenhoff IBI metric used by MiCorps
- Total Diversity: Total number of Families found
- Insect Diversity: Total number of insect Families found
- EPT Diversity: Total number of Ephemeroptera, Plecoptera, and Trichoptera Families found.

- Sensitive Diversity: Total number of Families found which have a 0, 1, or 2 tolerance rating on Hilsenhoff's IBI scheme.

For the Winter Stonefly Search, there is one metric of concern.
Stonefly Diversity: Total Number of Stoneflies found.

For the Measuring and Mapping Program, there is one metric of concern.
Procedure 51 score: Habitat score (0-100) based on EGLE's P51 assessment metrics

A given site's metrics will be noted as "preliminary" until three monitoring events have been completed for each of these programs. Since this takes 10 years for the M&M program, we hold the M&M data apart from the macroinvertebrate data and treat it separately.

After the preliminary period of monitoring is over, the resulting metrics for any new sample will be compared to the average results of the site and each metric should be within 40% of the average. If it is not, then there is a series of follow up checks that should be performed. The first step in this situation is to look at comments on the data sheet for an explanation of anything being done differently than standard protocols; if none is given, then the Program Managers need to reach out directly to the team leaders and collectors and ask for clarification.

Possible Problems (not exhaustive):
- Rain, flooding, and cold can prevent proper collection or measuring through changed water conditions or difficulty on the field team.
- Team does not spend the proper time at the creek; either too little or too much is a problem.
- Team forgets key equipment like nets or forceps.

If one of these problems is judged to have occurred, the sample is rejected. It is not included in HRWC's long-term database nor is it submitted to MiCorps. At their discretion the Program Managers can choose to send a different team to resample the site within two weeks of the original sample data.

Metrics that are 40% outside of the long-term average could also indicate that the insect community is actually changing. If there is no weather, sampling, team reason, or other outstanding issue that explains the sample going 40% outside the long-term average, it probably is an acceptable sample. The Program Managers can consider sending a new team back to the site within two weeks, to resample the location. If the new sample is within 20% of the first, then the first sample should be accepted into the long-term record with the new sample discarded. If the new sample is more than 20% different from the first sample but within 40% of the long-term average, then the new sample should be kept as the official sample.

Any resample must be done within two weeks but in normal circumstances, the data analysis of the results is not finished until one to two months after the monitoring event. Thus, the sites usually cannot be resampled following the procedures above and a gap is left in the data record. In some cases, the abundance is so low that a problem is seen immediately upon the teams turning in their samples, and then there can be enough time for the Program Managers to initiate a resample.

Bias:
Each event, sites will be sampled by different teams with different leaders and collectors. 99% of HRWC's sample sites have no dedicated team that always samples them; also, team membership is also constantly randomized. For the one site that we sample that does have a dedicated team (Hummocky Lick at M-36), a different team will sample it at least once in every two-year time frame to examine the effects of bias in individual collection styles. A relative percentage difference (RPD) calculation between the new measure and the mean of past measures should be less than 40% for all metrics. Samples not meeting this data quality objective will be evaluated by the Program Manager in the same manner that was discussed in the Precision and Accuracy statement above.

Completeness:
Following a QA/QC review of all collected and analyzed data, data completeness will be assessed by dividing the number of measurements judged valid by the total number of measurements performed. The data quality objective for completeness for each sampling event is 90%. If the program does not meet the standard, the Program Managers will consult with MiCorps staff to determine the cause of data invalidation and develop a course of action to improve data completeness in future sampling events.

Representativeness:
Study sites are selected to represent the full variety of stream habitat types available in each watershed. 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. Effort has been made to locate sampling sites in areas that represent the differing conditions within each watershed. Resulting data from the monitoring program will be used to represent the ecological conditions of the contributing watershed.

Comparability:
To ensure comparability, all volunteers participating in the program will follow the same sampling methods and use the same units of reporting. The methods are based on MiCorps standards, which will increase comparability with other MiCorps programs. Periodic reviews of sampling events by the Program Manager will ensure adherence to these standard methods.

A8. Special Training/Certifications

Paul Steen has a PhD. in aquatic ecology from the University of Michigan with multiple classes specifically on Michigan macroinvertebrates. He has been teaching HRWC volunteers as well as leaders and volunteers from other MiCorps groups since 2008.

Dr. Steen's MiCorps leader trainings provide information about basic stream monitoring methods established by MiCorps. Topics covered included stream macroinvertebrate sampling and identification, habitat assessment, data management and entry into the MiCorps database, attracting and retaining volunteers, and program and data evaluation.

Volunteer team Leaders and Collectors are trained by the Program Manager prior to field day collections. The training covers program goals and objectives, macroinvertebrate collection methods, filling out field data sheets, safety issues, and quality assurance practices. The program managers track all volunteers that have received training as well as the date of the training. The first training of a volunteer has to occur in person. Refresher trainings, which are required every three years, can be in person or can be done through watching an HRWC training video.

B1. Study Design & Methods

Monitoring Sites:
The Huron River is 125 miles long and the watershed is made of 22 major subwatersheds. The primary goal of HRWC's macroinvertebrate monitoring is to sample the full macroinvertebrate community at least once a year, preferably twice if volunteer effort allows, at one location in each major subwatershed and in multiple locations along the Huron River to best understand water conditions and possible new pollutant inputs.

The subwatershed sites were picked to be close to the mouth of each creek when possible, be safe for sampling and parking, and be public lands or else private land where we could get permission. The Huron River sites were chosen to be spread across the 125 miles length, areas where the river is wadable, be safe for sampling and parking, and be public lands or else private land where we could get permission.

They are sampled every five years for the Measuring and Mapping program.

Table 1. 30 Primary Sites:

Site ID	Site Name	Latitude	Longitude
1	Arms Creek: Walsh Rd	42.4139	-83.8457
2	Boyden Creek: Delhi Rd	42.3450	-83.8110
5	Chilson Creek: Chilson Rd	42.4979	-83.8595
11	Fleming Creek: Geddes Rd	42.2738	-83.6685
14	Woods Creek: Lower Huron Metropark	42.1854	83.4291
15	Hay Creek: M-36	42.4615	-83.8947
16	Honey Creek (N): Darwin Rd	42.4428	-83.9249
20	Honey Creek: Wagner Rd	42.3173	-83.7963
21	Horseshoe Creek: Merrill Rd	42.4526	-83.8216
24	Huron River: Cross St	42.2453	-83.6111
25	Huron River: White Lake Rd	42.6922	-83.4989
26	Huron River: Zeeb Rd	42.3240	-83.8407
27	Malletts Creek: Chalmers Rd	42.2652	-83.6888
30	Mann Creek: VanAmberg Rd	42.5340	-83.7300
35	Millers Creek: Glazier Way	42.2881	-83.7029
37	Portage Creek: Dexter-Townhall Rd	42.4238	-83.9482
40	South Ore Creek: Hamburg Rd	42.4975	-83.8027
41	Swift Run: Shetland Drive	42.2615	-83.6767
42	Traver Creek: Broadway Ave	42.2909	-83.7361
46	Woodruff Creek: Buno Rd	42.5408	-83.7460

47	Huron River: Commerce Rd	42.5927	-83.4849
49	Davis Creek: Silver Lake Rd	42.4690	-83.7415
61	Huron River: Island Park	42.2910	-83.7263
62	Huron River: Bell Road	42.4010	-83.9098
64	Huron River: Proud Lake Rec Area	42.5737	-83.5584
65	Norton Creek: West Maple Rd	42.5313	-83.5482
67	Pettibone Creek: Commerce Rd	42.5921	-83.6011
79	Mill Creek: Mill Creek Park	42.3394	-83.8902
103	Huron River: Huron Meadows Metropark	42.4751	-83.7823
100	Huron River: Flat Rock	42.0925	-83.2932

The secondary goal of the monitoring is to understand possible longitudinal variation in the system by sampling more sites further upstream in each subwatershed. In addition, there are some larger direct drainage streams to the Huron that we wanted to have a sample site on (i.e. Port Creek, Huron Creek).

“Secondary” sites were assigned in proportion to subwatershed size so that all subwatersheds are sampled approximately equal to one sample site per 30 square kilometers. For example, two sample sites (1 primary plus 1 secondary) are needed on Honey Creek to get a site density of 35 square kilometers per site, but three sample sites (1 primary and 2 secondary) are needed on Horseshoe Creek to get a site density of 26 square kilometers.

The goal was to get as close to a density of 1 site per 30 square kilometers as possible combined with the challenge of finding enough proper locations to monitoring (safety; access; not all muck) and also not adding more sites to the scheme than our volunteer numbers could support.

Some watersheds are so small that they are only sampled with one site and do not have a secondary site. (i.e. Boyden Creek).

For Arms Creek, two sample sites are needed under this scheme but we can only find a single safe and permissible sample site, so we keep it to 1 sample site and are not able to perfectly match the stated goals.

Table 2. Site Density to determine Primary and Secondary sampling scheme

Creekshed	**Watershed size km2**	**# of Sample sites (1 Primary + X Secondary)**	**Site Density**
Arms	56.1	1	56.1
Boyden	19.7	1	19.7
Chilson	40.4	2	20.2
Davis	176.2	5	35.2
Fleming	79.4	3	26.5

Honey (N)	69.9	2	35.0
Honey (S)	61.1	2	30.6
Horseshoe	78.3	3	26.1
Huron Creek	17.0	1	17.0
Malletts	26.8	1	26.8
Mill	368.3	10	36.8
Millers	5.7	1	5.7
Norton	63.0	2	31.5
Pettibone	72.7	2	36.4
Port	18.3	1	18.3
Portage	205.7	6	34.3
South Ore	102.7	3	34.2
Swift Run	11.0	1	11.0
Traver	18.7	1	18.7
Woodruff	96.1	3	32.0
Woods	26.8	1	26.8

Secondary sites are sampled in the River Roundup at least twice every two years, once in the fall and once in the spring, and more if volunteer numbers allow for it. They are sampled every five years for the Measuring and Mapping program.

Table 3. 30 Secondary Sites

Site ID	Site Name	Latitude	Longitude
6	Davis Creek: Doane Rd	42.4660	-83.7070
7	Davis Creek: Pontiac Trail	42.4891	-83.6532
8	Greenock Creek: Rushton Rd	42.4527	-83.6964
9	Fleming Creek: Botanical Gardens	42.3000	-83.6598
13	Fleming Creek: Warren Rd	42.3315	-83.6627
18	Honey Creek: Jackson Rd	42.2872	-83.8266
22	Huron Creek: Dexter-Pinckney Road	42.3722	-83.9160
31	Mill Creek: Fletcher Rd	42.3222	-83.9794
32	Mill Creek: Ivey Rd	42.3294	-84.0444
33	Mill Creek: Jackson Rd	42.2897	-83.9100
34	Mill Creek: Letts Cr at M-52	42.3236	-84.0207
45	Chilson Creek: Brighton Rd	42.5270	-83.8646
50	South Ore Creek: Lake Ridge Dr	42.5178	-83.8040
52	South Ore Creek: Bauer Rd	42.5088	-83.8098
55	Mill Creek: Manchester Rd	42.2527	-84.0345
57	Mill Creek: Klinger Rd	42.2627	-84.0039
58	Portage Creek: Unadilla	42.4299	-84.0578

60	Port Creek: Armstrong Rd	42.0742	-83.2843
63	Hummocky Lick: M-36	42.4698	-83.9993
68	Pettibone Creek: Livingston Rd	42.6383	-83.6066
80	Mill Creek: Shield Rd	42.3245	-83.8924
82	Walker Creek: 8 Mile Rd	42.4307	-83.6711
84	Fleming Creek: Galpin	42.3204	-83.6331
91	Portage Creek: Stockbridge	42.4561	-84.1745
92	Portage Creek: Williamsville Rd	42.4367	-84.0941
94	Portage Creek: Rockwell	42.4340	-84.1401
96	Mill Creek: Parker Rd	42.2682	-83.8969
97	Norton Creek: Gibson Park	42.5240	-83.5415
98	Horseshoe Creek: Barker Rd	42.4229	-83.7666
99	Horseshoe Creek: Brookside Drive	42.4160	-83.7611

The following are tertiary sites. Tertiary sites are not monitored under any sort of time schedule but may be sampled for particular reasons such as extra volunteers during an event, a particular desired location, or because other sites in the creekshed are showing problems and these can serve to help elucidate the issue. They are not regularly sampled for Measuring and Mapping either.

Table 4. Tertiary Sites

Site ID	Site Name	Latitude	Longitude
3	Boyden Creek: Golf Course	42.3386	-83.8228
4	Boyden Creek: Huron River Dr	42.3326	-83.8175
12	Fleming Creek: Radrick Farms	42.2825	-83.6643
19	Honey Creek: Pratt Rd	42.2990	-83.8186
28	Malletts Creek: I-94	42.2383	-83.7180
29	Malletts Creek: Scheffler Park	42.2522	-83.6979
43	Traver Creek: Dhu Varren Rd	42.3166	-83.7247
44	Woodruff Creek: Maxfield Rd	42.5840	-83.7343
56	Malletts Creek: N. Main St	42.2466	-83.7479
72	Millers Creek West Branch: Plymouth Rd	42.3014	-83.7009
73	Millers Creek East Branch: Baxter Rd	42.2983	-83.6988
74	Millers Creek Tributary: Lakehaven Ct	42.2858	-83.6988
75	Narrow Gauge Creek: Green Rd	42.2839	-83.6932
76	Millers Creek: Huron Parkway	42.2804	-83.6986
77	Millers Creek: Hubbard Rd	42.2948	-83.7043
81	Davis Creek: 11 Mile Rd	42.4768	-83.6123
87	Woods Creek: Martinsville Rd	42.1808	-83.4623
88	Woods Creek: Renton Rd	42.1829	-83.4439
89	Bancroft Noles Drain: Lebo Park	42.0607	-83.2499

90	Willow Run: Van Buren Park	42.2175	-83.5352
93	Livermore Creek: Doyle Road	42.4457	-84.0417
101	Traver Creek: Traver Road	42.3018	-83.7269
102	Swift Run: Sylvan Park	42.2522	-83.6865

Sampling in the Winter Stonefly Search is more targeted than River Roundups and Measuring and Mapping. 30 years into our monitoring, HRWC has a pretty good sense of which streams hold stoneflies and which do not. Streams that have never had a stonefly found get sampled about every five years in the stonefly search, just to continue to make sure nothing has changed. Streams that have marginal or known populations are sampled at least once every two years, and possibly every year if volunteer numbers can support it.

Equipment for Field Macroinvertebrate Collection:
Field sampling gear includes D-frame nets, white sorting trays, waders, five gallon buckets, 4 oz. plastic sample jars, 70% ethanol, plastic and metal forceps, eye droppers, plastic squirt bottles, field data sheets (order level), binders with maps and datasheets, and pencils. HRWC organizes and prepares equipment for each team prior to the sampling event. Three sample jars will be prepared for each site; each team goes to two sites. Each jar will be half-filled with 70% ethanol. Pre-printed labels are given with the site name, county, and date.

Equipment for Measuring and Mapping:
Tape measure with decimal feet; depth rods; stakes to secure tape measure, field data sheets.

Study Methods for Field Macroinvertebrate and Measuring and Mapping:
See Appendix A. The only deviation from Appendix A is as follows:

1) For the January winter stonefly collection, the volunteers are instructed to only keep stoneflies. All other insects are returned. Sampling is reduced to 20-30 minutes per site, with no specific picking time given.

2) For Measuring and Mapping, HRWC conducts the optional stream transects to determine substrate composition.

Equipment for Laboratory Identification of Macroinvertebrate Specimens:
Six celled sorting trays; white sorting trays, forceps, magnifying glasses, stereoscopes; water bottles and water (to keep specimens wet while sorting); bright yet small desk lights; 70% ethanol, 4 oz glass jars with polyseal lids for final samples.

Decontamination Procedures

Macroinvertebrate sampling

a. Teams are sent out with MiCorps Volunteer Monitoring Invasive Species Prevention Kits, contents can be seen here: https://www.hrwc.org/volunteer/decontaminate/

a. Teams typically go to two sites during macroinvertebrate sampling. After the first site, they:
- Conduct a visual inspection of gear before and after any sampling; thoroughly inspect and remove all plants, dirt and mud, and any other visible debris like seeds, shoots, animals, insects, and eggs from clothing and equipment.
- Disinfect wader boot, nets, and trays with dilute bleach and allow to sit for 10 minutes before rinsing with tap water and towel dry all equipment before leaving the site.

c. After sampling is done for the day, HRWC staff let equipment dry for at least 30 days before using gear again.
d. Teams are on the lookout for New Zealand mud snails; any suspected find is asked to be given to the Program Managers immediately.

Habitat study

a. The same general cleaning processes are followed as written above.
b. Bleach disinfection happens between sites. Bleach disinfection is also done at the end of the day, because during the busy summer field season the equipment is under high demand and can't be left to dry for 30 days before it is used again. Typically it is used several times a week from May- August.

B2 and B3. Instrument/Equipment Testing, Inspection, and Maintenance; Inspection/Acceptance for Supplies and Consumables

In the days prior to monitoring; HRWC staff will check all equipment carefully.

- **D-frame kick nets:** will be inspected before and after each sampling session to look for any defects or tears in the nets.
- **Collection jars** (4 oz glass with plastic lids): each jar and lid will be inspected for cracks or defects before each use. Jars will be labeled and half-filled with 70% ethanol prior to the collection event. After jars are in use they will be inspected for leaky tops, improper seals, cracks, and chips.
- **Forceps**: will be cleaned and inspected to make sure the tips meet before each sampling event.
- **Buckets, trays, eye droppers, squirt bottles**: will be inspected to make sure they are clean and not damaged.
- **Magnifiers/Dissection Scopes**: will be cleaned and inspected to make sure they are functioning properly before and after each identification event.
- **Decontamination Kit:** will be inspected to make sure all equipment is clean and in working condition and squirt bottles with disinfectant solution is filled.
- **70% Ethanol:** Each event takes approximately 1.5 gallons of ethanol. It is purchased about once a year.
- **Depth Rods:** Each year, depth rods need to be inspected to be sure that hash marks and numbers are legible.
- **Tape Measures:** Tape measures that don't go to zero because the tape broke at some point should be thrown away and replaced.

B4. Non-direct Measurements

This section is not applicable to our project.

B5. Data Management and Analysis

All data are recorded on field and family-level identification paper data sheets (Appendix B, C, D). These data sheets are stored indefinitely and electronically at the HRWC office. Raw data will be entered in Microsoft Access for long-term storage and exported to Microsoft Excel for analysis. All data is backed up on HRWC cloud storage.

The Program Manager will enter data into the spreadsheet which is then used for both analysis and reporting. The final data tables are checked against the field and laboratory data sheets. The metrics of interest as discussed in A7 are calculated; simple linear regressions are made of the metrics versus year, and graphs are made for each metric. The metrics are checked for the 40% difference (A7) to determine if the sample is kept.

The results of monitoring will then be posted on the website and on occasion in an HRWC newsletter, as well as distributed directly to other participating groups/community organizations, volunteers, schools, and anyone else who asks for it.

Aquatic macroinvertebrates collected by volunteers during sampling events are identified to the family level or lowest taxonomic level possible. Although reference literature for taxonomic identification is dependent upon the preference of the expert, copies of *Aquatic Insects of North America* by R. W. Merritt and K. W. Cummins, *Aquatic Insects of Wisconsin* by W. L. Hilsenhoff, and *Guide to Aquatic Invertebrates of the Upper Midwest* by R.W. Bouchard, Jr. are available during indoor identification sessions.

C1, C2, C3. Assessments and Response Actions; Data Review, Verification, and Validation; Reconciliation with Data Quality Objectives

The procedure for finding and correcting errors in the sampling program is described in A7.

Data quality objectives are described in section A7. The following points will be assessed for DQO during different phases of the program:

Equipment Quality Control:
Listed in B2 and B3.
All equipment must be cleaned, dried and stored securely after sampling events.

Field Procedures Quality Control:
1. Each team will have at least one trained team leader and/or collector.
2. The team leader is responsible for filling out datasheets.
3. The team leader will monitor collection at each site for: [1] collecting style (must be thorough and vigorous), [2] habitat diversity (must include all habitats and be thorough in each one), [3] picking style (must be pick thoroughly through all materials collected and pick all sizes and types) [4] variety and quantity of organisms (must ensure that diversity and abundance at site is represented in sample), and [5] the transfer of collected macroinvertebrates from the net to the sample jars (specimens must be properly handled and jars correctly labeled).
4. 300 feet of stream length will be sampled.
5. Sampling should last at least 35-45 minutes hour, depending on stream size.
6. A minimum of 100 organisms should be collected at each site, with an emphasis on collecting diversity versus quantity.
7. Before leaving a site, the team leader will assure that: the data sheet has been filled out including notes of any difficulties or observations, sample bottles are sealed, equipment has been fully decontaminated and rinsed, and all refuse is picked up.

Indoor Sorting and Identification Quality Control:

1. All jars with macroinvertebrate specimens must be checked by a program manager upon receipt from the volunteer team to assure that they are labeled, properly closed, and all jars from a site are put together with rubberbands..
2. Field datasheets used by volunteers must be checked for completeness and to verify that the correct number of containers from the sample site is indicated on the form.
3. Prior to identification, datasheets and containers must be checked to ensure that all containers, and only containers from that collection site are present prior to opening the jars to begin identification.
4. During the indoor session, if any specimens are separated from the pan during sorting and identification, a site label must accompany them.
5. All samples must be checked and verified by a qualified expert. Paul Steen must okay all final identifications.
6. Following identification, all specimens from the sample site in question must be stored in 70% ethanol in an air-tight container and a label included in the container that includes a site label (sample site location, and sample event date).

Data Analysis Quality Control:

1. Field datasheets must be reviewed for errors upon receipt by the Program Manager to minimize errors before entry into the spreadsheet and MiCorps Data Exchange.
2. Calculations for diversity indices must be verified by the Program Manager to minimize errors before entry into the spreadsheet and MiCorps Data Exchange.
3. Data entered into the computer must be reviewed by comparing hard copy print outs of spreadsheet with field data sheets.

C4. Reporting

The Program Manager has the primary responsibility for performing and verifying the QC points from C3 and A7. Program volunteers will be given timely feedback on their QC performance, especially if deficiencies are identified.

MiCorps Volunteer Stream Monitoring Program:
Monitoring Procedures

Updated December 2020

Prepared by:

Paul Steen, MiCorps Staff, Huron River Watershed Council
Jo Latimore, MiCorps Staff, Michigan State University

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

Prepared by:
Charlie Bauer, Saginaw Bay District
Greg Goudy, Cadillac District
Scott Hanshue, Great Lakes and Environmental Assessment Section Gary Kohlhepp, Great Lakes and Environmental Assessment Section Megan McMahon, Shiawassee District
Ralph Reznick, Nonpoint Source Unit

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:

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

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

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

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

E. Riparian Zone

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

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

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

Excellent: Width of riparian zone >150 feet, dominated by vegetation, including trees, understory shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.

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

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

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

III. Sources of Degradation

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

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

(1) 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 <u>pollutant loading</u> 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, <u>not</u> 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.
<u>Construction:</u>Highway/ Road /Bridge/Culvert	… there is clear evidence that on-going or recent construction of transportation infrastructure is contributing pollutants to the waterbody.
<u>Construction:</u> 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.

Additional Comments:

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

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

IV. Optional Quantitative Measurements

A. Transects and Pebble Counts

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

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

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

B. Bank Height

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

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

V. Final Check

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

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

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

STREAM TRANSECT DATASHEET

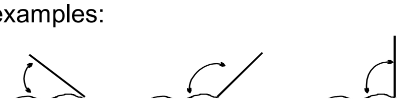
B: Boulder -- more than 10”
C: Cobble -- 2.5 - 10”
G: Gravel – 0.1 – 2.5”
S: Sand -- fine particles, gritty

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

T= Reading on tape
D = Depth
S = Substrate

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

Sketch examples:



Undercut (Acute)   Obtuse   Right

III. Stream Macroinvertebrate Monitoring Protocols

A. TEAM COMPOSITION

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

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

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

B. SAMPLING

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

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

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

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

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

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

C. COLLECTING TECHNIQUES IN DIFFERENT HABITATS

General Techniques

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

Riffles/Runs:

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

Quiet Place/pool:

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

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

2. Don't oversample muck. Not much will live here, and it is difficult to sort through. Process one or two nets worth and then don't go back to this habitat.

Undercut Bank/Overhanging Vegetation or Roots:

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

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

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

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

D. CLEANING YOUR GEAR

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

E. IDENTIFICATION

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

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

F. STREAM MACROINVERTEBRATE DATASHEET

Front page

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

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

Date: Record the month, day and year.

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

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

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

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

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

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

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

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

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

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

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

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

Backpage:

Identification and Assessment:

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

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

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

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

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

To calculate the WQR, follow these steps:

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

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

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

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

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

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

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:

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 <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

This data sheet was checked for completeness by: _________________________________

Name of person who entered data into data exchange: ______________________________

Date of data entry:____

VI. Credits

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

MiCorps Site ID#:___________ Date:_________________

Michigan Clean Water Corps

STREAM TRANSECT DATASHEET

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

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

T= Reading on tape
D = Depth
S = Substrate

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

Sketch examples:

Undercut (Acute) Obtuse Right

MiCorps Site ID#___________________ Sample Date______________

FAMILY LEVEL IDENTIFICATION AND ASSESSMENT

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

Count	**Name**	**Sensitivity Rating**	**Count x Sensitivity**

ANNELIDA-Segmented Worms

	Hirudinea	10	
	Oligochaeta	10	

COLEOPTERA- Beetles

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

DIPTERA- True Flies

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

Count	**Name**	**Sensitivity Rating**	**Count x Sensitivity**

CRUSTACEA- Crustaceans

	Amphipoda	4	
	Decapoda	6	
	Isopoda	8	

EPHEMEROPTERA- Mayflies

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

GASTROPODA- Snails, Limpets

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

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

HEMIPTERA- True Bugs

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

LEPIDOPTERA- Moths and Butterflies

	Cosmopterigidiae		
	Nepticulidae	5	
	Noctuidae		
	Pyralidae	5	
	Tortricidae		

MEGALOPTERA

	Corydalidae	0	
	Sialidae	4	

ODONATA- Damselflies, Dragonflies

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

PELECYPODA-bivalves

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

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

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

PLECOPTERA- Stoneflies

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

TRICHOPTERA- Caddisflies

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

OTHER GROUPS

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

WATER QUALITY RATING

	←Add up the Count columns on both sides (Total Abundance) Add up the "Count x Sensitivity" column for both sides →	

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

Less than 60 → Automatically give it a WQR of 7 (Poor rating)

Water Quality Rating =

Sum of (Count x Sensitivity)
Divided By
Total Abundance

=

In case of problem: Paul Steen (734) 709-6589
Or Jason Frenzel (734) 272-3517

River Roundup Data Sheet

Number of Jars for this site:___

Date:_____ Site Number:____ Stream and Site Name (copy from directions):_________________

TIMES. Arrival @_______ Start Collecting @_______ Stop Collecting @_______ Depart@________

Collector:_________________________ Leader/Scribe:_______________________

Other team members:____

COLLECTING GUIDE!

1. Collect water sample first, before you stir up the stream. Rinse the jar and lid with river water 3 times before collecting the sample.

2. Work in an upstream direction for 300 feet, unless your site map indicates otherwise. Collect for 35-45 minutes. (Your pickers can pick up to 60 minutes).

3. Look for and collect in different habitat types. Check off the habitat type below once they have sampled there. The collector should sample several times at each habitat type if it is available in the stream. **Riffles and big rocks especially** should be sampled several times. Leaders should remind collectors what habitats to look for.

4. HOW MANY creatures do we take?
We are looking for variety. We want all of the different insects and crustaceans at the site. Keep everything that moves within the 1 hour time frame for picking, recognizing that sometimes you need to dump out a white tray to make room for a new sample.

BUT DON'T KEEP: Fish, crayfish, clams, mussels, and snails.

GRAB WITH NET OR HANDS
☐ Big rocks
☐ Logs (be sure to check under bark)
☐ Leaf Packs (decaying clumps of leaves)
☐ Debris and Trash

Note: Bugs hold onto anything, really. ☺

SHUFFLE IN FRONT OF NET
☐ Riffles (turbulent moving water)
☐ Runs (flat moving water)

PULL THE NET THROUGH
☐ Mucky, quiet places (often on the creek edges)
☐ Pools (deeper quiet areas)

Note: Don't overload net with muck; don't go more than 1 inch deep into sediment

SCRAPE THE NET RIM ON THESE
☐ Undercut banks
☐ Overhanging vegetation
☐ Submerged vegetation
☐ Emergent vegetation
☐ Roots

Did you see any of the following? Please do NOT bring them back with you. Take pictures!

Clams/mussels___________ Crayfish________Fish________________ Snails___________

If you can identify anything specific, record their names below, and tell us of anything else you found:

Other: _________________ Other:___________________________

Other: _________________ Other:___________________________

10 Last Minute Questions Before You Leave:

1. Did you double-check your maps to be sure you are at the right location?____________________

2. Was the water sample jar and lid rinsed 3 times with water before the sample was collected?_____

3. Did you work in an upstream direction (more or less)?______________

4. Was any of the collection lost, for instance by a jar turning over?_______________

5. Are the labels for this site in the jars that have the bugs from this site?_______________

6. Did you write the total number of jars used on the other side of this data sheet?____________

7. If this is Site 1, did you follow decontamination procedures prior to leaving?__________________

8. Did someone check that you have all of the equipment prior to leaving?______________

9. Was the stream flooded badly enough that you think your sampling was negatively affected?_________ Details if needed:

10. Please describe any way this site is different from what was described in the materials provided to you (driving directions, parking, bad hand-drawn map, etc). You can also write this in the evaluation.

In case of problem: Paul Steen (734) 709-6589, Jason: (734)272-3517

Huron River Watershed Council

Date:___________________________

STONEFLY SEARCH DATA SHEET

Site #_______ **Stream Name/Location:**____

Collector Name:________________________ **Leader/Scribe Name:**_________________________

Names of everyone else on the team:____

____

Time of Arrival:___________________ **Time Leaving:**___________________

Instructions:

FIRST: Take a water sample before you stir up the stream bottom. Rinse the labeled plastic jar three times before filling it with stream or river water.

SECOND: Search for stoneflies. Look for leaf packs that have been submerged for a long time - old ones are usually black and slimy. Leaf packs may be in or just below a riffle, but also look in slower places or near the edge where leaves or sticks may get snagged. Also collect in riffles and in a variety of other habitats. **We're only collecting stoneflies** today. Use the sketch and magnifying glass to assist you in identifying a stonefly. The key characteristic of a stonefly is the presence of two tails.

Don't collect longer than 15-20 minutes,
and then it is okay to go up to another 10 minutes to look through the trays.

How many **leaf packs** did you search?____

How many **net samples** did you take (approximate)?_________________________________

What **other habitats** did you sample (please describe)?______________________________

Please describe **how abundant** the stoneflies were at this site:

None ☐ Rare ☐ Some ☐ Frequent ☐ Abundant ☐

Length of time spent collecting in the stream:______________ minutes

Total **number of jars** containing the bugs:_______

*Be sure to thoroughly **RINSE THE NET** to remove any creatures before leaving the site.*

Please continue on the other side.

Please describe any ways that your team's work or experience at this site was unusual, or anything unusual about the site itself:

Please include any suggestions for improvements in the procedure or any other comments on the **evaluation sheet**.

<u>Remember to take everything with you when you leave the site.</u>

EQUIPMENT LIST

Forceps
Jars
Trays
Water Sample (in plastic jar)
Magnifiers
Squirt Bottle
First aid kit
Study site sign
Bucket
Waders
Net
Ground Tarp/Shower Curtain
Garbage Bag
Nametags
Binder
Pencils

(HRWC staff will fill this out after identifying the stoneflies.)

Family	Abundance	Notes