A1. Title and Approval Sheet

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

Date: 7/24/2024
Version #4
Organization: Huron River Watershed Council (HRWC)
Previous versions: 2001, 2008, 2022

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

Signature: _____

_____

Signature upon approval:
MiCorps Reviewer: _____

_____
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 and spring collection events, there will be a training opportunity for volunteers to attend if they choose to be a leader or collectors.

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

Leaders direct the team and train new volunteers, and are responsible for ensuring data quality and that procedures are followed.

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.

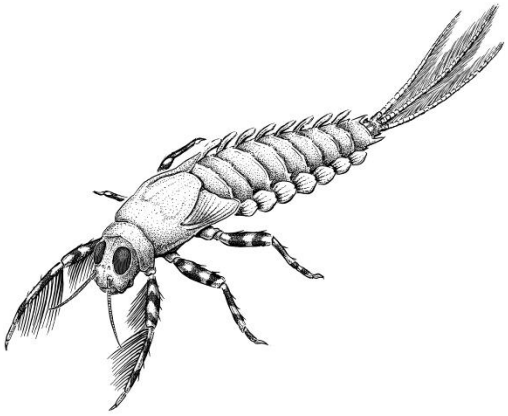
All leaders and collectors will be asked to retrain every 3 years, either through the in person training or through the recorded youtube video.

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 at least two macroinvertebrate volunteer training activities per year, held prior to the fall and spring collection event.. 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 sites 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:

Primary 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.

Secondary Sites

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 want to have a sample site on (i.e. Port Creek, Huron Creek, Regan Drain).

"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. There is nothing scientific about a density of 30, but rather it is what HRWC has historically been able to successfully pull off with our staffing, volunteers, and resource level.

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

Secondary sites are sampled in the River Roundup twice a year, one year on and one year off. Optimally they are sampled once in the fall and once in the spring on the same calendar year, but are sampled more if volunteer numbers allow for it. They are sampled every five years for the Measuring and Mapping program.

Table 1. 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	2*	28.1
Boyden	19.7	1	19.7
Chilson	40.4	1	40.4
Davis	176.2	5	35.2
Fleming	79.4	3	26.5
Hay	34.7	1	34.7
Honey (N)	69.9	2	35.0
Honey (S)	61.1	2	30.6
Horseshoe	78.3	3	26.1
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
Smith and Silver	67.1	2 (both primary sites)	33.5
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

* Arms, Woodruff, and Mill are each sampled at one location less than listed due to being unable to find a safe and accessible location. These are possible areas of monitoring expansion in the future if staff can locate a new site.

Table 2. 27 Primary Sites:

Site ID	Site Name	Latitude	Longitude
1	Arms Creek: Walsh Rd (private land)	42.4139	-83.8457
2	Boyden Creek: Delhi Rd (private land)	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
16	Honey Creek (N): Darwin Rd (private land)	42.4428	-83.9249
20	Honey Creek: Wagner Rd (private land)	42.3173	-83.7963
21	Horseshoe Creek: Merrill Rd	42.4526	-83.8216
23	Huron River: Flat Rock	42.0925	-83.2932
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 (private land)	42.2652	-83.6888
35	Millers Creek: Glazier Way	42.2881	-83.7029
37	Portage Creek: Dexter-Townhall Rd (private land)	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 (private land)	42.5408	-83.7460
47	Huron River: Commerce Rd	42.5927	-83.4849
49	Davis Creek: Silver Lake Rd (private land)	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
104	Silver Creek: Flat Rock Community Park	42.0984	-83.2791
106	Smith Creek: Flat Rock Community Center	42.0916	-83.2455
107	Hay Creek: Swarthout Rd (private land)	42.4895	-83.9170

Table 3. 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
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
30	Mann Creek: VanAmberg	42.5344	-83.7301
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
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
108	Portage Creek: Hell	42.4348	-83.9863

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
9	Fleming Creek: Botanical Gardens	42.3010	-83.6599
19	Honey Creek: Pratt Rd	42.2990	-83.8186
29	Malletts Creek: Scheffler Park	42.2522	-83.6979
43	Traver Creek: Dhu Varren Rd	42.3166	-83.7247
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

101	Traver Creek: Traver Road	42.3018	-83.7269
102	Swift Run: Sylvan Park	42.2522	-83.6865
103	Huron River: Huron Meadows	42.4741	-83.7835

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.