A1. Title and Approval Sheet

Quality Assurance Project Plan for
Rouge River Watershed Volunteer Benthic Macroinvertebrate Monitoring Program

Date: Dec. 22, 2016
Version # 3
Organization: Friends of the Rouge
QAPP Prepared for MiCorps by: Sally Petrella
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Other responsible individuals:

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Kevin Goodwin Title: Aquatic Biologist

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MiCorps Staff Use

Tracking Number:

MiCorps Reviewer: _____

☐ Approved ☐ Returned for modifications

Signature of reviewer Date

A2.Table of Contents

A3. Distribution List

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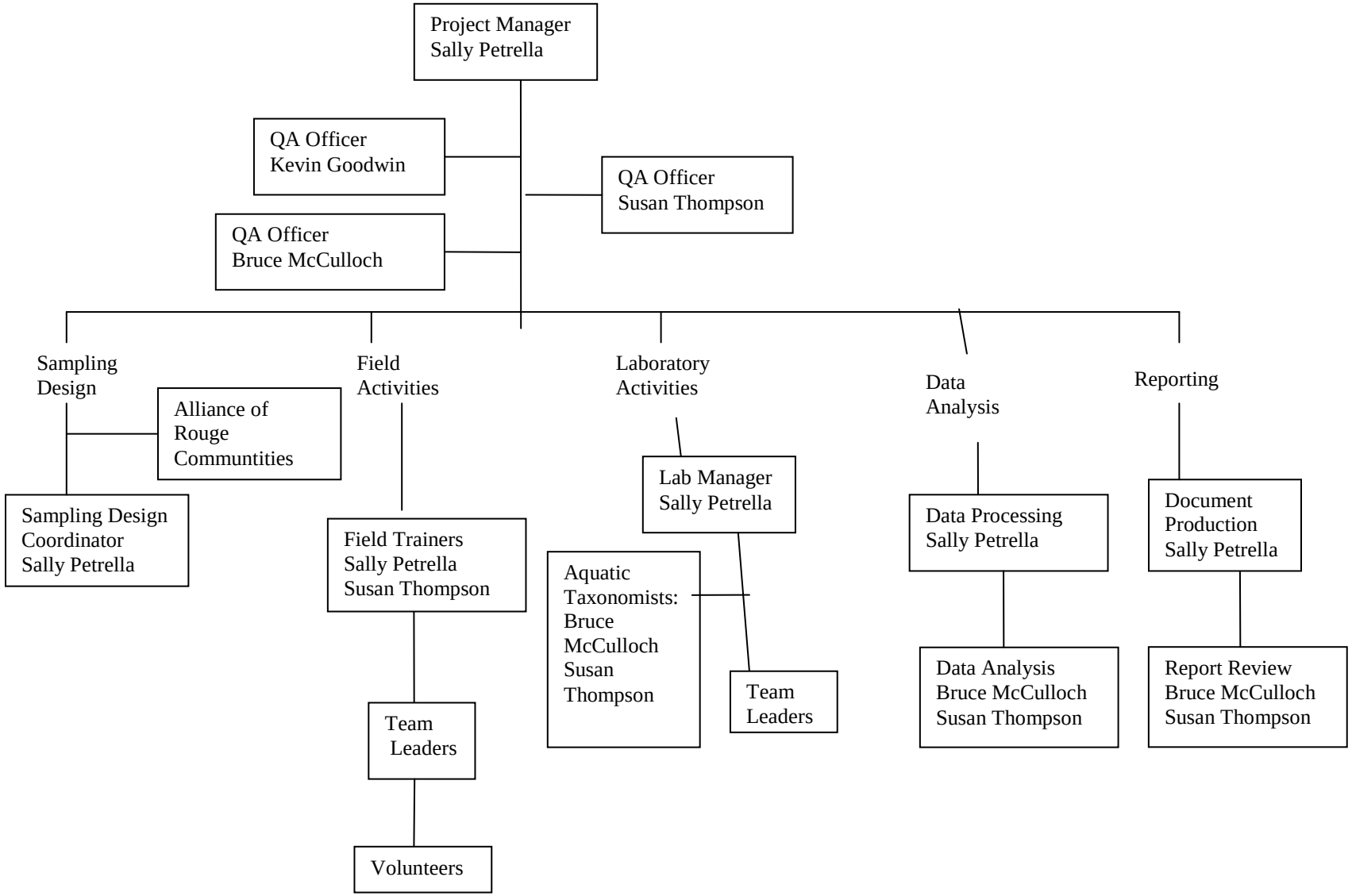
Team leaders

A4. Project Organization



A5. Problem Definition/Background

The Rouge River is listed by the International Joint Commission as one of 43 Areas of Concern in the Great Lakes Basin. In response, a Remedial Action Plan has been developed to guide restoration of impaired uses of the Rouge throughout the watershed. Use impairments that relate to benthic populations include loss of fish/wildlife habitat; degradation of benthic, fish, and wildlife populations; and eutrophication/undesirable algae growth. For most of these uses, the Rouge is considered severely impaired. The Rouge River is also listed on the Section 303(d) list submitted by the DEQ to the U.S. Environmental Protection Agency as required by the Clean Water Act, this list includes water bodies statewide that are not attaining one or more designated uses and require the establishment of Total Maximum Daily Loads (TMDLs) to meet and maintain Water Quality Standards. Portions of the Rouge have been placed on this list for violations of water quality standards for dissolved oxygen, aquatic biota, pathogens, and mercury and polychlorinated biphenyls both in fish tissue and ambient water. The degree of impairment can only be crudely estimated for most locations, as there is inadequate survey/monitoring information available. Although professional monitors provide detailed data for a few sites, the number of sites is very small and cannot adequately characterize locations throughout the watershed.

Volunteer monitoring has the potential to gather relevant, reliable data for a far larger number of sites than is possible with professional monitoring. In addition to other benefits, a volunteer program costs far less to run, and can garner a great deal of support from local communities. These factors create the potential for a monitoring program that is sustainable in the long run.

The Rouge River Watershed Volunteer Stream Monitoring Program will increase the number of stream sites throughout the Rouge River Watershed for which reliable data on benthic populations and riparian corridor conditions is available and increase public awareness of Rouge issues and support for corrective actions by promoting citizen involvement in monitoring problems and by publicizing projects and their results to all appropriate parties.

The data collected will be submitted to the Michigan Department of Environmental Quality through the Michigan Clean Water Corps. These agencies use it both in the Surface Water Assessment Section and the Non-Point Source Unit to screen for potential problems and also provide it to anyone who inquires about the watershed. The data will also be provided to the Alliance of Rouge Communities and to all participating volunteers.

A6. Project Description

Friends of the Rouge's Volunteer Monitoring Program (VM) trains adult volunteers to become team leaders and lead groups in benthic macroinvertebrate sampling every spring (April), fall (October) and winter (January) on Sampling Days. In the spring and fall, all benthic macroinvertebrates are collected, in the winter only stoneflies are collected.

Two levels of volunteers are involved: team leaders and volunteers. The Project Manager will train team leaders in sampling techniques and identification with the assistance of the Field Trainer. Team leaders will be responsible for collecting samples at each site, overseeing sorting by inexperienced volunteers, filling out data sheets, and preserving representative specimens. Inexperienced volunteers will search trays for organisms and sort them.

Sampling will be conducted as a team activity. Each team will consist of 1-2 experienced team leaders and 1-6 inexperienced volunteers. Each team will visit and sample two sites on Sampling Days. Teams will complete a Stream Macroinvertebrate Datasheet (or Stonefly Search Form) for each site sampled.

Sampling sites are located on wadable streams within the Rouge River Watershed. Every site is sampled each season for three years and then sampled on a rotating basis. The number of sites sampled on each sampling day is determined by the number of available team leaders because this is the limiting resource.

Following each Sampling Day, FOTR staff and aquatic biologists will sort and identify specimens. Aquatic insects will be identified to Family and any unusual or new Families will be verified by an aquatic biologist. Team leader Lab Identification Days will be held following spring and fall monitoring to give team leaders the opportunity to verify their field identifications.

Results for each site will be compiled and a report of the findings will be produced and distributed following each sampling event. Data forms will be submitted to MiCorps.

TASKS	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Team leader recruitment and training			X	X					X	X		
Volunteer recruitment	X	X	X	X				X	X	X		X
Sampling events	X			X						X		
ID Days				X	X					X	X	
Data analysis/reporting	X	X		X	X					X	X	
New site development			X						X			

A7. Data Quality Objectives

Precision

The following techniques will be reviewed during training and in retraining of team leaders every three years: (1) collecting style (must be thorough and vigorous), (2) habitat diversity (must include all habitats present and be thorough in each one), (3) the transfer of collected macroinvertebrates from the net to the pan to the ice cube tray to the sample jars (thoroughness is critical).

Since there is inherent variability in accessing the less common taxa in any stream site and program resources do not allow program managers to perform independent (duplicate) collections of the sampling sites, our goal for quality assurance is conservative. A given site's Stream Quality Index (SQI) score or total diversity (D) measure across macroinvertebrate taxa will be noted as "preliminary" until three spring sampling events and three fall sampling events have been completed. At least two of these six measures will be collected by different volunteer teams.

Data submitted by Team Leaders on Stream Macroinvertebrate Datasheets will be considered preliminary until reviewed by Project Manager. The Project Manager and aquatic biologists will identify all specimens collected (with the exception of crayfish and large clams and snails which are not collected) to Family and record on the Family Data Form (see Appendix). Data from the Family Form will then be compared MiCorps forms submitted by Team Leaders. Any errors will be corrected based on actual specimens collected and SQI and D recalculated.

The resulting measures of D and SQI for each site will be compared to the composite (median) results and each should have a relative percent difference (RPD) of less than 40%. Sample results for sites with three or more years of data will be compared to the median SQI and D. This statistic will be measured using the following formula:

$$RPD = [(Xc – Xv)/ Xc] \times 100,$$

where Xc is the composite measurement and Xv is an individual measurement for each parameter.

Sample results that exceed these standards should be then noted as "outliers" and examined to determine if the results are likely due to sampling error or a true environmental variation. If sampling error is determined the data point should be removed from the data record. Volunteer teams that generate more than one outlier should be observed by the Project Manager at the next sampling event and be considered for retraining and examined to determine if the results are likely due to sampling error or a true environmental variation.

Additionally, MiCorps staff will conduct a method validation review with the designated Project Expert to ensure his or her expertise, preferably prior to the first training session held by the Project Expert. This will be conducted with each new Project Expert added to a MiCorps monitoring program. This review will consist of a joint sampling event, with MiCorps staff jointly collecting, sorting and identifying the macroinvertebrates with the Project Expert. Any monitoring issues will be addressed on site. If no major concerns remain, the Project Expert will be considered "certified" by MiCorps.

Bias
Sites will be sampled by different team leaders at least once every three years in each season (two events among six sampling events, if conducted twice per year) to eliminate the effects of bias in individual collection styles.

Completeness
Every effort will be made to collect all species that inhabit the site. This includes using specific techniques for each available habitat multiple times. Sampling will continue until no new species are being found.

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

Comparability
To ensure data comparability, all volunteers in the watershed will follow the same sampling and site selection methods and use the same units of reporting. Program directors and trainers will learn the standard MiCorps monitoring methods at annual trainings by MiCorps staff and will train their volunteers to follow those methods to ensure comparability of results among all MiCorps programs. To the extent possible, the monitoring of all study sites will be completed on a single day.

A8. Training Requirements/Certification

Team leaders must :

1. Participate in one sampling day event (Bug Hunt or Stonefly Search) or have some prior experience in benthic sampling before they can attend training
2. Attend a training session conducted by the Project Manager
3. Sample with another experienced team leader
4. Attend bug identification sessions following sampling days
5. Attend periodic retraining

Trainings are provided by the Project Manager who will attend MiCorps training. Sign-in sheets are filled out by volunteers at every training and volunteer attendance is recorded afterwards in the office by FOTR staff on a spreadsheet that lists each volunteer.

SECTION B. PROJECT DESIGN AND PROCEDURES

B1. Study Design and Methods

Sampling Events

Sites are sampled during one day group sampling events held in the spring (April) and fall (October) for all benthic macroinvertebrates and in January for winter stoneflies. Team Leaders do the collecting, identifying to Order, filling out the MiCorps data forms, and collecting specimens for all taxa found with the exception of live crayfish, clams and snails. Other team members act as "pickers" and pick macroinvertebrates from material in trays. Data forms and samples are submitted to the Program Manager on the day of or within the week after the event.

If a team is unable to monitor their site on that day, the Project Manager and available volunteers will, if feasible, sample the site within the same two week period. If a site is temporarily inaccessible, such as due to prolonged high water, the monitoring time may be extended for two additional weeks. If the issue concerning inaccessibility is continued beyond the extended dates, then no monitoring data will be collected during that time and there will be a gap in the data.

Following sampling events, the Program Manager and Aquatic Taxonomists examine specimens, compare specimens collected to identifications on field form, and identify specimens to family in the lab.

Sampling Sites

Sites are chosen based on history of sampling for benthic macroinvertebrates at the site, available in stream benthic macroinvertebrate habitats, accessibility for volunteers, and community interest in site. Sites will all be located in the headwaters of the Rouge until benthic macroinvertebrate populations improve in order to maintain volunteer interest. As the Rouge River water quality improves due to the massive federally funded cleanup, sites will be added downstream. Representative sites are sampled in the four headwater subwatersheds.

Sites are sampled every season for three years and then sampled on a rotating basis every few years. Problem sites, sites of particular interest to a community, and sites that may potentially be impacted by a project are sampled every season or when necessary. Approximately 100 feet of stream is sampled.

Sampling Procedures

Sampling the benthic community: Multiple collections will be taken from each habitat type present at the site, including riffle, rocks or other large objects, leaf packs, submerged vegetation or roots, and depositional areas, while wading and using a D-frame net. The trained Team Leader will record the number of locations sampled within the monitored reach in each habitat type and note the locations sampled on a site map. The trained Team Leader will transfer the material from the net into white pans. The volunteers (Pickers) will pick out samples of all different types of macroinvertebrates from the pans and sort them by like organism into white ice cube trays. The Team Leader will instruct

and assist other team members in detecting and collecting macroinvertebrates in the sorting pans, including looking under bark and inside constructions made of sticks or other substrates. Potential sources of variability such as weather/stream flow differences, season, and site characteristic differences will be noted for each event and discussed in study results. There are places on the data sheet to record unusual procedures or accidents, such as losing part of the collection by spilling. Once all material in white pans has been "picked," Team Leader will identify specimens to Order, count individuals, and fill out MiCorps form using C (common) for more than 10 individuals and R (rare) for l0 or less, then transfer 5-6 individuals of each taxa into jars of 90% ethyl alcohol for later identification. One jar is utilized for each sampling site.

B2. Sample Handling and Custody

All macroinvertebrate samples collected in the field are placed into jars of 95% ethyl alcohol. Jars are pre-labeled for the site with a paper label that is written in pencil and placed in jar prior to the sampling event. The label contains the date, Field id and the site name. The Team Leader is responsible for labeling and securely closing the jars and returning the jars and all equipment.

At the Program Building, custody of samples and data sheets is transferred from the Team Leader to the Program manager. Upon return to the Program Building, the collections are checked for labels and placed together with corresponding data sheets. Within the next two weeks, the Program Manager and Aquatic Biologists check each specimen jar, identify all individuals to family and check against the field completed data sheet. Stereo dissecting microscopes are used to identify specimens to the family level. Texts consulted include: A Guide to Common Freshwater Invertebrates of North America by Voshell, Aquatic Entomology by McCafferty, An Introduction to Aquatic Insects of North America by Merritt & Cummins, and Guide to Aquatic Invertebrates of the Upper Midwest by Bouchard. Any inconsistencies in Team Leader identification are reconciled with the specimens, and a family form is completed. Following that, an identification day is held in the lab and Team Leaders check samples and resolve any inconsistencies between field identification and specimens collected.

Samples are maintained by FOTR, one jar for each site and sampling event, and stored at the Program office indefinitely. The alcohol is carefully changed in the jars every few years.

B3. Quality Control

Equipment Quality Control:

- Check to make sure equipment is in working order and not damaged
- Clean equipment before and after taking it into the field
- Label ethyl alcohol with purchase date and track all use in logbook

Field Procedures Quality Control:

- At least once every three years in each season: change the composition of the field crews to maintain objectivity and minimize individual bias

- Review field records before submitting for analysis to minimize errors

Data Analysis Quality Control:

- Check all calculations twice
- Hard copies of all computer entered data should be reviewed for errors by comparing to field data sheets
- Qualified professionals review data analysis methods and results once year

Since our evaluation is based on the diversity in the community, we attempt to include a complete sample of the different groups present, rather than a random sub-sample. We do not assume that a single collection represents all the diversity in the community, but rather we consider our results reliable only after repeated collections spanning at least three years. Our results are compared with other locations in the same river system that have been sampled in the same way. All collectors attend an in-stream training session, and most sites are sampled by different collectors at different times to diminish the effects of bias in individual collecting styles. Samples where the diversity measures diverge substantially from past samples at the same site are re-sampled by a new team within two weeks when possible. If a change is confirmed, the site becomes a high priority for the next scheduled collection. Field checks include checking all data sheets to make sure each habitat type available was sampled, and the team leader examines several picking trays to ensure that all present families have been collected.

B4. Instrument/Equipment Testing, Inspection, and Maintenance

FOTR purchases and maintains the following items for use by each team:

D-frame nets (firmly attached to poles and free of holes)
Chest Waders (clean and dry and do not leak)
Forceps (with tips that meet)
Magnifiers (not scratched)
Ice trays for sorting (clean and dry)
Developer trays (clean and dry)
Plastic spoons (clean and dry)
Plastic droppers (clean and dry)
Celsius thermometer
Ground cloth (clean and dry)
Collection jars with poly seal tops label and ethanol
Alcohol wipes/band-aids
Latex gloves
5-gallon bucket (clean and dry)
Nitrile gloves
Long rubber gloves and cotton liners
Car signs
Laminated identification keys
Data Forms
Site maps

All equipment is stored at Friends of the Rouge and inspected by Project Manager or Project Assistant once it is returned to the storage site after each monitoring event. It is also inspected again before it is sent out for sampling. Nets and waders are inspected for holes and replaced if necessary, all other items are cleaned and stored.

Invasive species known to be in the Rouge River system include round goby, zebra mussels, Asian clams and Eurasian milfoil. To minimize the risk of spreading known and potential new aquatic invasive species the following measures will be taken:

- On sampling and training days, each team will be assigned sites within the same subwatershed and will sample upstream sites before downstream sites to decrease the likelihood of carrying species farther up into the watershed. In the event that a team must sample within different watersheds, all equipment will be thoroughly disinfected with a diluted bleach solution applied by spraying or sponge so surface is thoroughly exposed to bleach solution for 10 minutes.

- Before a team leaves a site, waders and footwear will be inspected and any plants or excessive mud will be removed. Nets, waders and trays will be rinsed in the stream.

- All equipment is thoroughly cleaned and dried following every sampling and training event. Nets and chest waders are inspected for holes and repaired or replaced if necessary. All equipment is inspected again before it is used.

- If invasive aquatic plants or animals are collected from a site, the grantee will take steps to minimize the spread of these species. They will not be returned to the waterbody. Invasive plant material and invasive clams or mussels will be bagged and disposed of at a landfill.

B5. Data Management

Field data sheets are completed in the field and checked by FOTR once submitted. Any inconsistencies or incomplete forms are investigated by FOTR. Organism identifications are rechecked by volunteers on Bug Identification Day, verified by Project Manager or Assistant, and re-checked by aquatic biologists. Hard copies of all data sheets are then sent to the MDEQ with voucher samples if requested. Data is input into Excel spreadsheet by FOTR.

C. ASESSMENT AND OVERSIGHT

C1. System Audits and Response Actions

Team leader performance will be evaluated by comparison of samples to data calculations on data sheets. Team leaders will be provided with additional training if needed.

Data quality will be evaluated by comparing the number of Families found over time to number of Families found by past surveys at sites where this information is available. The QA Officer performs systems and data quality audits twice yearly. Any identified procedural problems will be corrected based on recommendations from the QA Officer.

C2. Data Review, Verification and Validation

The Project Manager, the QA Officer, and the MDEQ review all sampling data and determine if the data meet QAPP objectives. Decisions to reject or qualify data are made by the Project Manager and the QA Officer.

The Project Manager will recheck any findings out of the ordinary by re-sampling the site as soon as possible. ALL samples are re-identified by Project Manager and re-checked by aquatic biologist.

Data is input by Assistant Project Manager and proofread against the original data sheets. Errors in data are corrected. Outliers are investigated. Problems with data quality will be discussed in the interim and final reports to data users.

C3. Reconciliation with Data Quality Objectives

Data forms will be checked for completeness and computations checked following sampling events and on Bug Identification Day when samples are checked against forms. If data quality indicators do not meet project objectives, they will be discarded or limitations will be detailed in all reports.

If failure to meet project specifications is found to be unrelated to sampling error, specifications may be revised for the next sampling session. Revisions will be submitted to the MDEQ- WB for approval.

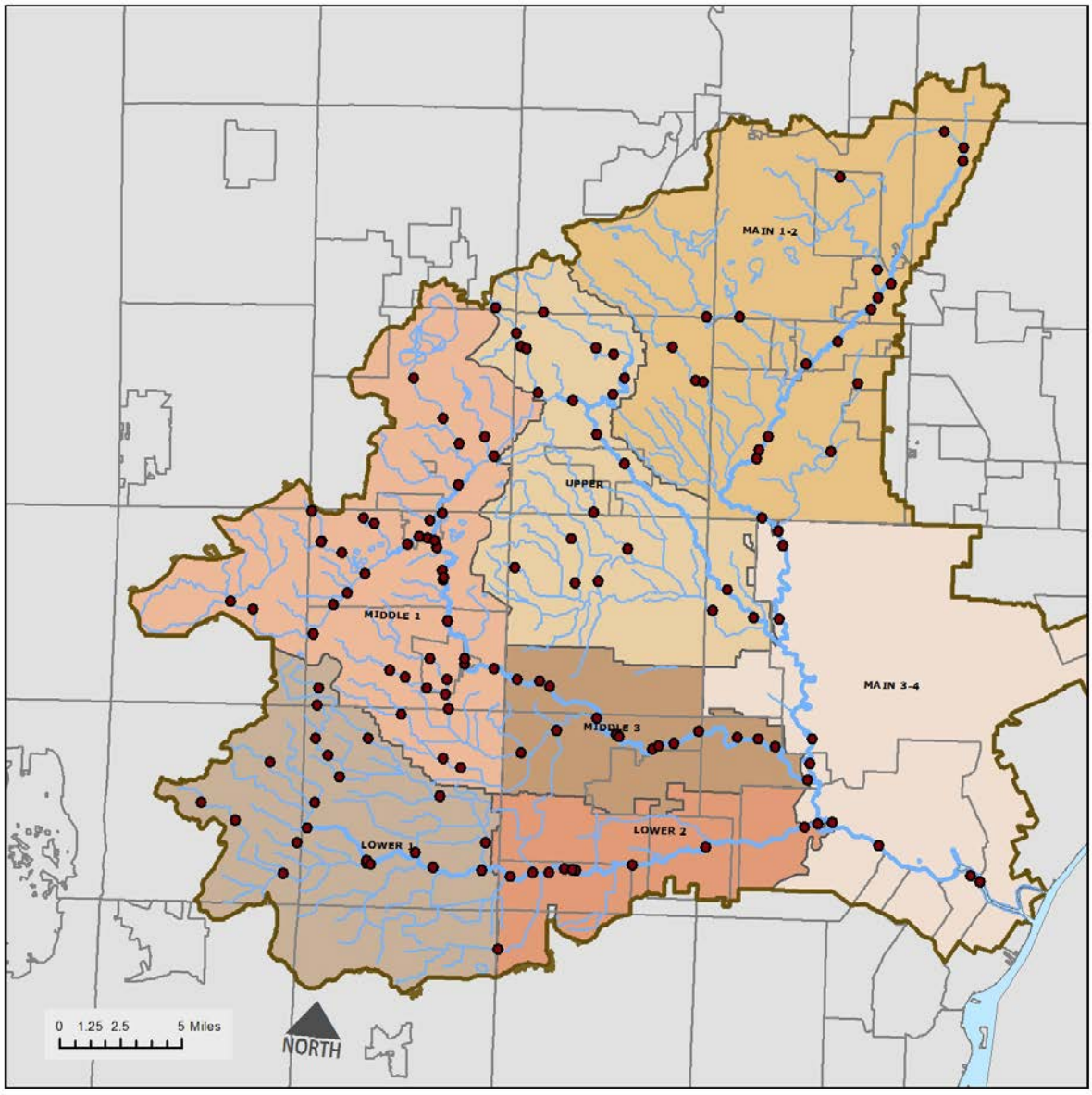
C4. Reporting

Bug Hunt reports will be produced following the spring and fall bug hunts and following the winter stonefly search. Reports will consist of data results, interpretation of data (if possible), information on project status, and volunteer highlights. Reports will be forwarded to all participants, MiCorps, and the Alliance of Rouge Communities.

Each team leader and teacher must complete the two page benthic macroinvertebrate form in the field (Appendix A). Several specimens of each type of organism found must be collected at the site and preserved in the jar of alcohol provided. This jar has a label on the outside and on the inside, with the station location and date. An additional taxonomy form is completed during Bug Identification Day. Following Bug Identification Day, data are input into an Excel spreadsheet by Project Manager. Data is submitted to the MiCorps website. Voucher collections are maintained by Friends of the Rouge (FOTR), 4901 Evergreen Road KM Bldg, Dearborn, MI 48128.

Appendix A

FOTR Sampling Sites



MiCorps Site ID#:_____

Michigan Clean Water Corps

Stream Macroinvertebrate Datasheet

Stream Name: _____

Location:_____ (Circle one: *Upstream* or *Downstream* of road?)

Date:_____ Collection Start Time:_____ (AM/PM)

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

Latitude:_____ Longitude:_____

Monitoring Team:

Name of Person Completing Datasheet:_____

Collector:_____

Other Team Members:_____

Stream Conditions: Water Temperature**:**_____°C Average Water Depth:_____ feet

Is the substrate covered with excessive silt? ____ No ____ Yes (describe:_____)

Substrate Embeddedness in Riffles: ____ 0-25% ____ 25-50% _____ > 50% ____ Unsure

Did you observe any fish or wildlife? ( ) Yes ( ) No If so, please describe:_____

Macroinvertebrate Collection: Check the habitats that were sampled. Include as many as possible.

____ Riffles
____ Cobbles
____ Aquatic Plants
____ Runs
____ Stream Margins
____ Leaf Packs
____ Pools
____ Undercut banks/Overhanging Vegetation
____ Submerged Wood
____ Other (describe:_____ _____)

Did you see, but not collect, any **live crayfish**? (___ Yes ___ No), or **large clams**? (___ Yes ___ No)
remember to include them in the assessment on the other side!

Collection Finish Time: _____(AM/PM)

Datasheet checked for completeness by:_____ Datasheet version 1/12/09
Data entered into MiCorps database by:_____ Date:_____

MiCorps Site ID#:_____

Michigan Clean Water Corps

IDENTIFICATION AND ASSESSMENT

Use letter codes [**R** (rare) = 1-10, **C** (common) = 11 or more] to record the approximate numbers of organisms in each taxa found in the stream reach.

*** Do NOT count empty shells, pupae, or terrestrial macroinvertebrates***

Group 1: Sensitive

____ Caddisfly larvae (Trichoptera)
EXCEPT Net-spinning caddis
____ Hellgrammites (Megaloptera)
____ Mayfly nymphs (Ephemeroptera)
____ Gilled (right-handed) snails (Gastropoda)
____ Stonefly nymphs (Plecoptera)
____ Water penny (Coleoptera)
____ Water snipe fly (Diptera)

Group 2: Somewhat-Sensitive

____ Alderfly larvae (Megaloptera)
____ Beetle adults (Coleoptera)
____ Beetle larvae (Coleoptera)
____ Black fly larvae (Diptera)
____ Clams (Pelecypoda)
____ Crane fly larvae (Diptera)
____ Crayfish (Decapoda)
____ Damselfly nymphs (Odonata)
____ Dragonfly nymphs (Odonata)
____ Net-spinning caddisfly larvae
(Hydropsychidae; Trichoptera)
____ Scuds (Amphipoda)
____ Sowbugs (Isopoda)

Group 3: Tolerant

____ Aquatic worms (Oligochaeta)
____ Leeches (Hirudinea)
____ Midge larvae (Diptera)
____ Pouch snails (Gastropoda)
____ True bugs (Hemiptera)
____ Other true flies (Diptera)

STREAM QUALITY SCORE

Group 1:
____ # of R's * 5.0 = ____
____ # of C's * 5.3 = ____
Group 1 Total = _____

Group 2:
____ # of R's * 3.0 = ____
____ # of C's * 3.2 = ____
Group 2 Total = _____

Group 3:
____ # of R's * 1.1 = ____
____ # of C's * 1.0 = ____
Group 3 Total = _____

Total Stream Quality Score = _____
(Sum of totals for groups 1-3; round to nearest whole number)

Check one:
____ Excellent (>48)
____ Good (34-48)
____ Fair (19-33)
____ Poor (<19)

Identifications made by:_____

Rate your confidence in these identifications: Quite confident 5 4 3 2 1 Not very confident

Datasheet checked for completeness by:_____ Datasheet version 1/12/09
Data entered into MiCorps database by:_____ Date:_____

Creek:_____ Sampling date:_____ ID Date:_____

Sampling Site:_____ Identifier:_____

Please write the number of different TYPES (not individuals) for each Order. Put a check by the family name if it has been confirmed.

INSECTA

_____ PLECOPTERA – STONEFLIES

- ♥ Capniidae — slender winter stonefly *(adults walk on snow)*
- ♥ Nemouridae — Nemourid broadback
- ♥ Perlidae — Perlid stonefly *(common stonefly in early summer)*
- ♥ Perlodidae — Perlodid stonefly
- ♥ Taeniopterygidae — broad-back stonefly *(Taeniopteryx is relatively tolerant)*

_____ EPHEMEROPTERA – MAYFLIES

- Baetidae — small minnow mayfly
- Baetiscidae — armored mayfly
- Caenidae — small, square gills *(often in silt)*
- Ephemeridae — common burrower
- ♥ Ephemerellidae — spiny crawler
- Heptageniidae — flathead mayfly *(If time, are there... Stenacron? Stenonema? Heptagenia?)*
- ♥ Isonychiidae — brush-legged mayfly *(formerly grouped with Oligoneuridae)*
- ♥ Leptophlebiidae — pronggill
- ♥ Metretopodidae — cleft minnow mayfly
- ♥ Oligoneuridae — brush-legged mayfly
- ♥ Polymitarcyidae — pale burrowers
- Potamanthidae — hacklegill
- Siphloneuridae — primitive minnow mayfly
- Tricorythidae — little stout crawlers *(quite tolerant)*

_____ HEMIPTERA – TRUE BUGS

- Belostomatidae — giant water bug
- Corixidae — water boatman
- Gerridae — water strider
- Mesoveliidae — water treaders
- Naucoridae — creeping water bug
- Nepidae — water scorpions
- Notonectidae — back-swimmers
- Pleidae — pigmy back-swimmers
- Veliidae — short-legged striders

_____ MEGALOPTERA — DOBSONFLIES

- ♥ Corydalidae — dobson fly or hellgrammite
- Sialidae — alderfly

_____ COLEOPTERA — BEETLES

- Chrysomelidae — aquatic leaf beetle
- Dryopidae — long-toed water beetle
- Dytiscidae — predacious diving beetle
- Elmidae — riffle beetle (larvae + adults)
- Gyrinidae — whirligig beetle
- Haliplidae — crawling beetle
- Hydrophilidae — water scavenger beetle
- Lampyridae
- Noteridae — burrowing water beetle
- Psephenidae — water penny
- Scirtidae — marsh beetle
- Staphylinidae — rove beetle

_____ TRICHOPTERA – CADDISFLIES

(Build Cases and/or Spin Nets)

- ♥ Brachycentridae — humpless case makers
- ♥ Glossosomatidae — saddle-case makers *(in cool streams with current)*
- Goeridae
- Helicopsychidae — snail-case caddisfly *(tolerate warmer water)*
- Hydropsychidae — common net-spinner *(often abundant)* *(Were Cheumatosyche present, if looked for?)*
- Hydroptilidae — micro (or purse-case) caddisfly *(don't require flow)*
- ♥ Lepidostomatidae — Lepidostomatid case makers
- Leptoceridae — long-horned case makers
- Limnephilidae — northern caddisfly *(many are scrapers)*
- Molannidae — hoodcase maker
- ♥ Odontoceridae — strong-case makers
- Philopotamidae — finger-net caddisfly *(in riffles only)*
- Phryganeidae — giant case-maker *(common in slow flows)*
- Polycentropodidae — spotted head
- ♥ Psychomyiidae — net-tube caddisfly
- ♥ Rhyacophilidae — free-living caddisfly
- Uenoidae

ODONATA – DAMSEL AND DRAGONFLIES

_____ ANISOPTERA – DRAGONFLIES

- Aeshnidae — darner
- Cordulegastridae — biddy
- Corduliidae
- ♥ Gomphidae — clubtail
- Libellulidae — common skimmer

_____ ZYGOPTERA — DAMSELFLIES

- Calopterygidae — broad-winged damselfly
- Coenagrionidae — narrow-winged damselfly
- Lestidae — spread-winged damselfly

_____ DIPTERA — TRUE FLIES

- ♥ Athericidae — watersnipe fly
- Ceratopogonidae — no-see-um
- Chironomidae — midge
- Culicidae — mosquito
- Dixidae — dixid midges
- Dolichopodidae — aquatic long-legged fly
- Empididae — aquatic dance fly
- Ephydridae — shore, brine fly
- Ptychopteridae — phantom crane fly
- Sciomyzidae — marsh fly
- Simuliidae — black fly
- Stratiomyidae — soldier fly
- Tabanidae — deer fly, horse fly
- Tipulidae — crane fly

NON-INSECT TAXA

MISCELLANEOUS MACROINVERTEBRATES

Most of the macroinvertebrates we collect are insects, but some are other Arthropods, and some are worms, leeches, flatworms, snails, or clams.

MOLLUSCA – SNAILS, CLAMS, ETC.

_____ **GASTROPODA – SNAILS AND LIMPETS** *(Have a single shell.)*
- Ancylidae – limpet; have a flat cone
- Right-handed snail
- Physidae — pouch snail; left-handed spiral
- Planorbidae – coiled in one plane; has no operculum

_____ **PELECYPODA – BIVALVES; CLAMS AND MUSSELS**

(Have a pair of symmetrical shells joined by a ligament.)
- Dreissenidae — zebra mussels
- Sphaeriidae – fingernail clams; usually tiny with a thin shell (either Pisidium or Sphaerium)
- Unionidae – large unless very young (either Anodonta or Elliptio)

_____ **CRUSTACEA**
- Decapoda — crayfish
- Isopoda – sowbug
- Amphipoda — scud

_____ **PLATYHELMINTHES**
- Turbellaria – flatworm
- Oligochaeta — worm

_____ **ANNELIDA**
- Hirudinea – leech

_____ **ARACHNIDA – SPIDERS, MITES**
- Hydracarina — water mites;parasites

_____ **PORIFERA – FRESHWATER SPONGES**

_____ **BRYOZOA – MOSS ANIMALS**

TALLY

_____**1. Number of taxa** (add up all the numbers you wrote on the line next to the order name)

_____**2. Number of non-insect taxa** (add up all the numbers from p.2 - misc. macroinvertebrates)

_____**3. Number of insect taxa** (subtract #2 above from #1)

_____**4. Number of EPT families** (add up number of families of mayflies, stoneflies, and caddisflies)

_____**5. Number of sensitive families** (add up all the number of families you found with a heart by it)

FOTR Benthic Macroinvertebrate Monitoring Program
Site Sketch

Field ID: Location:

Date:_____

Team Leaders:_____

1. Mark all the locations where samples were taken.
2. Draw any changes and note any discharges or concerns
3. Mark all locations with an “x” where samples were taken

Winter Stonefly Search

Benthic Macroinvertebrate Sampling Program

Data Form

Site Field Id:_____ Site name:_____ Date:_____

Start Time:_____ End Time:_____

Air temperature:_____°C Water temperature:_____°C Weather:_____

Collector:_____Identifier:_____

Person who filled in data sheet:_____

Check the types of habitats and substrates from which invertebrates were collected:

___Riffles	___Runs	___Pools
___Cobbles	___Margins	___Undercut banks/ Over-hanging vegetation
___Aquatic plants	___Leaf packs	___Submerged wood
___Other (Please describe)_____		

******Stonefly Distinguishing Characteristics:*** *Abdomen ends in two tails, No gills visible on abdomen, 2 tarsal claws*

Record the approximate numbers of stoneflies found in the stream (write 0 if none)

_____Stoneflies (put 5-6 specimens in collection jar)

List any other benthic macroinvertebrates or fish found (Please do not collect unless there is a chance it is a stonefly)

Describe any problems noticed at site (unusual discharges to river, etc.)

For Lab Use Only: _____# capnids _____# perlodids _____# other _____

Lab identifier:_____