

A2. Table of Contents

A3. Distribution List

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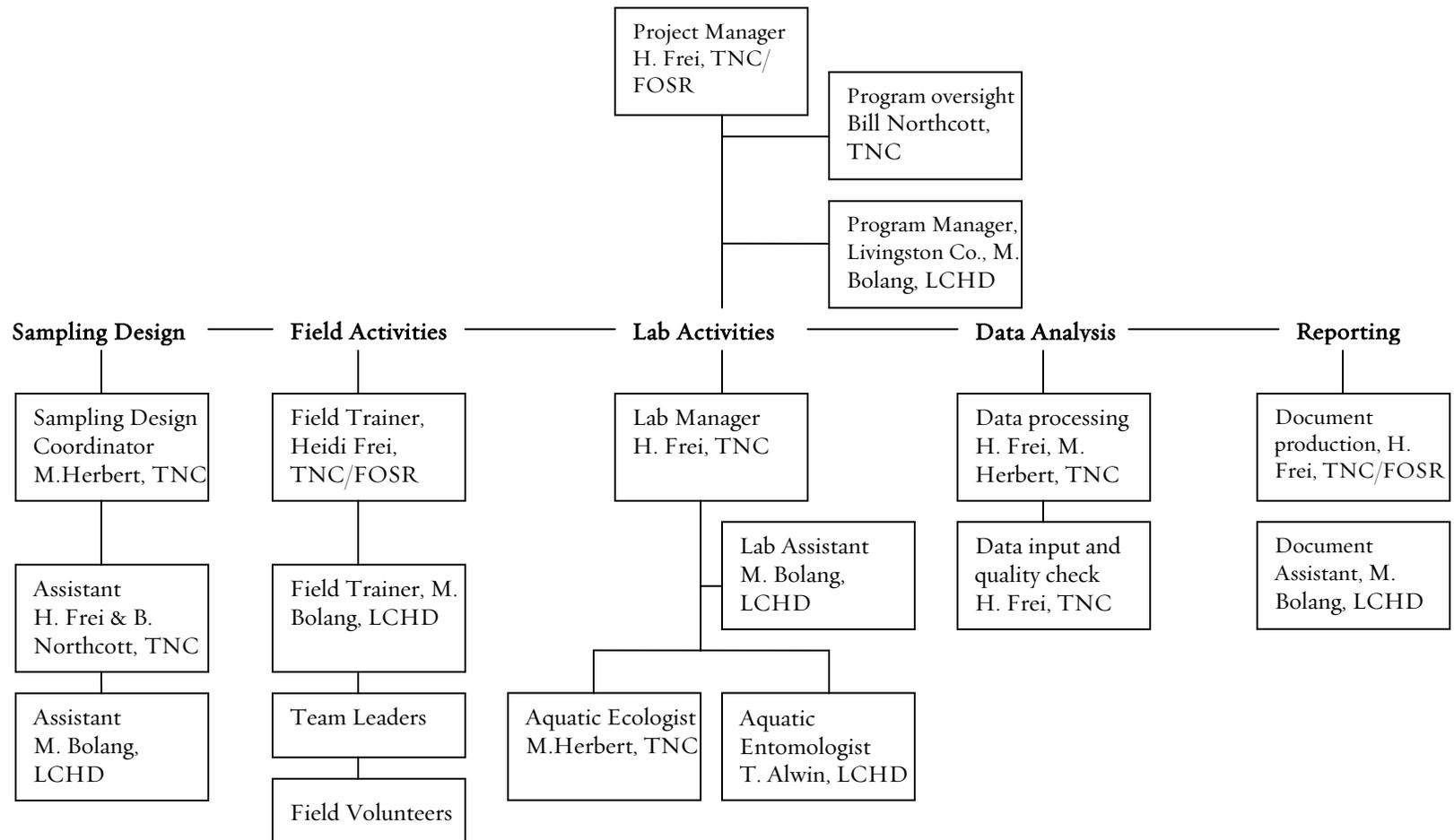
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Team Leaders

Friends of the Shiawassee River
Volunteers

Livingston County Volunteers

A4. Project Organization



A5. Problem Definition & Background

Located in a highly agricultural region, the Shiawassee River has historically been stressed by excessive levels of sedimentation as a result of incompatible land practices. As development patterns have progressed, the watershed is now impacted by urban development, primarily in the southernmost portions in the headwaters region. The Upper-2 Shiawassee River Watershed, located in Livingston County, is rapidly developing as growth spreads to more rural areas. The growth that has occurred appears to have had minimal impacts on the water resources; however, there has been very little monitoring. A unique opportunity exists for this rapidly developing watershed to collect monitoring data that could be used to minimize the effects of development on the sub-watershed.

The River, including its headwaters, is a top conservation priority and has been identified as one of the best remaining examples of a warm-water river system within its ecoregion. The River and its habitats also contribute significantly to the quality of life of the people of Shiawassee, Livingston and neighboring counties, providing recreational opportunities and a connection to natural resources for many. The Shiawassee is the principle river flowing into the Shiawassee National Wildlife Refuge leading to the Saginaw Bay, a threatened coastal area in Lake Huron. Throughout its course, the river support 59 species of fish and at least 14 species of freshwater mussel. The river also plays an integral role in the travels of migratory waterfowl and shorebirds.

This project will address sediment, the largest water quality issue in the mainstem and the headwaters of the Shiawassee River, which has the potential to damage habitat for macroinvertebrates and spawning habitat for many species of fish, including those valued for recreation. More specifically, the goals of the proposed partnership are:

- To collect baseline data and initiate a long-term data set on health of the Shiawassee River;
- To determine variability in health of the River within different environs, such as agricultural, urban, and naturally vegetated areas, within the watershed;
- To engage public and youth in data collection and foster appreciation of the Shiawassee River and its habitats.
- To utilize data to mitigate the impacts of future development and to better understand the impacts of existing development.

As human impacts on the Shiawassee River continues to grow, it is our ultimate goal to create a long-term data set to supplement that collected by the MDEQ to continually monitor changes in the ecosystem. Results will be reported following three years of benthic community data collection

This project will both collect reliable data while actively engaging and educating the public in conservation issues and, consequently, building local support for natural resources. Through increased public awareness we anticipate more support from communities and funders within the watershed resulting in long-term sustainability.

A6. Project Description

The Nature Conservancy in Michigan (TNC) and the Livingston County Health Department (LCHD) will partner with the Friends of the Shiawassee River (FOSR), a volunteer-based organization, to monitor benthic macroinvertebrate communities within the Shiawassee River watershed. Monitoring will be conducted twice annually (spring and fall), at five sites within and along the middle-mainstem of the river and five sites in the Shiawassee River headwaters located in Livingston County. All sites will be sketched and monitored as an event on one day each season and, with the assistance of aquatic ecologists, all samples will be identified to family level. It is the intent that additional parameters, such as chemical analysis, habitat assessment, and sampling sites will be added as interest and volunteer numbers grow with the program in future years.

This program will rely upon recruitment and training of volunteers through local newsletters, press releases, websites and relationships with community groups. Project managers from LCHD and TNC will be responsible for recruitment and training of volunteers for spring and fall sampling.

Prior to collection events, 'team leader' volunteers will be required to attend training from FOSR or LCHD. Team leaders will get additional instruction from staff on overall procedure, safety precautions, data collection, and sample identification in order to assist other volunteers in collecting quality data. The team leaders will also receive additional instruction in the field on proper sampling techniques. Knowledge of material will also be tested through mandatory quizzes given to team leaders. To track volunteer activities, TNC maintains an Access-based Volunteer Management System. FOSR is currently developing a similar method to update its records.

Sampling will be conducted as a team activity with one team per sample site. All sites will be located in wadable, accessible portions of the Shiawassee River watershed within Shiawassee and Livingston Counties. Each team will consist of 1-2 team leaders and 1-6 additional collectors/sorters. Sampling will be conducted in one event and specimens will be preserved for a separate identification event, to occur no more than 2 weeks later than sampling. Collected specimens will be identified to family with the assistance of aquatic biologists.

A7. Data Quality Objectives

Precision

The following techniques will be reviewed during training and in regular retraining of team leaders every three years: 1.) thorough and vigorous collecting style, 2.) habitat diversity, inclusive of all habitats present at sampling site, and 3.) the transfer of collected macroinvertebrates, with particular attention to thoroughness, from the net to sampling jars. These techniques will also be reiterated and stressed by project staff and team leaders prior to sampling on collection day.

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) collection 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. The resulting measures of D and SQI for each site will be compared to the composite (median) results and each should be within two standard deviations of the median. Each measure is to be compared to the median of all samples taken from a given site.

Bias

Volunteers will sign in and record activities at each sampling site for each sampling event. Sites will be sampled by different team leaders at least once every three years in each season (spring and fall) to examine the effects of bias in individual collection styles. The new measure should be within two standard deviations of the median of past measures. Sites not meeting this DQO will be evaluated by the Program Expert.

Completeness

Following a QA review of all collected and analyzed data, data completeness will be assessed by dividing the number of measurements judged valid by the number of total measurements performed. The data quality objective for completeness for each parameter for each sampling event is 90%. If the program does not meet this standard, the Program Manager will consult with MiCorps staff to determine the primary causes of data invalidation and develop an action plan to improve the completeness of future sampling events.

Representativeness

Study sites are selected to represent the full variety of stream habitat types available locally, emphasizing the inclusion of riffle habitat. All available habitats within the study site will be sampled and documented to ensure a thorough sampling of all of the organisms inhabiting the site. 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 subwatersheds will be added in the future 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 conducted 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. For each sampling event not completed on a single day, monitoring by volunteers will be conducted within a two week period.

A8. Special Training & Certification

Program managers from LCHD and FOSR/TNC will be trained following MiCorps procedures. Project managers will provide training to team leaders and collector volunteers. Team leaders must participate in one sampling day event (prior experience in benthic training will be sought out), attend a training session conducted by the project manager in either Livingston or Shiawassee County, sample jointly with another team leader, attend bug identification sessions following sampling days, sign in at all events, and participate in regular retraining events.

SECTION B: PROGRAM DESIGN AND PROCEDURES

B1. Study Design and Methods

Sampling Events

Ten sites will be sampled during a one-day group sampling event held in the spring (May) and fall (September) each year for all benthic macroinvertebrates. Each site will also be assessed for habitat every 5 years. Prior to collection events, “team leader” volunteers will be required to attend training from FOSR and LCHD. The team leaders will get additional instruction from staff on overall procedure, safety precautions, data collection, and sample identification in order to assist other volunteers in collecting quality data. The collector will also receive additional instruction in the field on proper sampling techniques. All other volunteers that attend our collection events will be the “pickers” and pick macroinvertebrates from material in the trays help sort into jars. Data forms and samples collected during the event are then submitted to the program managers on the day of the event or within  week of the event. A timeline of all tasks to be performed is included in [Appendix A](#).

Following the collecting event the program managers will schedule an identification workshop. During this workshop volunteers will help sort the macroinvertebrates collected into bug groups and the aquatic ecologist will further identify the specimens to family using a microscope.

Sampling Sites

Sites will be selected based on the following criteria: safety, accessibility, quality of habitat, prior sampling history (at some sites with the DEQ and TNC), ability to inform future conservation efforts, 303(d) list, proposed drain projects, locations of targeted conservation practices, existing development and sites of potential development. Five sites in Shiawassee County have been selected as representatives of varying habitat types in order to determine variability and draw comparisons between locations. The following sites will be monitored in Shiawassee County:

1. DeVries Nature Conservancy (north of Owosso, mainstem)
2. Six Mile Creek (tributary near Henderson)
3. Webber Drain (north of Vernon, DEQ site #12)
4. Henderson Park (county park in Henderson, north of Owosso, mainstem)
5. North State Drain (DEQ site #4)
6. DEQ site #1 (2000) near Byron (alternate)
7. DEQ site #7 (2000) near Bancroft (alternate)

A map of our proposed sampling sites in Shiawassee County is attached in [Appendix B](#) 

The morning of each collection event, volunteers will meet in a centralized location. During this meeting there will be a quick overview of the study for new volunteers. Maps will also be distributed giving detailed information on how to find the

sites as well as the exact location on where to collect the specimens. Sites will be sampled by different team leaders annually to examine the effects of bias in individual collection styles.

If a team is unable to monitor their site on our collection day, or the weather does not cooperate on our scheduled collection day, then the team/teams will be given a two week period to sample their sites and return the data and equipment to the project managers. If an issue concerning inaccessibility continues beyond the two-week period, then no monitoring data will be collected during that season and there will be gap in the data.

Sampling Procedures

Procedures for our sampling events will be based on the MiCorps “Techniques for Stream Macroinvertebrate Collecting” document. The team leader will make sure the collector takes multiple samples from each habitat types present at each site, including riffle, quiet place/pool, undercut bank/overhanging vegetation or roots, submerged or emergent vegetation, rocks/logs, and leaf packs while wading and using a D-frame kick net. The collector will start downstream and work upstream  avoid disturbing the areas yet to be sampled. Once specimens are collected the collector will transfer the material from the net into the white pans. During this time the team leader will be communicating with the collector to make sure samples are taken from each habitat. The leader will also be recording information such as stream name, location, date, monitoring team, stream conditions and site sketch on the “Stream Macroinvertebrate Datasheet”. Once the specimens have been transported into the white pans, the pickers will be picking out the macroinvertebrates from the rocks and leaves and putting them into a collection jar filled with 95% ethyl alcohol for later identification. Specimens of each invertebrate  will continue to be preserved until at least 15 individuals of each type are preserved. Prior to sampling, the team leader will explain to all pickers the importance of preserving multiple specimens of each type (i.e., will be used to define whether a taxa is rare or common, helps ensure that different families that may look alike to pickers both get preserved) and will explain that these collections will have no impact on local populations. The collection period will last 30  minutes, or as long as it takes to thoroughly sample every different kind of habitat. Picking will continue until all collected material has been sufficiently sorted. Collectors can help pick through material upon completion of collection activities. Teams will preserve approximately 15 individuals of each type, after which they can stop collecting them. At the end of each sampling the nets and pans will be rinsed before leaving the site to avoid transporting animals or plants between sampling sites. The team leader will also double check that the data sheet is completely filled out and that all habitats have been sampled.

Potential sources of variability such as weather/stream flow differences, season, and site characteristic differences will be noted for each event and discussed in study results. Any variations in procedure will be explained on the data sheet. (see appended “Stream Macroinvertebrate Datasheet.”) 

Identification Procedures

At the collecting site, all invertebrate sample jars receive a label written in pencil, collection date, location, name of collector, and number of jars containing the collection from this site, which is placed inside the jar. The data sheet also states the number of jars containing the collection from this site. The team leader is responsible for labeling and securely closing the jars and returning all jars and all equipment to the project manager. Upon return, the program managers check the collections for labels, makes sure the data sheets are complete with the correct information on the number of jars containing the collection from the site, and that the jars are secured together with a rubber band and site label and placed together in one box. The jars will be stored at either the offices of the Livingston County Health Department or The Nature Conservancy office until they are examined and counted on the day of identification (one or two weeks later). The data sheets are used on the identification day, after which they remain on file indefinitely. At the time of identifying the samples, the project managers checks the data sheet and jars to ensure that all the jars, and only the jars, from that collection are present prior to emptying them into a white pan for sorting. If any specimens are separated from the pan during identification, a site label will accompany them. For identification, volunteers sort all specimens from a single site into look-alike groups. An Aquatic ecologist will then identify them further to the family level. Literature references used for identification will include: Guide to Aquatic Invertebrates of the Upper Midwest: Identification Manual for Students, Citizen Monitors, and Aquatic Resource Professional, by Bouchard, A Guide to Common Freshwater Invertebrates of North America by Voshell, and Aquatic Insects of North America by Merritt and Cummins. When an identification of a sample is complete, the entire collection is placed in a single jar of fresh alcohol with a poly-seal cap and a printed label inside the jar and stored at the Nature Conservancy Office indefinitely. The alcohol will be carefully changed (to avoid losing small specimens) in the jars every few years.

Sampling Equipment

The following is a list of equipment we will be purchasing to assist us with our collection events:

20 D-frame nets	2 cases of glass jars
20 sorting trays	10 reel style measuring tapes
40 forceps	20 waders
10 (4L) bottles of preservative	10 squirt bottles

All equipment will be distributed equally between the Shiawassee and Livingston County sites and stored at either the Livingston County Health Department or the Nature Conservancy office. After each collection day the project managers will inspect the equipment and make any necessary repairs.

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 equipment with their dates of purchase and dates of last usage

- Check the expiration date of chemical reagents prior to each use
- Check the batteries of all equipment that requires them

Field Procedures Quality Control:

- Collect replicate samples 
- Conduct repeat and/or side-by-side tests performed by separate field crews
- 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

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 all sites are sampled by different collectors every three years to diminish the effects of bias in individual collecting styles. Samples where the diversity measures diverge substantially from past samples at the same site will be resampled by a new team within two weeks or will be discarded. 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. All lab sorting is rechecked by an expert before completing identification.

B2. Instrument/Equipment Testing, Inspection, and Maintenance

Equipment	Inspection	Maintenance
D-frame collection nets	Firmly attached to poles and free of holes	Adhere the nets to poles, replace and holes and if beyond repair then replace.
Sorting Tray	Clean and dry	Clean trays prior to collection. Replace as needed
Forceps	With tips that meet	Replace any forceps that the tips don't meet
Waders	Clean, do not leak	Fix any holes formed. Replace if beyond repair
Squirt Bottles	Clean and dry	Clean all bottles before next collection. Replace as needed

All equipment will be split equally between the Livingston County Health Department and The Nature Conservancy's office. Inspections and maintenance will be conducted by the project manager at each site once the equipment is returned to the

storage site after each monitoring event. Equipment will also be inspected again before it is sent out for sampling.

B3. Inspection/Acceptance for Supplies and Consumables

Equipment	Inspection	Maintenance
Preservative	Check expiration date. Make sure we have enough for next collection	Purchase more as needed.
Collection Jars	Poly seal top is intact. Make sure we have enough for next collection	Purchase more as needed

A tracking sheet will be created and kept with the supplies that records the purchase and replacement dates.

B5. Data Management

Field data sheets are completed in the field and checked by the project managers once submitted. Each project manager will enter the raw data into Microsoft Excel workbooks. The data from the Livingston County sites will then be sent to Heidi Frei, who will manage all the data collected from both Counties. All data will be backed-up and a copy of it will be kept off premises. After every collection, all new data will be exported to a MiCorps compatible format and sent to MiCorps for inclusion in their data exchange system. Data sheets will be filed at The Nature Conservancy’s office for a period of at least five years.

Metrics that will be calculated include the following:

- Stream Quality Index (SQI)
- Total Number of Orders 
- Total Number of Families
- Total Number of EPT
- Total Number of Mayfly Taxa (a subset of EPT, which will also be tracked independently)
- Total Number of Caddisfly Taxa (a subset of EPT, which will also be tracked independently)
- Total Number of Stonefly Taxa (a subset of EPT, which will also be tracked independently)

Each of these metrics will be tracked over time at each site (significant trends will be identified through regression) and sites will be compared based upon mean scores over time and differences in trends among sites.

C1. System Audits and Response Actions

To ensure quality data collection, steps will be taken to evaluate whether data collection procedures are being implemented correctly. This will be accomplished by training team leaders to evaluate team performance and by periodic steps from program staff to evaluate team leaders and team performance. This will ensure that data collection and management processes are being followed accurately. Any potential deviations from process will be corrected, noted, and will be evaluated using the results of the data (both short-term and long-term). Actions will be taken to eliminate data, if warranted. Steps that will be taken to periodically evaluate the performance of the program include the following:

- Volunteer team leaders will be trained for MiCorps protocols and will be instructed to evaluate sampling procedures to assure that methods and quality assurance protocols are followed. They will be asked to report any issues possibly affecting data quality. Program staff will periodically visit sites to evaluate sampling procedures and the performance of team leaders.
- If deviation from the QAPP is noted at any point in the sampling or data management process, the affecting samples may be deleted from the data set. Re-sampling will be conducted if warranted and feasible, if the deviation is noted soon after occurrence and volunteers are available. Otherwise, a gap may be left in the monitoring record. All corrective actions, such as the above, will be documented and communicated to MiCorps.

C2. Data Review, Verification, and Validation

Data will be reviewed at multiple stages for completeness and accuracy. Macroinvertebrate identification will be performed as part of an identification day where volunteers will help to sort specimens and record data, but all identifications will be confirmed by qualified ecologists/entomologists. All results will be examined for potential outliers that might indicate poor collection techniques. Any outliers will be investigated and eliminated if necessary. Specific steps for Data Review and Verification and Validation include the following:

Data Review

- Data forms will be standardized and will be designed to prompt collectors to complete all tasks.
- Team leaders will be asked to review all datasheets for completeness prior to leaving the site.
- Sheets will be reviewed by the program director for completeness, unusual measurements, and accuracy of calculations.
- Datasheets and data on computer will be scanned to proofread for data entry errors

Verification and Validation

- Macroinvertebrates will be identified by program experts with the aid of a dissecting microscope (we need to pick one out and report its enlargement ability) and dichotomous keys, including Guide to Aquatic Invertebrates of the Upper Midwest: Identification Manual for Students, Citizen Monitors, and Aquatic Resource Professional, by Bouchard, A Guide to Common Freshwater Invertebrates of North America by Voshell, and Aquatic Insects of North America by Merritt and Cummins.
- If total diversity undergoes a steep decline at a site, the site will be visited by staff to assess potential changes at the site and potentially to sample for missing taxa or to conduct a new survey. Sites with less than 70% of the diversity previously found at the site may indicate less-than-thorough sampling. In this event the site may be re-sampled for verification or results may be discarded.
- Some sites will overlap between MiCorps and DEQ P51 monitoring. We will compare MiCorps results with DEQ results to evaluate data collected at those locations.
- Data will be compared with data collected previously at the site, as described in the Data Quality Objectives (A7).
- Teams will shift to different sites over time, which will allow us to statistically compare efficiency among sampling teams (or team leaders) after several years of monitoring. Hopefully this will act to validate the data collected in the program. A certain amount of annual variability should be expected at each site, but if a team is consistently collecting a lower diversity of organisms over time (even if the results are within 1 standard deviation from the median), we will be able to detect this. Should some teams be less efficient than others, the issue will be documented and communicated to the volunteer and MiCorps. These data may still be utilized and may be statistically corrected for differences in sampling efficiency among teams, but this process will be noted and data points may need to be removed from the monitoring record. Similarly, sampling efficiency may improve over time as team leaders gain experience, which we will also be able to evaluate statistically.
- If time allows, replicate quality control sampling may be conducted by program staff at a subset of sites within 2 weeks of the volunteer monitoring.

C3. Reconciliation with Data Quality Objectives

Data will be reviewed periodically to determine if the project's data quality objectives are being met. The Program Manager will determine and ensure that the data have high quality (accuracy, precision, representativeness, comparability, and completeness) and if program protocols should be changed or updated and if corrective actions are necessary. The Program Manager will also consult with other staff and partners to review sampling locations and determine if any should be changed and/or what new stream sites might be added, as well as whether more data should be collected, different water quality indicators should be assessed, and/or different indices should be utilized. Project goals, aims, direction, and purpose will be reviewed on an annual basis.

C4. Reporting

A report will be prepared annually  to summarize MiCorps activities in the Shiawassee River for the previous year. The report will include:

- List of sites monitored
- Comparison among sites and trends in data at each site
- QA results, with a summary of any problems discovered
- Any notable achievements
- Names of volunteers