

A1. Title and Approval Sheet

Quality Assurance Project Plan for Muskegon River Water Monitoring Program

Date: August 19, 2005

Version # 2

Organization: Muskegon River Watershed Assembly (MRWA)

QAPP Prepared by: Terry Stilson

Title: MRWA Executive Assistant and Project Manager for the Muskegon River Water Monitoring Program

Signature: _____

Other responsible individual: Gary Noble

Title: MRWA Executive Director

Signature: _____

(Other signatures may be added as necessary)

MiCorps Staff Use	
Tracking Number:	
Funding Source:	
MiCorps Reviewer: _____	
<input type="checkbox"/> Approved	<input type="checkbox"/> Returned for modifications

Signature of reviewer	Date

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A3. Distribution List

Ric Lawson, Project Manager
Michigan Clean Water Corps (MiCorps)
Great Lakes Commission

Cynthia Fitzwilliams-Heck (Subcontractor)
Ferris State University instructor
22929 Fifteen Mile Road
Big Rapids, MI 49307

Muskegon River Watershed Assembly
@FSU College of Allied Health Sciences
200 Ferris Dr., VFS 311
Big Rapids, MI 49307-2740

A4. Project Organization

1. Team Members and Subcontractor:

- **Project Manager and QA Manager: MRWA Executive Assistant Terry Stilson**, will recruit volunteers, create the monitoring database, create the web-pages and complete other oversight aspects of the project. She will also prepare contracts, reports and other documents needed for the project. The Project Manager will be responsible for maintaining the QAPP. Contact information – address:
@FSU College of Allied Health Sciences
200 Ferris Dr., VFS 311
Big Rapids, MI 49307-2740
Phone: 231-591-2324
Email: mrwa@ferris.edu
- **Gary Noble, MRWA Executive Director**, will provide administrative oversight for this project. He will review and sign contracts and reports concerning this project. Contact information – address:
@FSU College of Allied Health Sciences
200 Ferris Dr., VFS 320
Big Rapids, MI 49307-2740
Phone: 231-591-2334
Email: nobleg@ferris.edu
- **Subcontractor:** Training sessions for the volunteers will be conducted by **Ferris State University (FSU) biology faculty member, Cindy Fitzwilliams-Heck**. Fitzwilliams-Heck will also provide technical assistance when needed in macroinvertebrate identification. Contact information – address:
22929 Fifteen Mile Road
Big Rapids, MI 49307

2. Field Responsibilities

- **Volunteers** will be responsible for macroinvertebrate identification and will attend a one-day training session in identifying macroinvertebrate and conducting stream habitat assessments. An exam will be given to these volunteers and a 95% score is needed before these volunteers can assume the field responsibility of macroinvertebrate identification. These volunteers will be the **Team Leaders** or **Qualified Volunteers** for the sites that will be monitored. Volunteers who do not take the exam or do not achieve the 95% score will be able to assist the team leader in collecting the samples and assessing the stream habitat but will not assist in macroinvertebrate identification. Volunteers will report to the Project Manager.

3. Laboratory Responsibilities

- The MRWA does not anticipate using any parameters that will need to be processed in a laboratory.

4. Corrective Action

- Muskegon River Water Monitoring Program Project Manager, Terry Stilson, and Executive Director Gary Noble will be responsible for any corrective actions that are needed.

A5. Problem Definition/Background

How do you get local citizens and government interested in the water quality of rivers and streams? One method is to get them involved in water quality activities and educate them in the significance of water quality. Too many citizens in the Muskegon River Watershed have grown up with the assumption that our rivers and streams are inexhaustible supplies of fresh, clean water. They need to realize that increased development, industry and lack of good land use strategies jeopardize water quality in our Watershed. Citizens also need to realize that what people do in other areas of the Watershed can affect the water quality in their areas. This project will not only stimulate citizen involvement in their local water quality issues but incite their interest in issues involving other areas of the Watershed.

The Muskegon River Watershed is one of the largest watersheds in Michigan (over 2,700 square miles) and is fed by warm, cool and cold water tributaries. With its headwaters in the Higgins Lake/Houghton Lake areas and outlet into Lake Michigan in Muskegon, the Watershed covers twelve Michigan Counties. Land use in the Muskegon River Watershed is diverse, ranging from forests, agricultural, recreational and urban areas. Because the Watershed is so large, the MRWA must depend on volunteers to assist them in many of their projects.

In 2000, Grand Valley State University's Annis Water Resources Institute (GVSU-AWRI) received a Watershed Management Planning grant for the Muskegon River Watershed from the U.S. Environmental Protection Agency and the Michigan Department of Environmental Quality (DEQ). The Plan stated that "The DEQ has never before awarded a grant of this type for such a large watershed...and has led to a more comprehensive and holistic understanding of what is important for the Muskegon River Watershed, its residents, and those who use its resource." In Chapter 10 of the Plan, "Proposed Implementation Activities in the Muskegon River Watershed", one of the Information and Education Activities recommended is to "Support Local Volunteer Monitoring Efforts and Involvement".

This project, the **Muskegon River Water Monitoring Program**, will train volunteers in the Watershed and provide them with proper and effective equipment for their water monitoring efforts. Volunteers will also be trained to identify macroinvertebrates which will give them a more accurate view of water quality. They will also be trained to complete stream habitat assessments.

The MRWA Education Committee is also recruiting and training volunteer Stewards to disseminate information about the Watershed to schools, local governments and other organizations. Water quality data from this project will be part of the information that Stewards will disseminate. Schools will use this data in their science studies, while local governments will use this information to help formulate their master plans and assess areas that need attention. The MRWA and other organizations will use the data to illustrate areas to focus their efforts for projects and best management practices.

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Because water issues are currently very crucial in the U.S. and because the Great Lakes contain twenty percent of the world's fresh water, the MRWA seeks to engage local citizens in water monitoring efforts and to incite their interest in water quality issues, through this project. The MRWA will also keep a database of the water monitoring results to alert them to changes and locations of concern and will publish this information in reports and on the MRWA website.

The four targeted sub-watersheds in this project were purposely chosen for their diverse land uses: recreation, forested, urban and agriculture. Data collected from these water monitoring efforts will help the MRWA comprehend how these land uses affect the Watershed. Monitoring will take place in areas where the MRWA plans to install Best Management Practices (BMPs). Data will assist the MRWA in understanding how these BMPs have improved the water quality in these streams. This project will also help satisfy the recommendation of the Muskegon River Watershed Management Plan to support local volunteer monitoring efforts and will give the MRWA data they can use to disseminate to students, government officials and other organizations within the Watershed.

A6. Project Description

The overall goal of this project is to incite citizen interest in water quality issues in the Muskegon River Watershed on a sub-watershed level. The first specific goal of the project is to unify and educate Watershed residents by training them to collect and record data that will indicate the healthiness of the Muskegon River Watershed. Educating citizens in watershed protection will spread good environmental stewardship and help them realize they are part of a bigger picture beyond their respective communities. A second goal is to use the data collected in this project to assist the MRWA, local government officials, other organizations and researchers in guiding them to formulate protective and restorative projects and to develop better local ordinances.

Four training sessions will be held in the four targeted sub-watersheds of the Muskegon River Watershed. Two groups of volunteers in two of the sub-watersheds will be trained the first year in September 2005, with the first monitoring being accomplished in the fall of 2005. The remaining two groups will be trained in 2006 with their first monitoring being completed in the spring and fall of 2006. Monitoring will continue to be done each fall and spring. Before the training session, volunteers will be given a pre-training survey to forecast their knowledge and interest in the monitoring program. A post-training survey will be completed by each volunteer to identify their increase in knowledge and to evaluate the training session. Training sessions will involve classroom instruction and actual in-stream monitoring. A certificate of completion will be granted to each participant verifying that they have successfully completed the training and have successfully scored at least 95% on a written macroinvertebrate identification exam. Volunteers will be expected to sign commitment forms verifying that, to the best of their abilities, they will make a long-term commitment (minimum of three years) in monitoring their section of the Watershed.

A group meeting, at the end of each year's monitoring (early summer 2006 and 2007), will be held for volunteers to share their experiences, receive the data report for all participating sub-watersheds and a time to give recognition to each volunteer. This will help stimulate a unified Watershed sensitivity in its volunteers and increase sub-watershed group interest and involvement. At this meeting, volunteers will share with one another about their monitoring efforts, problems and solutions, and give an account of activities in the Watershed that are or could have an effect on the whole Watershed, such as development, dam removal and industry. They will also be given a survey to calculate their increased knowledge and interest in water quality issues. Due to the large size of the Muskegon River Watershed, volunteers will receive a mileage stipend as an incentive to participate in group meetings.

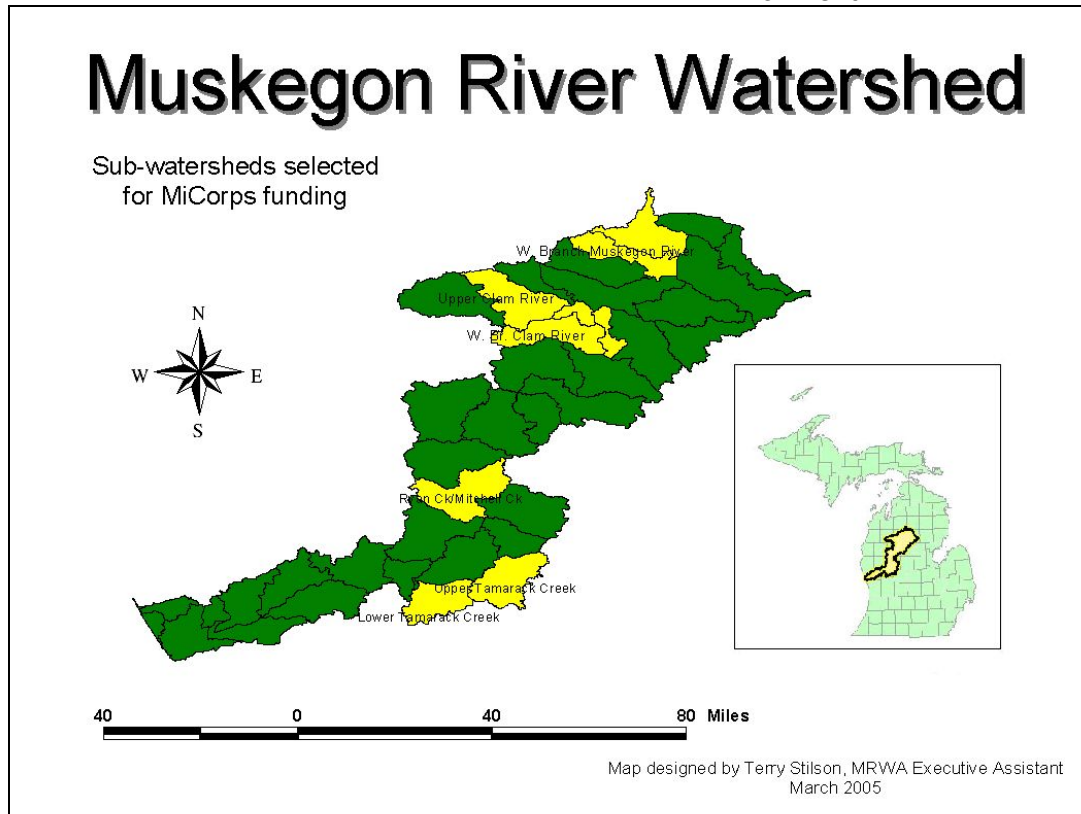
Each targeted sub-watershed to be monitored has a different surrounding environment: urban, agricultural, recreational and forested. Bi-yearly monitoring will take place in the spring and fall. Monitoring parameters will include macroinvertebrate identification and habitat classification. Data collection sheets will be developed under the guidance of the MiCorps datasheets. Volunteers will be expected to send their datasheets to the MRWA no later than two weeks following the date of their collection.

The four targeted sub-watersheds (see map on page 7) are:

1. Tamarack Creek Sub-watershed
 - a. Montcalm County
 - b. Three Sites Monitored - Minimum
 - c. Primarily Agricultural Environment
2. Ryan Creek/Mitchell Creek Sub-watershed
 - a. Mecosta County
 - b. Three Sites Monitored - Minimum
 - c. Primarily Urban Environment

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- 3. Clam River Sub-Watershed
 - a. Clare/Missaukee Counties
 - b. Three Sites Monitored - Minimum
 - c. Primarily Forested Environment
- 4. West Branch Muskegon River
 - a. Missaukee/Roscommon Counties
 - b. Three Sites Monitored – Minimum
 - c. Outlet of Recreational Environment



Methodology of Location Selection – The selection of sampling locations and sites will depend on the sub-watershed. Presently, the MRWA has projects in the Clam River, Tamarack Creek, and Mitchell Creek areas. Sampling locations will correspond with these projects. In the West Branch Muskegon River Sub-watershed, sites will be chosen that will reflect any effect that recreation has on the River. Sampling will be completed upstream of recreational activities and downstream of activities. From the samples taken in all of the above sub-watersheds, the MRWA can compare the effects that the land uses of forestation, urbanization, recreation and agriculture have on the Watershed.

The MRWA will create and maintain a database of Muskegon River Watershed monitoring information. This information will assist the MRWA in tracking water quality in the Watershed. Distribution of the monitoring data will be completed in several ways. Notices concerning the availability of this information will be sent to the local government agencies in each municipality, township and county within the four targeted sub-watersheds. Monitoring data will be made available on the MRWA website. This information will also assist schools and other educational groups with their watershed studies and projects.

The Muskegon River Watershed is a large and long watershed, over 2700 square miles and the River is over 217 miles long. These geographic boundaries may present a constraint of achieving a unified feeling in volunteers. It may also present a challenge of having enough equipment to distribute and in transferring datasheets and specimen jars.

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Scheduled Task List:

Tasks and Sub-tasks	Jun-Sept 2005	Oct-Dec 2005	Jan-Mar 2006	Apr-Jun 2006	Jul-Sept 2006	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007
Task 1. Project Administration – facilitate the implementation of project objectives through project oversight								
1.1 Develop and submit status reports per MiCorps guidelines		●—————●						●—————●
1.2 Complete an approved Quality Assurance Project Plan (QAPP)	●—————●							
1.3 Finalize sub-contract between MRWA and FSU	●—————●							
1.4 Attend 8-hour training session provided by MiCorps	●—————●							
1.5 Perform fiscal responsibilities	●—————●							●—————●
1.6 Purchase equipment/supplies	●—————●							
1.7 Distribute and maintain equipment for volunteer monitoring		●—————●		●—————●		●—————●		●—————●
1.8 Develop and submit final report per MiCorps guidelines								●—————●
1.9 Submit release of claims statement								●—————●
1.10 Provision of products and deliverables								●—————●

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Tasks and Sub-tasks	Jun-Sept 2005	Oct-Dec 2005	Jan-Mar 2006	Apr-Jun 2006	Jul-Sept 2006	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007
Task 2. Education and Training								
2.1 Plan and conduct four project partner meetings	●—●		●—●		●—●		●—●	
2.2 Develop and print brochure handout to publicize program	●—●							
2.3 Recruit volunteers	●—							●—
2.4 Develop and finalize pre-training and post-training surveys	●—●							
2.5 Assemble training materials and curriculum	●—●							
2.6 Publicize training sessions	●—●				●—●			
2.7 Conduct training sessions in four sub-watersheds	●—●				●—●			
2.8 Plan & conduct 2 annual meetings of volunteers				●—●				●—●
Task 3 Data Collection								
3.1 Conduct river/stream monitoring	●—●		●—●		●—●		●—●	
3.2 Submit data to MRWA		●—●	●—●		●—●		●—●	
Task 4 Data Development & Distribution								
4.1 Create monitoring database	●—●							
4.2 Collect data from volunteers and enter into database		●—●	●—●		●—●		●—●	
4.3 Design web-pages and input data		●—●	●—●		●—●		●—●	

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Tasks and Sub-tasks	Jun-Sept 2005	Oct-Dec 2005	Jan-Mar 2006	Apr-Jun 2006	Jul-Sept 2006	Oct-Dec 2006	Jan-Mar 2007	Apr-Jun 2007
4.4 Publication of Project in Newsletter and Newspapers	●————●		●	●————●		●————●		●————●
4.5 Send postcard notices and e-mails to public officials and other organizations of availability of data								●————●
4.6 Distribute data to public officials and other interested citizens								●————●
Task 5 Evaluation and Publication								
5.1 Evaluate Project	●————●							

A7. Data Quality Objectives

Macroinvertebrate Identification:

The water quality in a stream or river can determine which types of macroinvertebrate are present. Some macroinvertebrates are better indicators of water quality than others. For example, caddisfly larvae and water pennies are very sensitive to pollution and low amounts of dissolved oxygen, and will only be found in large number in high quality streams. Because macroinvertebrates are sensitive to ecosystem changes and cannot easily escape their surroundings, environmental changes such as runoff from a newly developed area (nonpoint source of pollution) or a break in a gas pipe (point source of pollution), will change the types and numbers of macroinvertebrates contained in the stream. Before these environmental changes, sensitive macroinvertebrates may be present in large number but after the changes their numbers may greatly decrease. Macroinvertebrate will be identified as to its order – taxonomic level. In this project, the macroinvertebrates will be collected and identified using the orders identified in the data sheet in Appendix 1. Each specimen in the denoted orders will be counted with the number inserted by their respective names. The quality of the water is then computed using the formulas in the **Stream Quality Score** box on the same page of the data sheet.

The total diversity reported by each team must have a precision and accuracy. The first macroinvertebrate sample taken by each team will be collected by the Project Manager and verified for accuracy. If the accuracy is less than 90%, each sample taken thereafter by the team will be collected by the MRWA and verified for accuracy by the FSU trainer, DEQ personnel or another biologist. If the team is consistently identifying macroinvertebrate inaccurately, the Team Leader and other qualified volunteers in the team will be asked to take another macroinvertebrate identification exam and may be asked to participate in another macroinvertebrate identification training session.

Monitoring by volunteers will be completed in the first two weeks of May and September of each year. If a site is temporarily inaccessible, such as due to prolonged flooding or high water, the monitoring time will be extended to the end of each month. If the issue concerning inaccessibility is continued to the extended dates, then no monitoring data will be collected during that time and there will be a gap in the data.

If a team is unable to monitor their site during a specific time, the Team Leader will contact the Project Manager by the 10th of the month (May or September). Another team from that area will be asked to complete the monitoring. If no team is available, the Project Manager will be responsible to see the site is monitored. Sites will periodically be sampled by different teams to diminish the effects of bias in individual collection styles. The total diversity reported by each team must equal at least 70% of the diversity previously found at the site. Sites with results less than 70% will be sampled again by the Project Manager to verify or discard such unusual results.

Results of each team's samples will be compared with other teams' results in the Muskegon River Watershed. Sampling results will also be compared to DEQ or other expert measurements, whenever possible, as a way to verify precision and estimate accuracy.

A data set for a given site is considered complete if it has been sampled within precision,

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limits stated above for three or more years. Results will be highly comparable to other macroinvertebrate measures conducted to the same level of identification comparing the results to DEQ measures of identical or equivalent sites. Information from the monitoring activities is useful only after accumulating data for several years so as to get the sense of trend. Persistent changes in the monitoring data can indicate that the health of the stream has changed. If data received from one collection is significantly different than all other data, it will be recorded and only considered as outlier data if it far exceeds the data of the preceding and subsequent collections.

Stream Habitat Assessment:

An initial stream habitat assessment will be completed by the MRWA when sites are chosen in the Watershed (see datasheets in Appendix 1). These initial assessments will be compared to the team assessments and compared one to another for agreement. If site assessments are less than 70% in agreement, a follow-up assessment will be made by the Project Manager and Team Leader concerned. Experts, such as biologists or DEQ and MiCorps personnel, may be consulted.

Sites will periodically be sampled by different teams to diminish the effects of bias in individual collection styles. If site assessments are less than 70% in agreement, a follow-up assessment will be made by the Project Manager and Team Leader concerned. Experts, such as biologists or DEQ and MiCorps personnel, may be consulted.

An assessment for a given site is considered complete if it has been assessed within these precision limits for three years or more. Assessments will also be compared to DEQ or other expert assessments, whenever possible, as a way to verify precision and estimate accuracy.

A8. Special Training/Certifications

Terry Stilson, Project Manager for the Muskegon River Water Monitoring Program, completed the MiCorps training session held on June 4, 2005, in Petoskey, MI.

Training sessions for the volunteers will be conducted by Ferris State University (FSU) biology faculty member, Cindy Fitzwilliams-Heck. Fitzwilliams-Heck has a strong background and deep interest in aquatic and terrestrial ecology, evolution and conservation. She received a B.S. degree in Biology Education from FSU and M.S. degrees in Aquatic Ecology and Conservation Biology from Central Michigan University. In her graduate studies, she examined the effects of two potentially harmful types of cyanobacteria on the zooplankton, *Daphnia pulicaria*, and emphasized how this affects food web dynamics in freshwater lakes. She is currently teaching an array of biology courses at FSU in which she enjoys organizing ecological projects and conservation activities.

Training sessions will be conducted in the sub-watersheds noted earlier in this QAPP. A sign-in list will be used to document all participating volunteers.

Volunteers will participate in a one-day training session which will consist of classroom identification of macroinvertebrate and discussion of habitat assessments. The session will also include a hands-on session in the stream which will further illustrate and demonstrate to volunteers how to collect samples and identify macroinvertebrate and assess the stream habitat. A written macroinvertebrate identification exam will be taken by the participating volunteers. A 95% score or better must be achieved to obtain the “Team Leader” or “Qualified Volunteer” status. Certificates will be given to each volunteer who passes the exam with a score of 95% or better. The Project Manager will keep a list of these volunteers who obtain the status of Team Leader or Qualified Volunteer. Only Team Leaders and Qualified Volunteers are allowed to identify macroinvertebrate at the sampling sites.

Before the training session, volunteers will be given a pre-training survey to forecast their knowledge and interest in the monitoring program. A post-training survey will be completed by each volunteer to identify their increase in knowledge and to evaluate the training session.

A yearly meeting of volunteers will be conducted in a central location to discuss monitoring problems and successes. This will be a time for volunteers to share experiences and express concerns about activities in their parts of the Watershed. A review of macroinvertebrate identification and habitat assessment parameters will be included if volunteers have expressed difficulty in completing these elements.

A9. Documentation and Records

Volunteer data collectors will participate in at least one training session conducted by the MRWA. A certificate of completion will be granted to each participant verifying that they have successfully completed the training and have successfully scored at least 95% on a written macroinvertebrate identification exam. Volunteers will be expected to sign commitment forms verifying that, to the best of their abilities, they will make a long-term commitment (minimum of three years) in monitoring their section of the Watershed.

Both datasheets will be completed onsite at the time sampling occurs. Volunteers will record site number, location, date, collectors' names and number of jars used, on the identification label (see Appendix 3, page 38), and insert the labels inside each jar used.

Team Leaders will be responsible to mail, fax or directly give the MRWA the original site datasheets within one week of site sampling. Team leaders will keep a copy of the datasheets. Datasheets are contained in Appendix 1.

Jars from the first sampling will be collected by the Project Manager. Subsequent samples will be in the custody of the Team Leader for a minimum of three years. The Project Manager will select subsequent samples, on a random basis, for a review or accuracy. One sample in each sub-watershed will be collected annually.

Raw data will be entered and managed in a Microsoft Access database by the Project Manager. All data will be backed-up on CDs on a weekly basis during the spring and fall when monitoring information is being inputted. Computer passwords will provide data security. Terry Stilson, Project Manager for the Muskegon River Water Monitoring Program, will be responsible for creating the database and maintaining and forwarding the records to MiCorps. Records will be maintained indefinitely at the MRWA offices but for a minimum of five years. The data will be available to local governmental officials and other organizations that are interested in resource management. Some of the data may be entered on the MRWA website, www.mrwa.org.

B1. Study Design (Experimental Design)

Sites will initially be selected by the Project Manager. Sites will be selected with other MRWA projects in consideration. Other criteria for site selection will involve accessibility, location concerning the surrounding land uses for each sub-watershed (i.e. urban, forested, agricultural, or recreational) and landowner permission. Volunteer teams will then choose which site from these that they prefer to monitor. To assist volunteers in locating the sites, volunteers will be given a map with the selected site denoted, pictures of the site, a short written description and latitude/longitude coordinates. At sites that are difficult to identify using landmarks or descriptions, marking tape will be used and tied around a tree or bush to specify the location.

Each site will be monitored in the first two weeks of May and September of each year. Monitoring equipment will be provided to the volunteers by the MRWA and will be housed in a location each of the targeted sub-watersheds. Each team of two or more volunteers will have the responsibility to monitor one site. A qualified Team Leader and other volunteer(s) will monitor the sites designated by the MRWA.

The steps involved from monitoring sites to data storage follow (see also Appendix 2, Standard Operating Procedures, pages 33-34):

1. Volunteers will participate in a one-day training session conducted by the MRWA.
2. Volunteer teams will be formed to monitor each site with a Team Leader being chosen by the participating team members.
3. Team Leaders must score a minimum of 95% on a macroinvertebrate identification exam.
4. Team leaders and members will choose the site they wish to monitor from the sites designated by the MRWA.
5. Team leaders and other volunteers will collect the equipment and monitor their site in the first two weeks of May and September.
6. Each team will collect their samples, assess the stream habitat and complete the datasheets (more detail in B2. Study Methods).
7. Team leaders will mail, fax or personally give the original datasheets to the MRWA. Team Leaders will keep specimen jars and copies of datasheets for a minimum of three years.
8. The Project Manager will review the data promptly in case the team needs to add data.
9. The Project Manager will input the data from the datasheets into a MRWA Access database.
10. The Project Manager will backup the Monitoring Database onto a CD – weekly during the inputting time.
11. The Project Manager will upload the data to the MiCorps database biannually or more frequently if specified by MiCorps.
12. Some data may be entered in the MRWA website at www.mrwa.org.
13. Monitoring data will be available to the public from the MRWA upon request.

All information that will be collected from the volunteers is critical to the MRWA for monitoring the health of the Watershed. When possible, monitoring sites will correspond with current MRWA project sites and will assist the MRWA in verifying that the Best

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Management Practices (BMPs) installed through those projects are improving the water quality of the streams and rivers. Sites will be identified with latitude and longitude coordinates, maps and pictures.

If a team is unable to monitor their site during a specific time, another team from that area will be asked to complete the monitoring. If no team is available, the Project Manager will be responsible to see the site is monitored.

Monitoring will be completed in the first two weeks of May and September of each year. If a site is temporarily inaccessible, such as due to prolonged flooding or high water, the monitoring time will be extended to the end of each month. If the issue concerning inaccessibility is continued to the extended dates, then no monitoring data will be collected during that time and there will be a gap in the data. Because volunteers will be monitoring on different days during the two-week window, results may differ due to the weather and storm events. Volunteers will note the weather conditions (air temperature, current conditions and last storm event) on their **Stream Macroinvertebrate Datasheet**. Other differences such as adjacent land uses and potential sources of stream degradation are noted in the **Stream Habitat Assessment (datasheets contained in Appendix 1)**.

The MRWA has selected four sub-watersheds for this project, targeting the diverse land uses of forested, recreational, agricultural and urban areas. The MRWA would like to know how the water quality differs in comparison to each of the land uses. The MRWA will not restrict volunteers from other areas in the Muskegon River Watershed from monitoring in their sub-watersheds. They will also be able to participate in any training session. The MRWA would ultimately like to have all sub-watersheds monitored and reported.

B2. Study Methods

Please see Standard Operating Procedures (SOPs) in Appendix 2, pages 35-37.

The Benthic Macroinvertebrate equipment to be used in the collections was selected primarily from a list provided by MiCorps trainers. (See equipment list on page 23 for model numbers and description).

The MRWA will store the equipment and will be responsible to see that damaged equipment is replaced or repaired. The Project Manager will contact Team Leaders to organize a schedule of when teams will monitor their sites. Each Team Leader will be responsible to sign equipment out and to verify that the equipment has been cleaned and if any equipment has been damaged. The Project Manager will check the equipment and supplies upon their return and see that they are repaired or replenished.

The Team Leader of each team will be responsible to check the cleanliness, completeness and working order of all equipment before their team's use. The Team Leader is also responsible to see that the equipment is cleaned and in working order when it is returned to the designated location. Nets and trays will be thoroughly rinsed at the monitoring site after each monitoring activity. Nets will be carefully picked clean of all insects and debris. If zebra mussels are found at the site, a different net and waders will be used until they are thoroughly cleaned. Other equipment will be dried before inserting it into the plastic container. If the Team Leader finds the equipment in unworkable condition, they will immediately report this to the Project Manager. The Project Manager will be responsible to check the equipment for completeness and accuracy on a yearly basis, normally during the winter months.

The MRWA will be responsible for the quality of data. After each volunteer team's first collection, the Project Manager will obtain the jar(s) of macroinvertebrate from each Team Leader. The macroinvertebrates collected, along with the datasheets, will be reviewed by the Project Manager and training facilitator for accuracy. If the information is found to be less than 90% accurate, the Team Leader and other Qualified Volunteers will be asked to complete another macroinvertebrate identification exam. A minimum of a 95% score will be needed for the Team Leader to retain their position. Subsequent collections will be monitored for accuracy until the MRWA is confident in the team's collection abilities.

In subsequent collections following the first collection, the MRWA will continue the verification of accuracy by collecting the macroinvertebrate jar(s) from teams on a random basis. They will be collected in one site in each sub-watershed per year and checked for accuracy. The same procedures as in the initial collection in the above paragraph will be implemented.

Collection and assessment methods will follow the **Standard Operation Procedures**. On a random basis, side-by-side monitoring will be completed with the volunteers by the Project Manager, training facilitator or DEQ representative to check for procedural accuracy.

B3. Sample Handling and Custody

At the collecting site, all invertebrate sample jars receive a label written in pencil (or computer generated beforehand), stating the date, location, site number, name of collectors and number of jars containing the collection from this site (See label example in Appendix 3). A label is placed inside every jar. If more than one jar is used, each jar will be labeled with the same information noting the number of jars used. The datasheet will also state the number of jars containing the collection from each site. The Team Leader is responsible for labeling and securely closing the jar(s) and retains custody of them.

The Project Manager will arrange to pick up jar(s) from the first sampling event for each group and will keep the jars at the MRWA offices for a minimum of three years. After the first collection, the Team Leader is responsible to keep the collection jars in their custody for a minimum of a three-year period. If more than one jar is used, they will be secured together with a rubber band and placed together in one box properly labeled. All jars will be stored in a cool place. Alcohol will be changed periodically in the jars according to MiCorps specifications.

The numbering system for MRWA datasheets will consist of a number using the following guidelines – “**county number-subwatershed number-site number-season/year**”. County numbers used will be Clare County=1; Mecosta County=2; Missaukee County=3; Montcalm County=4; Muskegon County=5; Newaygo County=6; Osceola County=7; Roscommon County=8; and Wexford County=9. Sub-watershed numbers will be derived from the Muskegon River Management Plan, Figure 4, and page 22. The site numbers will be assigned by MRWA and the season/year number will be, for example, fall 2005=F05. Therefore, site 1 datasheets recorded in the fall of 2005 in the Mitchell Creek/Ryan Creek Sub-watershed would have the following identification number: “**2-25-01-F05**”.

Team leaders will decide to separate and count the specimens onsite or collect them in properly identified jar(s) and separate and count them at a more convenient location with all team members present. Team members may fill out the Stream Macroinvertebrate Datasheet as the Team Leader or Qualified Volunteer dictates the numbers to them. The Team Leader is responsible to check the datasheet for completeness and accuracy and signs the datasheet verifying this.

The Team Leader is also responsible to return the original datasheets to the MRWA and keep copies for themselves. Upon receiving the first collection jars and datasheets, specimens will be counted and datasheets will be checked for completeness and for accuracy by the Project Manager and/or subcontractor. Data will be entered into the monitoring database by the Project Manager, from the datasheets, within seven days of receipt. The Project Manager will be responsible to submit all information to MiCorps. Datasheets will be kept in the MRWA offices indefinitely.

B4. Analytical Methods

Parameters:

- Macroinvertebrate communities will be monitored annually during the first two weeks of May and September.
- Macroinvertebrate will be identified as to its order – taxonomic level.
- Stream Macroinvertebrate Datasheet will contain the statistical scores used per MiCorps guidelines (see datasheet – Appendix 1).
- Stream habitat will be assessed at the same time the macroinvertebrate is monitored (see Appendix 2 for Standard Operating Procedures) using MiCorps guidelines.

Timing:

- The macroinvertebrate population is sampled on one day during the first two weeks of May and September. The particular day will be chosen by each individual team.
- The stream habitat assessment will take place during the same day of macroinvertebrate collection.

Literature and Equipment:

- All equipment, except for nets, yardsticks and waders will be contained in a plastic container.
- Equipment for macroinvertebrate collection will consist of:
 - D-frame kicknet
 - White collection pan
 - Forceps and magnifying glasses
 - Jars, lids and preservative (70% ethanol)
 - 6” rulers and yardsticks
- Stream habitat assessment and safety equipment will consist of:
 - Compasses
 - First-aid kits
 - Waders
- Literature will consist of a notebook containing but not limited to the following:
 - Standard operating procedures
 - A Key to Macroinvertebrate Life in the River
 - Dichotomous Key to Stream Macroinvertebrates
 - Directions on completing the datasheets
 - Datasheets and pencils

Sample disposal procedures:

- Jars containing macroinvertebrates from collection sites will be kept for a minimum of three years. The first collection from each team will be kept in the MRWA offices and the Team Leader will keep subsequent collections. All jars will be kept in a cool place and alcohol will be changed periodically according to MiCorps specifications.
- Paper waste will be discarded properly in a trash can.
- Datasheets will be kept in the MRWA offices indefinitely.

B5. Quality Control

Equipment Quality Control:

- MRWA will:
 - ✓ Provide equipment used by volunteers
 - ✓ Provide a checklist of equipment
 - ✓ Label equipment with their dates of purchase
 - ✓ Replenish equipment and supplies as needed
- Team leaders will:
 - ✓ Pick up equipment at designated location
 - ✓ Check to make sure all equipment is present using checklist provided
 - ✓ Check to make sure equipment is in working order and not damaged
 - ✓ Report to MRWA of any damaged or missing equipment
 - ✓ Check the expiration dates of alcohol prior to each use
 - ✓ Make sure equipment is thoroughly cleaned before and after monitoring event
 - ✓ Return equipment to designated location within 5 days of picking it up

Field Procedures Quality Control:

- MRWA will:
 - ✓ Provide one-day training session by a professional in targeted sub-watersheds
 - ✓ Collect specimen jars from the first collection of each team to verify accuracy of macroinvertebrate identification
 - ✓ Occasionally mix and alternate individuals in teams to maintain objectivity and minimize bias
 - ✓ Randomly collect collection jars to verify continued accuracy
 - ✓ Provide yearly meetings to refresh team members in their collection activities
- Monitoring teams will:
 - ✓ Only allow a qualified team member to identify macroinvertebrate
 - ✓ Verify that collection jar(s) are labeled correctly with labels inside the jars
 - ✓ Perform the habitat assessment as a team
 - ✓ Verify that datasheets are checked for completeness
 - ✓ Clean all equipment and dry items placed in plastic container
 - ✓ Attend yearly meetings for review

Data Analysis Quality Control:

- MRWA will:
 - ✓ Check all calculations
 - ✓ Check all datasheets for completeness
 - ✓ Enter data from datasheets into monitoring database within 7 days of receipt
 - ✓ Have hard copies of all computer entered data reviewed for errors by comparing them to the field datasheets
- Monitoring teams will:
 - ✓ Check all calculations twice
 - ✓ Check all datasheets for completeness
 - ✓ Team leader will promptly send datasheets to MRWA within one week of collection

All Team Leaders and qualified volunteers will attend a training session of both

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classroom and in-stream training. A notebook containing keys to stream macroinvertebrates, standard operation procedures, datasheets and other pertinent information will be provided to each training participant. Volunteers who did not complete the training or who did not score a 95% or better on the macroinvertebrate exam may participate in the collection but will not identify macroinvertebrate. A yearly meeting of all Team Leaders and volunteers will be held to review data collected, identify problems that occurred during collections and check all quality control measures.

Since our evaluation is based on the diversity in the community, we attempt to include a complete sample of the different groups present. 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. Initial samples of each team will be collected by the Project Manager and reviewed for accuracy. Sites will periodically be sampled by different teams to diminish the effects of bias in individual collection styles. Samples where the diversity differs substantially from past samples, are resampled by a new team within two weeks. If a change is confirmed, the site becomes a high priority for the next scheduled collection. After the first collections, collection jars will be randomly collected from Team Leaders (one site per sub-watershed on a yearly basis) and will be reviewed for accuracy.

Field checks include checking all datasheets to make sure each habitat type available was sampled and checking datasheets for completeness. Calculations will be checked twice by the field teams and once by the Project Manager when they are received. Jars will also be checked to determine if labels are inside each jar with the date, location, name of collector(s) and number of jars noted. A checklist of equipment will also be reviewed to assure that all equipment has been collected from the stream site and returned to its case.

Information from the monitoring activities is useful only after accumulating data for several years so as to get the sense of trend. Persistent changes in the monitoring data can indicate that the health of the stream has changed. If data received from one collection is significantly different than all other data, it will be recorded and only considered as outlier data if it far exceeds the data of the preceding and subsequent collections.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

The Project Manager will be responsible for the equipment and will see that the Team Leader has access to it. A checklist of equipment (Appendix 4) will be contained in every training participant’s notebook and will be contained in each container of equipment. Each Team Leader will be responsible to check the list of equipment for completeness and make sure the equipment is in working order and not damaged. If Team Leaders find damaged or missing equipment, they will report this information to the Project Manager, immediately. The Project Manager will replace the equipment in a prompt manner. All the equipment except for nets, yardsticks and waders will be stored in a plastic container.

Critical Equipment	Inspection/Maintenance Procedures (When Team Leader picks up or returns equipment)	Person responsible for inspection	Agency responsible for replacement
D-Frame net	Check to see if aquatic net bag contains holes and is securely fastened to pole. Before using: Check to be sure the net is clean and clear of all substances. After use: Clean and rinse net after every collection to prevent transfer of biological matter. If zebra mussels are found at a site, the net will not be used at another site until thoroughly cleaned.	Team Leader MRWA will inspect on yearly basis	MRWA will keep at least one spare net bag
White sorting tray	Before using: Check to be sure tray is clean and clear of all substances. After use: Clean and rinse after every collection to prevent transfer of biological matter	Team Leader MRWA will inspect on yearly basis	MRWA will keep at least one spare tray
Waders	Check to see if waders contain holes Before using: Check to be sure waders are clean and clear of all substances. After use: Clean and rinse waders after every collection to prevent transfer of biological matter. If zebra mussels are found at a site, waders will not be used at another site until thoroughly cleaned.	Team Leader MRWA will inspect on yearly basis	MRWA will return waders to Cabela’s for replacement

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First-aid Kits	Write down, on form enclosed in the kit, any item used. If an item is fully consumed, contact MRWA for replacements.	Team Leader MRWA will inspect on yearly basis	MRWA will keep extra first-aid items.
Other items on equipment checklist	Check to make sure they are present in the container.	Team Leader MRWA will inspect on yearly basis	MRWA

B7. Instrument/Equipment Calibration and Frequency

Not applicable.

B8. Inspection/Acceptance for Supplies and Consumables

The Project Manager is responsible to purchase equipment and consumables and will check supplies once a year. The Team Leader of each monitoring team will check equipment and consumables every time they monitor. The Team Leader will contact the Project Manager of damaged items or items needing replenishing at the end of the monitoring season and not at the beginning.

Item	Source	Description	Item #	Price	Date Purchased
<i>For Invertebrate Sampling</i>					
D-Frame Collection Nets	BioQuip	Aquatic Net 12” D Shape	7412D	\$53.80/ea	
		Aquatic Net Bag D-Shape, 12”	7212DD	\$12.70 ea.	
Sorting Trays	Ward’s	Tray with Pour Lip	189918	\$12.25 ea.	
Forceps	BioQuip	Featherweight Forceps, narrow tip	4748	\$4.45/ea	
	Wards		14V0520	\$3.25/ea	
Eye droppers					
Preservative	Carolinabiological	70% ethanol	86-1263	\$20.94 (4 liters)	
Jars	Ward’s	Plastic Jars, 4 oz., pkg. of 12	181633	\$4.20/pkg	
Lids	Ward’s	Bakelite Jar Caps, 58 mm, Polyvinyl liner, pkg of 12	170370	\$9.48/pkg	
6” Rulers	www.shoplet.com	Clear plastic		.62	
Magnifying glasses	BioQuip	3”	112BQ	\$6.00/ea	
Reel-style measuring tapes					
	Hardware stores www.northerntool.com	Fiberglass 100’		Under \$20 \$14.99	
Yardsticks	www.shoplet.com/office/db/ACM10425.html	Metal ends	ACM10425	\$2.25/ea	
Waders					
	Cabela’s	Three Forks 420-Denier Featherlight Chest Waders		Under \$60	
Outdoor First-aid Kits	www.readykor.com	28 pieces		\$3.25/ea	
Compasses	Wildlife Supply Co. Wards		78-530	\$3.95/ea	
			12V0600	\$2.99/ea	
Container to hold all	Wal-Mart	Rubbermaid container			

B9. Non-direct Measurements

Not applicable to the Muskegon River Water Monitoring Program.

B10. Data Management

1. Data will be entered in datasheets by volunteer team members onsite at the stream. Macroinvertebrate identification may be done in another more convenient location but with all team members present.
2. Team Leaders or other Qualified Volunteers will verify the datasheets for completeness and for quality assurance protocols and sign in appropriate spaces.
3. Datasheets will be mailed, faxed or given directly to the MRWA by the Team Leaders within one week of the monitoring event. Team Leaders will keep a copy of all datasheets.
4. Datasheets will be reviewed for completeness by the Project Manager.
5. Data will be entered by the Project Manager into the Muskegon River Water Monitoring Database in Microsoft Access format within seven days of receipt.
6. Monitoring database will be backed up on CDs on a weekly basis during the collection time periods.
7. Hard copies of the database information will be reviewed and compared to the datasheets by the Project Manager.
8. Data from the MRWA's database will be exported to a MiCorps compatible format and sent to MiCorps for inclusion in their data exchange system.
9. Datasheets, along with backup CDs, will be filed at MRWA offices for an indefinite time period.
10. Data will be made available by the MRWA to local government agencies or other interested organizations.
11. Some monitoring data may be contained on MRWA's website, www.mrwa.org.

C1. Assessments and Response Actions

Volunteer Team Leaders trained through the Muskegon River Water Monitoring Program will monitor that quality assurance protocols are followed in the field and report any issues possibly affecting data quality to the Project Manager. Before the training session, volunteers will be given a pre-training survey to forecast their knowledge and interest in the monitoring program. A post-training survey will be completed by each volunteer to identify their increase in knowledge and to evaluate the training session.

A place on the datasheets will be provided to verify that field quality assurance protocols have been met. Team Leaders will be notified either personally or by phone within one week of their monitoring event to discuss the event and what took place. This could be a time to learn of any deviations from this quality assurance plan.

The first sample taken by a team will be collected by the Project Manager and verified for accuracy. If the accuracy is less than 90%, each sample taken thereafter by the team will be collected by the Project Manager and verified for accuracy. If the team is consistently identifying macroinvertebrate inaccurately, the Team Leader and other qualified volunteers in the team will be asked to take another macroinvertebrate identification exam and may be asked to participate in another macroinvertebrate identification training session.

Sites will periodically be sampled by different teams to diminish the effects of bias in individual collection styles. The total diversity reported by each team must equal at least 70% of the diversity previously found at the site. Sites with results less than 70% will be sampled again by the Project Manager to verify or discard such unusual results. MiCorps will be notified if previously submitted data is in question.

On a random basis, side-by-side monitoring will be completed with the volunteers by the Project Manager, training facilitator or DEQ representative to verify compliance with this quality assurance plan.

If deviation from the QAPP is noted at any point in the sampling or data management process that would affect the outcome of the sampling, the affected samples will be deleted from the data set. Re-sampling will be conducted if feasible. Otherwise, a gap must be left in the monitoring record. All corrective actions will be documented in a record book and communicated to MiCorps by the Project Manager.

C2. Reporting

Quarterly project reports and other reporting will be completed by the Project Manager. Quality control issues will be reported formally to MiCorps in the quarterly project reports. These issues may also be conveyed informally through a phone call or e-mail. These issues will also be discussed with volunteers who attend the yearly meeting and could be a basis for instruction at these meetings. Data report formats will follow MiCorps guidelines, with all quality issues noted.

D1. Data Review, Verification, and Validation

Project data will be reviewed for accuracy and acceptance using the following criteria:

- Only Team Leaders or Qualified Volunteers may identify macroinvertebrate.
- The first sample taken by a team will be collected by the Project Manager and verified for accuracy. If the accuracy is less than 90%, each sample taken thereafter by the team will be collected by the Project Manager and verified for accuracy.
- Sites will periodically be sampled by different teams to diminish the effects of bias in individual collection styles. The total diversity reported by each team must equal at least 70% of the diversity previously found at the site. Sites with results less than 70% will be sampled again by the Project Manager to verify or discard such unusual results.
- The Project Manager will compare the results of each team's samples with other teams' results in the Muskegon River Watershed. Sampling results will also be compared to DEQ or other expert measurements, whenever possible, as a way to verify precision and estimate accuracy.
- Reports on progress will be submitted to MiCorps as required, with all quality issues noted.

D2. Reconciliation with Data Quality Objectives

When datasheets are received by the MRWA, the Project Manager will review them and compare them to previous datasheets within seven days of receipt. If the total diversity is less than 70% in comparison to previous sampling, the Project Manager will collect sampling jars from the Team Leader to verify the results. If the difference in habitat assessment is less than 70% in agreement, a follow-up assessment will be made by the Project Manager and Team Leader concerned. MiCorps will be notified if data previously entered into the MiCorps database is in question.



Site ID: _____

Appendix 1 - Datasheets

Stream Macroinvertebrate Datasheet

Stream Name: _____ Location: _____

Date: _____ Major Watershed: Muskegon River

Datasheet completed by: _____ Collector: _____

Latitude/Longitude (if known): _____

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

Other Team Members: _____

WEATHER and STREAM CONDITIONS

Average Water Depth (ft): _____

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

Substrate Embeddedness: ___ 0-25% ___ 25-50% ___ >50% ___ Unsure

Did you observe any fish or wildlife _____ No _____ Yes

If so, describe: _____

Air Temperature _____
Current conditions _____
Last storm event _____

MACROINVERTEBRATE COLLECTION

Check the habitats that were sampled. Include as many as possible.

_____ Riffles _____ Stream Margins _____ Submerged Wood

_____ Cobbles _____ Leaf Packs _____ Other (describe: _____)

_____ Aquatic Plants _____ Pools _____

_____ Runs _____ Undercut banks/Overhanging Vegetation

Datasheet checked for completeness by: _____

Data entered into MRWA database – date: _____

Data entered into MiCorps database by: _____ Date: _____



Site ID: _____

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.

Group 1: Sensitive

- _____ Caddisfly Larvae (Trichoptera)
- _____ Hellgrammites/Dobsonfly (Megaloptera)
- _____ Mayfly nymphs (Ephemeroptera)
- _____ Gilled snails (Gastropoda)
- _____ Stonefly nymphs (Plecoptera)
- _____ Water Penny (Coleoptera)
- _____ Black fly larvae (Diptera)

Group 2: Somewhat-Sensitive

- _____ Beetle adults (Coleoptera)
- _____ Beetle larvae (Coleoptera)
- _____ Clams (Pelecypoda)
- _____ Crane fly larvae (Diptera)
- _____ Crayfish (Decapoda)
- _____ Damselfly nymphs (Odonata)
- _____ Dragonfly nymphs (Odonata)
- _____ Scuds (Amphipoda)
- _____ Alderfly larvae (Megaloptera)

Group 3: Tolerant

- _____ Aquatic worms (Oligochaeta)
- _____ Leeches (Hirudinea)
- _____ Midge larvae (Diptera)
- _____ Pouch snails (Gastropoda)
- _____ Sowbugs (Isopoda)
- _____ 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)

Number of jars containing specimen from this site: _____

Identifications made by: _____

Rate your confidence in these identifications: Quite confident Not very confident

1 2 3 4 5

Datasheet checked for completeness by: _____

Quality Assurance protocols verified by: _____

Data entered into MRWA database – date: _____

Data entered into MiCorps database by: _____ Date: _____



Site ID: _____

Stream Habitat Assessment

Stream Name: _____ Location: _____

Date: _____ Major Watershed: Muskegon River

Start Time: _____ (AM/PM) Datasheet completed by: _____

Other Team Members: _____

County: _____ Township: _____ Sec T R $\frac{1}{4}$ $\frac{1}{4}$

Latitude: _____ Longitude: _____

Coordinate Determination Method (check one):

_____ GPS _____ GPS w/DBR _____ Digital mapping software _____ Topographic map

_____ Other (describe _____) Map Scale (if known) _____

Please note any site characteristic differences since you previously monitored this site, i.e. weather, stream flow, etc. If none, put none. _____

Site Sketch

On the back of this datasheet, draw a bird's-eye view of the study site. Include enough detail that you can easily find the site again!

Include the following items in the sketch:

- Direction the water is flowing
- Which way is north
- Channel shape (e.g., straight, curvy)
- Large wood in the water
- Vegetation
- Bank features
- Areas of erosion
- Riffles
- Pools
- Location of road
- Trees
- Fences
- Parking Lots
- Buildings
- Any other notable features

Datasheet checked for completeness by: _____

Data entered into MRWA database – date: _____

Data entered into MiCorps database by: _____ Date: _____

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Muskegon
River
Watershed
Assembly

Site ID: _____

PHYSICAL HABITAT														
BACKGROUND INFORMATION						PHYSICAL APPEARANCE (check all that apply)								
Storm Event Condition noted at site	None	Light	Moderate	Heavy		Aquatic Plants	None	Present	Abundant					
Days since rain	≤ 1	2	≥ 3		Unknown	Floating Algae	None	Present	Abundant					
Water Temp/DO/pH*						Filamentous Algae	None	Present	Abundant					
Water Color	Clear	Gray	Brown	Black	Green	Bacterial Sheen/ Slimes	None	Present	Abundant					
Water Body type-u/s	Stream	Lake	Impound	Wetland		Turbidity	None	Present	Abundant					
Water Body type-d/s	Stream	Lake	Impound	Wetland		Oil Sheen	None	Present	Abundant					
Stream Width (feet)	<10	10-25	25-50	>50		Foam	None	Present	Abundant					
Avg Stream Depth (ft)	<1	1-3	>3		Unknown	Trash	None	Present	Abundant					
Water Velocity (ft/sec)*														
Stream Flow Type	Dry	Stagnant	L	M	H									
SUBSTRATE (%) (add to 100%)						INSTREAM COVER (check all that apply)								
Boulder >10 inches diameter						Undercut Banks								
Cobble/Gravel – 10 to .08 in. diameter						Overhanging Vegetation								
Sand – coarse grain						Deep Pools								
Silt/Detritus/Muck – fine grain/organic matter						Boulders								
Hardpan/Bedrock – solid clay/rock surface						Aquatic Plants								
Artificial – manmade						Logs or Woody Debris								
Unknown														
RIVER MORPHOLOGY						STREAM CORRIDOR (left and right facing downstream)								
Riffle	None	Present	Abundant			Riparian Veg. Width ft. (L)	<10	10-30	30-100	>100				
Pool	None	Present	Abundant			Riparian Veg. Width ft. (R)	<10	10-30	30-100	>100				
Channel	Natural	Recovering	Maintained			Bank Erosion	0	L	M	H				
Designated Drain	?	Y	N			Streamside Land Cover	Bare	Grass	Shrub	Trees				
Highest Water Mark (ft.)	?	<1	1-3	3-5	5-10	>10	Stream Canopy %	<25	25-50	>50				
Typical Stream Cross Section Sketch						Adjacent Land Uses (check all that apply)								
						Wetlands							L	R
						Shrub or Old Field							L	R
						Forest							L	R
						Pasture							L	R
						Crop Residue							L	R
						Row Crop							L	R
						Residential Lawns, Parks							L	R
						Impervious Surface							L	R
						Disturbed Ground							L	R
No Vegetation							L	R						

***Optional Data Item**

Datasheet checked for completeness by: _____

Data entered into MRWA database – date: _____

Data entered into MiCorps database by: _____ Date: _____

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Michigan Clean
Water Corps

Site ID: _____

Stream Name: _____ Location: _____

In the table below, note any potential sources of degradation that may be affecting this site.

POTENTIAL SOURCES OF STREAM DEGRADATION (Severity: N=none; S=slight; M=moderate; H=high) (Indicate all that apply)									
Crop Related Sources	N	S	M	H	Land Disposal	N	S	M	H
Grazing Related Sources	N	S	M	H	Onsite Wastewater Systems	N	S	M	H
Intensive Animal Feeding Operations	N	S	M	H	Silviculture (Forestry NPS)	N	S	M	H
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	N	S	M	H	Resource Extraction (Mining NPS)	N	S	M	H
Channelization	N	S	M	H	Recreational/Tourism Activities (general)	N	S	M	H
Dredging	N	S	M	H	• Golf Courses	N	S	M	H
Removal of Riparian Vegetation	N	S	M	H	• Marinas/Recreational Boating (water releases)	N	S	M	H
Bank and Shoreline Erosion/Modification/ Destruction	N	S	M	H	• Marinas/Recreational Boating (bank or shoreline erosion)	N	S	M	H
Flow Regulation/ Modification (Hydrology)	N	S	M	H	Debris in Water	N	S	M	H
Upstream Impoundment	N	S	M	H	Industrial Point Source	N	S	M	H
Construction: Highway, Road, Bridge Culvert	N	S	M	H	Municipal Point Source	N	S	M	H
Construction: Land Development	N	S	M	H	Natural Sources	N	S	M	H
Urban Runoff (Residential/Urban NPS)	N	S	M	H	Source(s) Unknown	N	S	M	H

Additional Comments: Please use this space to make any additional comments about site conditions or this assessment process...

Datasheet checked for completeness by: _____

Data entered into MRWA database – date: _____

Data entered into MiCorps database by: _____ Date: _____

**Volunteer Stream Monitoring
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Muskegon
River
Watershed
Assembly

Site ID: _____

Stream Name: _____ Location: _____

Site Sketch

A large, empty rectangular box with a black border, intended for drawing a site sketch. The box is currently blank.

Finish Time: _____ (am/pm)

Datasheet checked for completeness by: _____

Field Quality Control Measures have been met and are verified by: _____

Data entered into MRWA database – date: _____

Data entered into MiCorps database by: _____ Date: _____

Appendix 2

Standard Operating Procedures (SOPs)

Note: “Team Leaders” or “qualified volunteers” have completed one day of Water Monitoring Training and have completed the Macroinvertebrate Identification exam with a minimum of a 95% score.

1. Sampling the benthic community

- a. At least one Qualified Volunteer (may be the Team Leader) will participate in the stream monitoring. For safety reasons, at least two people must participate in the sampling of the benthic community. One person will be designated the Team Leader.
- b. Sampling will be completed in the first two weeks of May and September of each year. If a site is temporarily inaccessible, such as due to prolonged flooding or high water, the monitoring time will be extended to the end of each month. If the issue concerning inaccessibility is continued to the extended dates, then no monitoring data will be collected during that time and there will be a gap in the data.
- c. Weather conditions will be noted on the Stream Macroinvertebrate Datasheet including air temperature, current weather conditions (raining, sunny), and last storm event.
- d. The MRWA will supply necessary equipment. The Team Leader will be responsible to pick up the equipment and assure that it is complete and in operating condition.
- e. Safety is considered the most important element. Do not attempt to sample the benthic community when the stream is at a flood-level or during adverse weather.
- f. Sampling the benthic community will take place before the Stream Habitat Assessment.
- g. Multiple collections will be taken by volunteers from each habitat type present at the site, including riffles, rocks or other large objects, leaf packs, submerged vegetation or roots, runs, pools, submerged wood, undercut banks and stream margin areas, while wading and using a D-frame kicknet. Care will be taken to retrieve all the macroinvertebrates in the collection locations.
- h. The Team Leader or another qualified volunteer will transfer the material from the net into a white pan.
- i. Macroinvertebrate will be identified as to its order – taxonomic level. The macroinvertebrates will be collected and identified using the orders that are identified in the **Stream Macroinvertebrate Datasheet**. Each specimen in the denoted orders will be counted with the number inserted by their respective names. The quality of the water is then computed using the formulas in the **Stream Quality Score** box on the same page of the data sheet.
- j. The Team Leader or another qualified volunteer will identify the different types of macroinvertebrate from the pan, count them and record them on the datasheet. The Team Leader may choose to identify the different types of

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- macroinvertebrate in a more convenient location but all team members must be present.
- k. Identification tools will be used to identify the different types of macroinvertebrate, including the Muskegon River Water Monitoring Program notebook.
 - l. All macroinvertebrate collected will be placed into a jar of 70% ethyl alcohol with a label written in pencil (or pre-printed) inserted inside the jar. Jars will be rinsed first with stream water before adding the alcohol. Labels will contain the collecting date, location, name of collector (team), and number of jars used at the site. If more than one jar is used, each jar will have the same identification labels placed inside each jar. The jars will then be rubber banded and stored together.
 - m. All calculations on the datasheet will be checked twice.
 - n. Potential sources of variability, such as weather/stream flow differences, season and site characteristic differences will be noted on the datasheet.
 - o. The Team Leader or another qualified volunteer will sign the datasheet in the line provided after “Identifications made by”.
 - p. The datasheet will be checked for completeness and signed by all volunteers involved in the collection.
 - q. The Team Leader is responsible to have the net and other collecting utensils rinsed at the site to prevent transferring anything from one site to another. Nets will be carefully picked clean of all insects and debris. If zebra mussels are found at the site, a different net and waders will be used at following sites until they are thoroughly cleaned. The Team Leader will assure that all equipment placed in the plastic container is dry.
 - r. The Team Leader will assure that any item used from the First-aid kit is noted on the sheet provided in the kit.
 - s. The Team Leader is responsible to keep one copy and send the original datasheet to the Project Manager within one week of the monitoring event.
 - t. The Project Manager will review the data promptly in case the team needs to add data.
 - u. The Project Manager will enter the information in an Access database and upload the data to MiCorps.
 - v. The Project Manager will make arrangements to collect the first collection jar(s) of macroinvertebrate from the Team Leaders.
 - w. The Team Leader will house the subsequent collection jars for a minimum of three years. All specimen jars will be store in a cool place. Alcohol will be changed periodically according to MiCorps specifications.
 - x. The Project Manager will collect one site’s jar(s) per sub-watershed on a random basis per year which will be checked for accuracy.
 - y. On a random basis, side-by-side monitoring will be completed with the volunteers by the Project Manager, training facilitator or DEQ representative to check for procedural accuracy.
 - z. The Team Leader will be in charge of picking up the equipment and returning it within a five day time period because other teams may be waiting to use it.
 - aa. If a team is unable to monitor their site, the Team Leader will contact the Project Manager by the 10th of the month (May or September).

2. Assessing the stream habitat

- a. For safety reasons, at least two people must participate in the Stream Habitat Assessment. One person will be designated a Team Leader.
- b. Safety is considered the most important element. Do not attempt to assess the stream habitat when the stream is at a flood-level, during adverse weather or during other hazardous conditions.
- c. An approximate 300 foot section of the stream will be assessed.
- d. At least one person must be in the stream while completing the Stream Habitat Assessment but the Assessment will be completed as a team.
- e. The following assessments may be done onshore after a water sample is taken:
 1. Site sketches
 2. Adjacent Land Uses
 3. Potential Sources of Stream Degradation
- f. Potential sources of variability, such as weather/stream flow differences, season and site characteristic differences will be noted on the datasheet.
- g. The datasheet will be checked for completeness by the Team Leader and signed by all volunteers involved in the collection on the lines provided.
- h. The Team Leader is responsible to keep one copy and send the original datasheet to the Project Manager.
- i. The Project Manager will enter the habitat assessment information in an Access database and upload the data to MiCorps.
- j. If a team is unable to monitor their site, the Team Leader will contact the Project Manager by the 10th of the month (May or September).

Appendix 3

Sample Tags and Labels

Jar labels (placed inside the jars):

Muskegon River Water Monitoring Program	
Site Number: _____	Date: _____
Location: _____	
Name of Collectors: _____	
_____	Number of Jars used: _____

First-Aid Kit Form:

First-aid Kit Item	Item(s) used (no. and date)	Date MRWA is contacted	Date replenished
First Aid Guide			
2 – Ibuprofen tablets			
4 – ¾" x 3" plastic bandages			
2 – ¾" x 3" fabric bandages			
1 – knuckle fabric bandage			
1 – large butterfly wound closure			
2 – alcohol cleansing pads			
2 – antiseptic cleansing pads			
2 – antibiotic cleansing wipes			
1 – antibiotic ointment pack			
1 – insect sting relief pad			
1 – 2"x2" moleskin square			
1 – lip ointment			

Muskegon River Water Monitoring Program Equipment Checklist (Appendix 4)

Check in “Pickup Time” Column if items are present. Check in “After Monitoring” column if items are present when you return the monitoring equipment. Write in the “Your Notes” section if items are missing or there is a need to contact the MRWA* to replenish items.

Pickup Time	Item	Things to Notice	Your Notes	After Monitoring
	D-Frame Net	Make sure net is clean and free from soil and insects		
	Waders	Make sure waders are clean and free from soil and insects		
	Yardstick			
Items below are in plastic container:				
	Sorting tray	Make sure tray is clean and free from soil and insects		
	2 Forceps			
	Jars & lids	Are there at least 5 jars in the container?		
	Preservative	Is there enough preservative for your monitoring event and the next?		
	6” Ruler			
	2 Magnifying glasses			
	Reel-style Measuring Tape			
	Compass			
	First-Aid Kit and List	Do any items need replenishing?		
	Clipboard and datasheets	Are there at least 3 sets of datasheets?		

*Contact Terry Stilson at the MRWA by calling 231-591-2324 or email at mrwa@ferris.edu