Michigan Trout Unlimited *River Keepers Program* Volunteer Manual

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Prepared by:
Kristin Thomas
Michigan Trout Unlimited

Chapter 5 Prepared by:
Jo Latimore, Huron River Watershed Council, August 2006

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Chapter 1 – *River Keepers Program* Overview

1.1 Scope of this Manual

This manual contains methods and tools for volunteer monitoring of water temperature, in-stream habitat characteristics, aquatic macroinvertebrate based water quality indices, in-stream flow, and fisheries populations. Some of the methods and training techniques are specific to Michigan; in these instances chapters outside of Michigan should consult with their local agency biologists about modifying methods to meet their needs. This manual is intended for use by Trout Unlimited (TU) chapters across the country, although it was written specifically for Michigan and includes examples and methods specific to Michigan.

The methods included in this manual are standard to governmental agencies in Michigan. For most types of data the methods presented should work across the country. Methods for water temperature, in-stream flow, and in-stream habitat are standard and should work throughout the nation with little modification unless otherwise noted. However, methods for sampling macroinvertebrates and fisheries survey techniques are specific to those required by the Michigan Departments of Natural Resources and Environment (MI DNRE). Chapters outside of Michigan interested in monitoring macroinvertebrates and/or fish should contact local agencies to determine what methods are standard for stream monitoring in their area.

It is a good idea to contact local agencies and fisheries biologists early on in the planning process regardless of which variables you are monitoring. Maintaining a good relationship and open communication with agency staff is very beneficial. It will make setting up most aspects of a volunteer stream monitoring program easier. In addition, in most cases, one of the goals of stream monitoring is to provide data to state and/or federal agencies. Communication about how they would like the data collected and delivered is critical to ensuring that the data will get used in future fisheries and habitat management decisions.

1.2 Stream Monitoring, A New Opportunity for TU Volunteers

One of the important identities of TU is the hands-on stream restoration that its members achieve through volunteer efforts. Through the past decades this has been a hallmark of TU, incredibly beneficial to our rivers and streams, and has provided a critical means for TU volunteers to directly contribute to our mission in a meaningful and valuable manner. In many parts of the country, this hands-on stream restoration work is still the foundation of TU work. Michigan Trout Unlimited (MITU) is fortunate to have a wealth of highly productive partners in conservation and in particular, stream restoration. Many of our watershed councils and conservation districts (and the RC&D's) possess a high level of capacity, have many fulltime technical staff, and are very productive in performing stream restoration projects. We are fortunate for this, as performing stream restoration projects in Michigan has become administratively demanding (engineering design

requirements, grant subcontracting, etc.), at least for a volunteer-based organization such as TU. Hands-on volunteer involvement is not always needed for these projects. Fortunately, volunteer stream monitoring offers TU members an ideal opportunity to contribute in a hands-on manner while capitalizing on the greatest strength of TU, its large number of members who are knowledgeable about specific trout streams. The volunteer stream monitoring program also comes at a time when governmental agencies need this type of assistance more than at any other time in history. MITU's large number of members and wide distribution across Michigan provide MITU with a unique opportunity to conduct widespread stream monitoring. Monitoring coldwater streams across the state will provide a wealth of valuable information.

Volunteer stream monitoring engages members, educates them about coldwater resources, and contributes needed information that is the foundation to achieving any component of our conservation mission. The MITU *River Keepers* stream monitoring program was created with this premise in mind. The three primary goals of the *River Keepers Program* are to collect data that will help guide future coldwater conservation and restoration efforts, to provide hands-on volunteer opportunities for Trout Unlimited members, and to provide meaningful data to the MI DNRE. This program will allow MITU to conduct conservation and restoration projects based in science. The ultimate goal of the *River Keepers Program* is to improve coldwater conservation in MI while strengthening MITU's working relationship with the MI DNRE.

Each subsequent chapter of this manual focuses on one type of monitoring: 2) temperature, 3) river habitat mapping, 4) Adopt-A-Station habitat monitoring, 5) macroinvertebrates, 6) in-stream flow, and 7) fish. Objectives and methods for monitoring each type of data can be found in subsequent chapters.

1.3 Recording Volunteer Time and Travel

It is very important to know how many active volunteers are participating in *River Keepers*, how many hours each volunteer is putting in, and how far each volunteer is traveling by car. This information is very important for leveraging funds and for use as match when writing grants. Please keep track of your time and travel each time you volunteer for the *River Keepers Program*. A volunteer time and travel log can be found in Appendix 1A.

Appendix 1A – Volunteer Time and Travel Log

Volunteer Time and Travel Log

Name _____ **Email or Phone Number**_____

Date	Activity	Start Time	End Time	Miles Traveled by Car

Please send an electronic copy of this sheet to Kristin Thomas kthomas@michigantu.org

Chapter 5 – Macroinvertebrates

The methods outlined in this chapter are standard for qualitative analysis of stream macroinvertebrates, and will work in most areas. Chapters around the country wishing to begin a macroinvertebrate monitoring program should contact local agencies to determine what methods are best for that area.

Any chapter wishing to begin a MiCorps program must coordinate through the Huron River Watershed Council and MiCorps. Michigan Trout Unlimited can help with this coordination process.

This chapter was prepared by Jo Latimore, Huron River Watershed Council, in 2006.

MiCorps Volunteer Stream Monitoring Procedures

5.1 Objectives

This set of stream monitoring forms is intended to be used as a quick screening tool to increase the amount of information available on the ecological quality of Michigan's streams and rivers, and the sources of degradation to the rivers. This document is designed to provide standardized assessment and data recording procedures that can be used by trained volunteers participating in the Michigan Clean Water Corps (MiCorps) Volunteer Stream Monitoring Program.

This stream monitoring procedure is designed to address several general objectives:

- Increase the information available on the ecological quality of Michigan rivers and the sources of pollutants, for use by DNRE staff, local communities and monitoring groups.
- Provide consistent data collection and management statewide.
- Serve as a screening tool to identify issues and the need for more thorough investigations.

5.2 Training

All MiCorps Volunteer Stream Monitoring Program leaders must have received basic training in the stream assessment methods described below from MiCorps staff. Trained program leaders are then qualified to train their program volunteers in these procedures.

5.3 General Concepts

The procedures and data forms provided below include two types of assessment: Stream Habitat Assessment and Macroinvertebrate Sampling.

The Stream Habitat Assessment is a visual assessment of stream conditions and watershed characteristics. The assessment should include approximately 300 feet of stream length. Only observations that are actually seen are to be recorded. No "educated guesses" are to be made about what should be there or is probably there. If something cannot be seen, it should not be recorded. The one exception is if a significant pollutant source or stream impact is known to be upstream of a particular site, a comment about its presence can be made in the comment section of the form.

The Macroinvertebrate Sampling procedure should be used in conjunction with the Stream Habitat Assessment because each approach provides a different piece of the stream condition puzzle. Because of their varying tolerances to physical and chemical conditions, macroinvertebrates indicate the ecological condition of the stream, while the macroinvertebrate data is used to calculate the MiCorps Stream Quality Index, which provides a straightforward summary of stream conditions and can be used to compare conditions between study sites.

5.4 Survey Design

1. Selecting Monitoring Sites

One of the basic questions in planning stream monitoring is the location of study sites: how many stream sites should be surveyed within a watershed to adequately characterize it, and where should they be located? That depends on a variety of factors including the heterogeneity of land use, soils, topography, hydrology, and other characteristics within the watershed. Consequently, this question can only be answered on a watershed-by-watershed basis.

A general DNRE guideline is to try to survey a minimum of 30% of the stream road crossing sites within a watershed, with the sites distributed such that each sub watershed (and in turn their sub watersheds) are assessed to provide a representative depiction of conditions found throughout the watershed. At least one site should be surveyed in each tributary, with the location of this site being near the mouth of the tributary. The distribution of sampling stations within the watershed should also achieve adequate geographic coverage. Consider establishing stations upstream and downstream of suspected pollutant source areas, or major changes in land use, topography, soil types, water quality, and stream hydrology (flow volume, velocity or sinuosity). If the intent of monitoring is to meet additional, watershed-specific objectives, then additional data may be needed.

In all cases, the site should be representative of the area of stream surveyed, it should contain a diverse range of the available in-stream cover, and it should contain some gravel/cobble bottom substrates if possible. Remember that each study site should allow for the assessment of 300 feet of stream length.

2. Time of Year

The time of year in which monitoring is conducted is important. For comparison of monitoring data from year to year, data should be collected during the same season(s) each year. Ideally, macroinvertebrate sampling should take place in spring and again in early fall. Different macroinvertebrate communities are likely to be encountered during these different seasons, and sampling twice a year will provide a more complete picture of the total stream community. Surveys conducted during or shortly after storm runoff events may help to identify sources of pollutants, but high water obscures bank conditions and increased stream turbidity which may make assessment of in-stream conditions difficult. Furthermore, all sites within a single watershed should be surveyed as closely together in time as possible to facilitate relative data comparisons among stations surveyed under similar stream flow and seasonal conditions.

5.5 Instructions for Completing Data Sheet

1. Stream Habitat Assessment

a. Photographs

Taking Pictures

Always take photos. Photographs are useful for interpretation of Stream Habitat Assessment data and for later comparisons among different sites. Site photos should show the bank conditions and some of the riparian corridor. Additional photos may be taken to highlight a particular item of concern in the stream or upland landscape. Be sure to document photos as they are taken, to simplify identification later.

b. Stream, Team, Location Information

MiCorps Site ID#: A site ID# for each of your study sites will be assigned to you by MiCorps. If you do not know the MiCorps Site ID#, leave this space blank.

Stream Name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area and also note the local name if it is different. For tributary streams to major rivers, record the tributary stream name here, ***not*** the major river name. If the tributary is an unnamed tributary, record as "Unnamed Tributary to" followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as "Unnamed Tributary to Hogg Creek".

Location: This is often the name of the road from which you access the study site. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. "Green Road between Brown Road and Hill Road").

Date: Record the month, day and year.

Time: Record the time when the monitoring activity began. Use 24-hr time (e.g.

1:00 PM should be recorded as 1300).

Names: Record the name and the phone number of the person completing the datasheet, as well as the names of other team members participating in the assessment.

c. Stream and Riparian Habitat

Average Stream Width (ft): Circle the range that represents the average stream width in feet. Take width measurements of the stream at several points along the 300-foot assessment area, and indicate the average width here. These measurements are also useful in creating the Stream Site Sketch.

Average Stream Depth (ft): Circle the appropriate depth range in feet. Take depth measurements at several points within the 300-foot assessment area, and indicate the average depth here. This observation is for the average depth of the stream that is consistently observed. For example, if the stream is generally shallow (<1ft), but has a pool that is 3ft deep, circle the <1ft category since a pool is not representative of the average depth of <1ft observed over most of the stream.

Stream Flow Type: Circle the category that best represents general flow volume in the stream. Describe the flow during the assessment in relation to the annual average flow. If river flow is reduced in the summer, due to dry and hot conditions, circle "L" because it is below average, even though low flow may be typical for that stream in the summer.

Dry	=	No standing or flowing water, sediments may be wet.
Stagnant	=	Water present but not flowing, can be shallow or deep.
L (low)	=	Flowing water present, but flow volume would be considered to be below average for the stream.
M (medium)	=	Water flow is in average range for the stream.
H (high)	=	Water flow is above average for the stream.

Highest Water Mark: The highest water mark is the maximum height to which the stream water level rises at the site, as determined by the visible evidence present. This level is typically reached during floods or high flow conditions. The highest water mark is determined as the distance in feet **above the present water level** at the site. If the surveyor cannot visibly determine how far the stream rises at the site, circle the "?" on the form. The highest water mark may be visible as discoloration on bridge pilings or abutments, stream debris (trash, leaves, weeds) left along the stream banks or in tree/shrub branches, ice scour marks on trees or streambanks, or muddy residues left in floodplains or on streamside vegetation.

Turbidity: Circle the appropriate description of turbidity. Turbidity is caused by suspended particulates such as silt, sand, algae, or fine organic matter. Turbid water is opaque to varying degrees, preventing the observer from seeing very far into it. Note that water can have a color to it that is not turbidity, such as the brown transparent water often associated with swampy areas.

Oil Sheen: An oily appearing sheen on the water surface caused by petroleum products. A thin sheen will often have a rainbow of hues visible. The sheen can be distinguished from bacterial sheens by remaining viscous when poked with a stick or otherwise physically disturbed, whereas bacterial sheens break into distinct platelets.

Bacterial Sheen: Bacterial sheens occur as oily appearing sheens on the water surface, often with a silverish cast to them. The sheens are produced from bacterial decomposition activity, and occur most often in still water areas of lake edges and coves, as well as wetland areas. The sheen can be distinguished from petroleum products by breaking into distinct platelets when poked with a stick or otherwise physically disturbed, whereas petroleum products remain viscous.

Foam: Naturally occurring foam often looks like soap suds on the water surface and can be white, grayish or brownish. Foam is produced when water with dissolved organic material is aerated and can range in extent from individual bubbles to mats several feet high. Foam is typically produced in streams when water flows through rapids or past surface obstructions such as logs, sticks and rocks. Simple wave action can produce foam in lakes. This naturally occurring foam is quite common. Natural foam can be distinguished from soap suds by rubbing it between the fingers. If the suds disintegrate and leave only wet fingers or a gritty residue, the foam is natural. If the suds feel slippery and soapy, or smell perfumed, it is not natural foam.

Water Temp: This is an optional data item. The person coordinating a particular watershed survey will determine if temperature measurements will be made. If measured, record the water temperature to the nearest degree Fahrenheit or centigrade, making sure to include the scale units.

Water D.O.: This is an optional data item. The person coordinating a particular watershed survey will determine if dissolved oxygen (DO) measurements will be made. If measured, record the DO level in the river. If DO is measured, it is important that the water temperature be measured also.

Water pH: This is an optional data item. The person coordinating a particular watershed survey will determine if pH measurements will be made. If measured, record the pH of the stream to the nearest tenth.

Water Velocity (ft/sec): This is an optional data item. The person coordinating a particular watershed survey will determine if water velocity measurements will be made. If measured, record the approximate surface water velocity in feet per second, observed at the surface in the area of fastest river flow that is not impacted by a road crossing. One method is to observe how far downstream a floating object travels in one second (observe for 10 seconds and divide the distance by 10).

Substrate: Substrate is the material that makes up the bottom of the stream. In general, good quality substrates (from an aquatic habitat perspective) contain a large amount of course aggregate material—such as gravels and cobbles—with a minimal amount of fine particles surrounding or covering the interstitial pore spaces. These stable materials

provide the solid surfaces necessary for the colonization of attached algae and the development of diverse macroinvertebrate communities.

Using the particle size and composition guidance provided below, identify the percent areal extent of each substrate type present. The composition estimate should include the entire area of the stream bottom in the study site (typically, 300 feet of stream). Sometimes it is not possible to determine the substrate type all the way across a river because it is too deep or the water is turbid. In these cases, assign the appropriate percentage amount to the "unknown" category.

Substrate Type		**Composition and Size**
Boulder	-	Rocks 10" diameter or larger
Cobble	-	Rocks 2.5 – 10" diameter
Gravel	-	Rocks 0.1 – 2.5" diameter
Sand	-	Coarse grain
Silt-Muck-Detritus	-	Fine grain/organic matter
Hardpan-Bedrock	-	Solid clay/rock surface
Artificial	-	Human made
Unknown	-	The portion of the stream bottom for which a substrate type determination cannot be made because the bottom cannot be seen due to water depth or turbidity.

Plant Community: The following categories should be observed throughout the 300-foot assessment reach. If a category type (e.g. aquatic plants) is not present in the stream, mark 0 for absent. If a category type can be seen only in a very small amount, mark 1 for rare. If a category is present in most areas, mark 2 for common. If a category type is present in a large portion of the stream, mark 3 for abundant. If a category occupies nearly the entire site, mark 4 for dominant.

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

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

Adjacent Land Uses: Circle the appropriate left or right streambank (facing downstream) designation for all of the following land uses that are adjacent to the stream. Land use along the entire length of stream that can be seen from the road stream crossing should be evaluated. This might include land that is beyond the riparian corridor. "Adjacent"

requires the use of some judgment on the part of the surveyor, but generally refers to any land that can be seen from the crossing and is reasonably close to the stream such that pollutants could run off it into the stream. For example, if a 20-acre corn field is near a stream but separated from it by a 10' grass/shrub buffer strip, the "row crop" category should be circled. If the same field were 100' from the stream and the intervening distance was wooded, the "forest" category should be circled.

Riparian Vegetative Width: The riparian vegetative width is the width of the streamside natural vegetation zone along the stream banks. The width is measured from the edge of the stream to the end of the contiguous block of natural vegetation. Natural vegetation is defined as including trees, shrubs, old fields, wetlands, or planted vegetative buffer strips (often used in agricultural areas and storm water runoff control). Agricultural crop land and lawns are **not** considered natural vegetation for the purposes of this question. Circle the appropriate distance (in feet) that represents the **average, or most representative** (>50% of the lineal bank distance) width of the vegetation zone for each side of the river. Left and right banks are determined from the perspective of facing downstream.

Sources of Degradation: The intent of this section is to evaluate the relative importance of potential sources in terms of pollutant contribution to the water body at a given site in the watershed. The evaluation assesses the potential for pollutant inputs at the site, **NOT pollutant impacts**, or the potential for pollutant impacts. Pollutant impacts, as indicated by visual manifestations, were evaluated previously on the first page of the data sheet. Evaluating potential sources of pollutants to a water body is a three step process: identification of potential sources, evaluation of pathways for pollutants to get to the water body, and finally evaluation of the severity (magnitude) of this pollutant input or loading. The three steps of this process will result in scoring identified sources on the survey sheet as Slight, Moderate, or High Priority in terms of the severity or amount of their pollutant contribution to the water body at the site being surveyed.

(1) Source Identification

Visually evaluate the various land use/land change activities at the site for potential sources of pollution. Note all potential sources for the area that can be seen (choosing from among the list of sources on the data sheet). For example, is there evidence of soil disturbance at the site, or land uses such as residential lawns, agricultural fields, parking lots, urban areas, etc., near the water body? Use the source definitions provided to help identify what potential sources may exist. If it is known that a significant source exists upstream of the study site, such as a wastewater treatment plant, it may be important to note the presence of that source, but it should be recorded in the comments section since it was not visible at the site.

(2) Pollutant Pathway

Next, for each potential source that has been identified, evaluate how pollutants could get from the source to the water. An evaluation of likely pathways for pollutants to enter the water body provides information regarding the potential for the identified sources to contribute pollutants. The following provides a quick outline of some visual observations

to consider in evaluating pollutant pathways. Pay particular attention to likely water runoff patterns at the site that may occur during rainfall or snowmelt events.

- Gully/rill erosion provides a direct pathway for pollutants to enter the stream in a concentrated flow when the land slopes toward the stream. Pollutants associated with eroding soils will vary depending on the type of land use activity.
- Tile/pipe discharges are potential direct pathways for pollutants.
- Bare soils near the edge of a water body provide a likely pathway for sediment to get to the water body.
- Maintained lawns to the edge of a water body provide a likely pathway for nutrients and pesticides to the water body.
- Land disturbance/use activities to the edge of a water body provide a likely pathway for various pollutants to the water body.
- Open areas of disturbed soils and/or bare soils devoid of vegetation provide a potential pathway for pollutants via wind erosion.
- Steep streambanks (steeper than a 2:1 slope) devoid of vegetation are likely pathways for sediment.
- No canopy over the water body is a pathway for dramatic thermal increase in water temperature during the day.
- Impervious surfaces (parking lots, roads, roof tops, etc.) provide a likely pathway for various pollutants, and may increase flows in the watershed causing flashiness.
- Culverts/bridges may not be aligned with the stream, or may be undersized, and could provide a likely pathway for flow to create streambank erosion both upstream and downstream of the culvert or bridge.

(3) Severity Ranking

Finally, for each source for which a pathway has been identified, evaluate how severe the pollutant loading is. Rank each source identified as Slight, Moderate or High severity for the contribution of pollutants, based on the magnitude or quantity of pollutants likely to be delivered to the stream. The surveyor must use their judgment on assigning a slight, moderate or high rating.

The severity ranking is based only on *pollutant inputs* from the specific source *at the site*, not on visible stream impacts or impacts the pollutant may cause downstream. The pollutant loads from the identified source(s) may or may not have an impact at the site.

Evaluation of the source, location and pathways can provide a reasonable assessment of the severity of the pollutant loading. The following provides a quick outline of some visual observations to consider in evaluating the severity of pollutant loading.

- Proximity to water body – generally the closer the use, or land disturbance activity, is to the water body, the greater the likelihood for pollutant delivery.
- Slope to water body – generally the steeper the slope/topography to the water body, the greater the likelihood of overland pollutant delivery.

- Conveyance to water body (ditch, pipe, etc.) – generally a conveyance from the use, or land disturbance activity, increases the likelihood of pollutant delivery.
- Imperviousness – impermeable surfaces reduce the amount of land area available for water infiltration and increase the potential for overland runoff. Additionally, if a watershed is greater than 10% impervious, it will start to show some systemic problems due to impacts from flow. If a watershed is greater than 25% impervious, the natural hydrology is generally heavily impaired.
- Intensity and type of use, or land disturbance activity – generally the more intensive the activity the greater the likelihood for the generation of pollutants. Certain activities may have specific types of pollutants associated with them.
- Size of erosion area – generally the larger the erosion area the greater the likelihood for sediment delivery.
- Soil type – clay is less permeable than sand, and therefore would create a greater potential for overland runoff of pollutants.
- Presence and type of vegetation – the greater the vegetative buffer around a water body, the better the filtration of pollutants from nearby land disturbance and use activities. Certain types of vegetative buffers work better than others and should be evaluated on a case-by-case basis.

2. Stream Macroinvertebrate Monitoring

a. Streamside Procedures

Stream Location Information:

MiCorps Site ID#: A site ID# for each of your study sites will be assigned to you by MiCorps. If you do not know the MiCorps Site ID#, leave this space blank.

Stream Name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area. For tributary streams to major rivers, record the tributary stream name here, ***not*** the major river name. If the tributary is an unnamed tributary, record as "Unnamed Tributary to" followed by the name of the next named stream downstream. For example, a station on an unnamed tributary of Hogg Creek would be recorded as "Unnamed Tributary to Hogg Creek".

Location: This is often the name of the road from which you access the study site. It is very important to indicate whether the site is upstream or downstream of the road. If the same road crosses a single stream two or more times, it is sometimes desirable to record the road name relative to the nearest crossroads (e.g. "Green Road between Brown Road and Hill Road").

Date: Record the month, day and year.

Collection Start Time: Record the time when macroinvertebrate sampling begins. Use 24-hr time (e.g. 1:00 PM should be recorded as 1300).

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

- *Latitude and Longitude:* Record the latitude and longitude coordinates of the study site. Ideally, these coordinates will correspond to the midpoint of the stream study reach. Sources for these coordinates include a GPS unit, a topographic map, or digital maps, such as www.topozone.com.

Monitoring Team: Record the name of the person completing the datasheet, the person doing the actual in-stream macroinvertebrate collecting, as well as other team members participating in the assessment.

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

Siltation: Some siltation along stream margins is normal. However, silt that settles on gravel, cobble, and woody debris in the main stream channel can have a negative impact on the benthic invertebrates that colonize these substrates and also can affect fish reproduction. Note on the data form whether there is obvious siltation on the dominant substrate types in the main stream channel.

Embeddedness: Embeddedness refers to the extent to which gravel, cobble, or boulders are surrounded or covered by fine material (such as silt or sand). The more the substrate is embedded, the less its surface area is exposed to the water and available for colonization by invertebrates. Record the appropriate level of embeddedness observed in the stream reach. This is measured as the percentage of an **individual** substrate piece, such as a rock, that is covered on average.

Fish or Wildlife: During the macroinvertebrate survey, volunteers should take note of any fish or wildlife (frogs, turtles, ducks, etc.) that may be visible in or near the stream and document any observations on the survey form.

Note if any crayfish or large clams that would not fit in the sample jar were found at the site but not collected. Many freshwater clams are rare or endangered, and should not be disturbed. Remember; however, to include these organisms in the Stream Quality Score on the second page of the data sheet.

Macroinvertebrate Collection:
The sampling effort expended to collect benthic macroinvertebrates at each site should be sufficient to ensure that all types of benthic invertebrate habitats are sampled in the stream reach. This generally will be about 30 minutes of total sampling time per station. Macroinvertebrate samples should be collected from all available habitats within the stream reach using a dip net with one millimeter (mm) mesh, a kick screen made from doweling and window screening, or by hand picking. Habitat types can include riffles, pools, cobbles, aquatic plants, runs, stream margins, leaf packs, undercut banks, overhanging vegetation, and submerged wood. Habitat and substrate types from which macroinvertebrates were collected (or collections were attempted) should be recorded on the form; include as many as possible.

Collecting should begin at the downstream end of the stream reach and work upstream.

All organisms collected should be placed into a bucket or tray. The composite sample should be rinsed and all large pieces of debris removed. The remaining sample contents should be emptied into enamel or plastic pan(s) with a light-colored bottom.
The team of volunteers should then sort through the collection and place the macroinvertebrates into jar(s) of 70% ethanol preservative for later identification. Volunteers should be shown how to pick through the tray, and to inspect rocks and other debris, emphasizing hidden locations under bark and in caddisfly cases. Be sure that every jar has a label written in pencil and placed inside the jar. It is recommended that all individuals collected be placed in the sample jar. However, in cases where there are VERY large numbers of clearly identical organisms, no more than approximately 15 individuals need to be included in the collection.

*** While macroinvertebrates collected from the stream can be identified to order in the field by experienced collectors, the collected organisms must still be preserved in labeled sample jars and retained by the volunteer monitoring program for verification purposes. See "Macroinvertebrate Monitoring: Is It Good for the Stream?" in the MiCorps Monitor, Issue 2 (April 2006) for more information (www.micorps.net/newsletter.html) ****

b. Macroinvertebrate Identification and Stream Quality Assessment

The organisms in the collection should be identified to order or sub-order, as indicated, using taxonomic keys. The abundance of each taxon in the stream study site should be estimated and recorded on the survey form (R=Rare [1-10 organisms], C=Common [11 or more organisms]).

The total stream quality score should be calculated as indicated on the survey form. This score is then used to rank the site as excellent, good, fair, or poor.

Identification Confidence: The name(s) of those determining the identification of organisms in the sample should be recorded, as well as a numerical rating of confidence in the identifications.

For more information, or to view the latest version of this procedure and MiCorps data sheets, visit the MiCorps website at www.micorps.net.

Appendix 5A – Stream Macroinvertebrate Datasheet

MiCorps Site ID#:_____

Michigan Clean Water Corps

Stream Macroinvertebrate Datasheet

Stream Name: _____

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

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

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

Latitude:_____ Longitude:_____

Monitoring Team:

Name of Person Completing Datasheet:_____

Collector:_____

Other Team Members:_____

Stream Conditions: Average Water Depth:_____ feet

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

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

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

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

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

Did you see, but not collect, any **live crayfish**? (___ Yes ___ No), or **large clams**? (___ Yes ___ No)

remember to include them in the assessment on the other side!

Collection Finish Time: _____(AM/PM)

Datasheet checked for completeness by:_____ Datasheet version 10/08/05

Data entered into MiCorps database by:_____ Date:_____

MiCorps Site ID#:_____

Michigan Clean Water Corps

IDENTIFICATION AND ASSESSMENT

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

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

Group 1: Sensitive

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

Group 2: Somewhat-Sensitive

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

Group 3: Tolerant

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

STREAM QUALITY SCORE

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

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

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

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

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

Identifications made by:_____

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

Datasheet checked for completeness by:_____ Datasheet version 10/08/05
Data entered into MiCorps database by:_____ Date:_____

Appendix 5B – Stream Habitat Assessment

STREAM HABITAT ASSESSMENT

Michigan Clean Water Corps

I. Stream, Team, Location Information

Site ID:_____ Date:_____ Time:_____

Location:_____

Name(s):_____

II. Stream and Riparian Habitat

A. General Information *Circle one or more answers as appropriate*						Notes and Observations: Give further explanation when needed.
1	Average Stream Width (ft)	< 10	10-25	25-50	>50	
2	Average Stream Depth (ft)	<1	1-3	>3	>5	
3	Has this stream been channelized? (Stream shape constrained through human activity- look for signs of dredging, armored banks, straightened channels)	Yes, currently	Yes, sometime in the past	No	Don't know	
4	Estimate of current stream flow	Dry or Intermittent	Stagnant	Low	Medium	High
5	Highest water mark (in feet above the current level)	<1	1-3	3-5	5-10	>10
6	Which of these habitat types are present?	Riffles	Deep Pools	Large woody debris	Large rocks	Undercut bank
		Overhanging vegetation	Rooted Aquatic Plants	Other:	Other:	Other:
7	Estimate of turbidity	Clear	Slightly Turbid (can partially see to bottom)		Turbid (cannot see to bottom)	
8	Is there a sheen or oil slick visible on the surface of the water?	No	Yes			
9	If yes to #8, does the sheen break up when poked with a stick?	Yes (sheen is most likely natural)		No (sheen could be artifical)		
10	Is there foam present on the surface of the water?	No	Yes			
11	Is yes to #10, does the foam feel gritty or soapy?	Gritty (foam is most likely natural)		Soapy (foam could be artifical)		
The following are optional measurements not currently funded by MiCorps						
8	Water Temperature					
9	Dissolved Oxygen					
10	pH					
11	Water Velocity					

MiCorps Site ID#:_____ Date:_____

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II. Stream and Riparian Habitat (continued)

B. Streambed Substrate

Estimate percent of stream bed composed of the following substrate.

If group will take transects and pebble counts (in Section IV), check this box and record the measured percentages. ☐

Substrate type	*Size*	*Percentage*
Boulder	>10" diameter	
Cobble	2.5 - 10" diameter	
Gravel	0.1 - 2.5" diameter	
Sand	coarse grain	
Fines: Silt/Detritus/Muck	fine grain/organic matter	
Hardpan/Bedrock	solid clay/rock surface	
Artificial	man-made	
Other (specify)		

C. Bank stability and erosion.

Summarize the extent of erosion along each bank separately on a scale of 1 through 10, by circling a value below. Left/right banks are identified by looking downstream.

Excellent	Good	Marginal	Poor
Banks Stable. No evidence of erosion or bank failure. Little potential for problems during floods. < 5% of bank affected.	Moderately stable. Small areas of erosion. Slight potential for problems in extreme floods. 5-30% of bank in reach has areas of erosion.	Moderately unstable. Erosional areas occur frequently and are somewhat large. High erosion potential during floods. 30-60% of banks in reach are eroded.	Unstable. Many eroded areas. > 60% banks eroded. Raw areas frequent along straight sections and bends. Bank sloughing obvious.
LEFT BANK 10 - 9	LEFT BANK 8 - 7 - 6	LEFT BANK 5 - 4 - 3	LEFT BANK 2 - 1 - 0
RIGHT BANK 10 - 9	RIGHT BANK 8 - 7 - 6	RIGHT BANK 5 - 4 - 3	RIGHT BANK 2 - 1 - 0

You may wish to take photos of unstable or eroded banks for your records. Record date and location.

Comments:

MiCorps Site ID#:_____ Date:_____

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II. Stream and Riparian Habitat (continued)

D. Plant Community

Estimate the percentage of the stream covered by overhanging vegetation _____%

Using the given scale, estimate the relative abundance of the following:

Plants in the stream:		*Plants on the bank/riparian zone:*	
Algae on Surfaces of Rocks or Plants	Filamentous Algae (Streamers)	Shrubs	Trees
Macrophytes (Standing, Floating Plants)	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**	Grasses	**0= Absent 1= Rare 2= Common 3= Abundant 4= Dominant**
Identified species (optional)		Identified species (optional)	

E. Riparian Zone

The riparian zone is the vegetated area that surrounds the stream. Right/Left banks are identified by looking downstream.

1. Left Bank

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Residential Lawn Park Shrub, Old Field Agriculture

Construction Commercial Industrial Highways Golf Course Other_____

2. Right Bank

Circle those land-use types that you can see from this stream reach.

Wetlands Forest Residential Lawn Park Shrub, Old Field Agriculture

Construction Commercial Industrial Highways Golf Course Other_____

3. Summarize the size and quality of the riparian zone along each bank separately on a scale of 1 through 10, by circling a value below.

Excellent	Good	Marginal	Poor
Width of riparian zone >150 feet, dominated by vegetation, including trees, understory shrubs, or non-woody macrophytes or wetlands; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.	Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.	Width of riparian zone ,10 feet; little or no riparian vegetation due to human activities.
LEFT BANK 10 - 9	LEFT BANK 8 - 7 - 6	LEFT BANK 5 - 4 - 3	LEFT BANK 2 - 1 - 0
RIGHT BANK 10 - 9	RIGHT BANK 8 - 7 - 6	RIGHT BANK 5 - 4 - 3	RIGHT BANK 2 - 1 - 0

MiCorps Site ID#:_____ Date:_____

III. Sources of Degradation

1. In what ways is this stream degraded, if any?

2. Does a team need to come out and collect trash?

3. Based on what you can see from this location, what are the potential causes and level of severity of this degradation? Only judge what you can see from the site.

(Severity: S – slight; M – moderate; H – high) (Indicate all that apply)							
Crop Related Sources	S	M	H	Land Disposal	S	M	H
Grazing Related Sources	S	M	H	On-site Wastewater Systems	S	M	H
Intensive Animal Feeding Operations	S	M	H	Silviculture (Forestry)	S	M	H
Highway/Road/Bridge Maintenance and Runoff	S	M	H	Resource Extraction (Mining)	S	M	H
Channelization	S	M	H	Recreational/Tourism Activities (general)	S	M	H
Dredging	S	M	H	• Golf Courses	S	M	H
Removal of Riparian Vegetation	S	M	H	• Marinas/Recreational Boating (water releases)	S	M	H
Bank and Shoreline Erosion/ Modification/Destruction	S	M	H	• Marinas/Recreational Boating (bank or shoreline erosion)	S	M	H
Flow Regulation/ Modification (Hydrology)	S	M	H	Debris in Water	S	M	H
Invasive Species	S	M	H	Industrial Point Source	S	M	H
Construction: Highway, Road, Bridge, Culvert	S	M	H	Municipal Point Source	S	M	H
Construction: Land Development	S	M	H	Natural Sources	S	M	H
Urban Runoff	S	M	H	Source(s) Unknown	S	M	H

Additional comments:

Appendix 5C – Optional Quantitative Measurements

MiCorps Site ID#:_____ Date:_____

IV. Optional quantitative measurements

A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 5-10 transects of your stream reach. Required equipment: tape measure long enough to stretch across the stream, and graduated rod or stick to measure water depth. Data sheet is on the next page.

Directions:
1) Determine stream width.
2) Use the rod to measure depth (D) and substrate (S) at more than 10 but less than 20 regular intervals along the entire transect. (For streams less than 10 feet wide, measure every ½ foot, for streams about 10 feet wide, measure every foot, etc.)
3) At every depth measurement, identify the single piece of substrate that the rod lands on (can be arbitrary).
4). For every measurement, enter the reading on the tape measure, the depth, and the substrate on the data sheet on the next page.

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

B. Bank Height

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

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

V. Final Check

This data sheet was checked for completeness by: _____

Name of person who entered data into data exchange: _____

Date of data entry:_____

VI. Credits

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

MiCorps Site ID#:_____ Date:_____

Michigan Clean Water Corps

STREAM TRANSECT DATASHEET

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

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

T= Reading on tape
D = Depth
S = Substrate

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

Sketch examples:

Undercut (Acute) Obtuse Right