A2. Table of Contents

A3. Distribution List

White River Watershed Partnership Board of Directors
Muskegon Conservation District

A4. Program Organization

Program Manager

Contact information

Thomas Tisue, Ph. D.
4388 Duck Lake Road, Whitehall, MI, 49461
thomastisue@comcast.net
231 421 4408 (home)   630 670 2237 (mobile)

Responsibilities

Project preparation; official QAPP development and maintenance; volunteer training; equipment and supplies acquisition; habitat characterization and sampling event supervision; database management; website updates; volunteer recruitment; education and outreach; quarterly reports preparation; final report preparation; Micorps Conference presentation; initiate, develop, approve, and implement corrective actions as needed.

Reports to WRWP Chair and Board

Technical Specialist

Contact information

Raymond Schinler, B. S
Cobmoosa Road, Ferry, MI, 49421
raymondschinler@wildblue.net
231 861 4624 (mobile)

Responsibilities

Sampling sites and dates selection; habitat characterization; sorting and identification of organisms; data compilation and analysis;
Micorps Conference presentation

Reports to Program Manager

WRWP Chair and Board

Contact Information

Raymond Schinler, B. S
Cobmoosa Road, Ferry, MI, 49421
raymondschinler@wildblue.net
231 861 4624 (mobile)

Responsibilities

Volunteer recruitment; website management; public outreach and dissemination of results; review and approve quarterly and final reports; insure completion of all deliverables; review of financial status reports

Lead Volunteers

Contact Information

Ted Stojak
ted.stojak@gmail.com
231-557-6398

John Stivers
8050 W. Stonycroft Road, Shelby, MI 49455
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Barbara Grob
2508 Meinert Rd, Holton, MI 49425
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231-894-5939 (home) 231 670 9339 (mobile)

Margitta Rose
4388 Duck Lake Road, Whitehall, MI 49461
231-730-6619

Responsibilities

Participate in train-the-trainers events for volunteer leaders; training and supervision of volunteers; macro invertebrate sampling ; habitat characterization, including physical surveys and pebble counts

Reports to Program Manager

A5. Problem Definition/Background

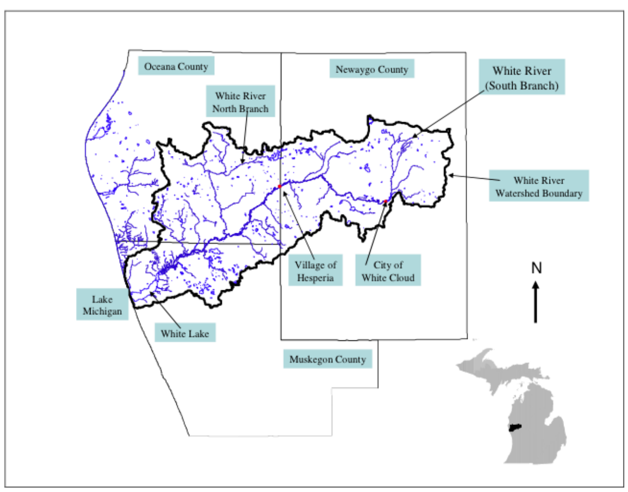
The principal goals of the project are:

- to better acquaint the watershed's residents and elected officials with the role that volunteer monitoring can play in environmental protection;

  to expand stakeholder participation in the implementation of stream monitoring;
- to monitor the characteristics of the benthic macro-invertebrate community as a measure of stream health that will serve as a benchmark against which to assess any changes therein; and
- to establish where deterioration has created the need for remedial actions, and to document the effects of any such actions that may be taken.

A6. Program Description

The White River, a designated Michigan Natural River, is a major feature of the western Michigan biome. The river and its watershed are diverse with respect to both the biological community they support as well as the environmental services they provide. The upper watershed is mostly subject to low levels of anthropogenic degradation, including alterations to the thermal regime. As a result, many of its streams support naturally-reproducing fish populations and host several migrating fish species. In contrast, portions of the lower watershed are more heavily impacted. A comprehensive watershed management plan (WMP), completed in 2009, identifies water quality as a top natural resource conservation priority among area residents and their elected representatives.



The White River Watershed Partnership (WRWP) is a non-profit 501[3][c] organization established in 2003. Our mission statement is "To protect the unique characteristics and natural resources of the White River by promoting education, conservation, restoration and preservation activities". We see the Upper White River Volunteer Stream Monitoring Project as a key means of increasing community awareness and support of, and participation in, our continuing efforts to fulfill this mission. Our experience teaches that participation in volunteer monitoring is an effective means of enhancing people's sense of responsibility for the environment of which they are a part.

The generally high quality of streams in the upper White River watershed, including much of the main branch, should not be taken as a reason for complacency. In fact, this high quality warrants more vigilance, not less. These watercourses are fragile, and their quality is easily degraded by habitat loss; non-point source inputs; inadequate road crossings; development and other land use changes; recreational over-use; and invasive species. All of these factors threaten the healthy functioning of the river ecosystem. The benthic macro-invertebrate community provides a synoptic assessment of their combined effects.

The WRWP has been monitoring macroinvertebrates and riparian habitat in the upper watershed since 2012. We have also conducted pebble counts and geohydromorphological surveys at sites before and after road-stream crossing improvements. This work will continue within the limits of our human and financial resources.

Cobmoosa (Osborn) Creek watershed is located in Oceana County. The stream rises at Cobmoosa Lake (at an elevation of 854 ft), running 7.4 river miles to its confluence with the White River North Branch at an elevation of 717 ft. The average pitch is 18.5 ft mi^{-1} with little variation, among the highest in the entire watershed and enough to produce riffle-pool sequences and reasonable hydraulic diversity. Cobmoosa Creek is generally regarded as high quality water. The WMP characterizes the stream as groundwater-driven, with low base flow, moderate peak flow, and exhibiting a cold mean temperature of 14 – 19 C with low variation. It supports a naturally reproducing brook trout population, is visited seasonally by large numbers of migratory fish, and is a designated trout stream. Fish habitat restoration efforts have taken place in a few locations. Metal flat-bottom arch culverts culverts have been recently installed at two road crossings, resolving earlier connectivity disruptions; other road crossing improvements took place in 2013 and 2014. A short reach near Fillmore Road supports notable numbers of native mussels. Except for that reach, the stream is subject to lamprey control applications. Land in the watershed is mostly forest or herbaceous cover and some agriculture. There are scattered residences, some adjacent to the floodway, but no conurbations or municipal wastewater treatment facilities. The WMP assigns Cobmoosa Creek mesotrophic status. Habitat in the Creek was rated "fair to poor" partly due to sedimentation caused by problem road crossings.

From Filmore Ave. downstream, Cobmoosa Creek is a protected tributary under the Michigan Natural Rivers Act. Its generally pristine quality and small size render Cobmoosa Creek vulnerable to even small insults, demanding a high level of vigilance. The WMP ranks the stream as under moderately critical threat and designates it a high priority for protection

Sampling sites for the Cobmoosa Creek watershed

(CC1) Fillmore Road: this is the first access site below the creek's source in Cobmoosa Lake. Downstream from the crossing is a riffle with coarse gravel and a notable mussel population. (43.65669509 N, -86.18980408 W)

(CC2) Baseline Road: beginning point for lampricide applications. This site has been sampled by WRWP since 2012. (43.64231778 N, -86.18040562 W)

(CC3) Pierce Road/148th Ave: these two road crossings lie only about 300 ft from one another. A timber bridge was completed in 2012 at the upper crossing, the road approaches regraded and paved, and erosion protection provided. The upper crossing has been sampled by WRWP since 2012. The inadequate culvert at the lower 148th Ave. crossing was replaced in 2013. This site lies just above the confluence of Cobmoosa and Swinton Creeks. (43.62029489 N, -86.18860245 W)

(CC4) Johnson Road: a premium quality, flat-bottom metal-arch culvert was completed in 2012, the road approaches were regraded and paved, and erosion prevention undertaken. Fish habitat restoration work has taken place just downstream from the crossing. This site is a short distance above the confluence of Cobmoosa with the White River N. Branch. It has been sampled by WRWP 2012. (43.59914967 N, -86.18106008 W)

Carlton Creek watershed is located in Oceana and Muskegon Counties. The headwaters of the creek lie in the village of New Era, adjacent to a large food processing facility---the site of an earlier processing waste release---at an elevation of 748 ft. The watercourse extends 12.4 mi before joining the White River a few miles above the river's mouth in White Lake, at a nominal elevation of 580 ft. The average pitch is 13.5 ft mi^{-1}, a value associated with some riffle-run-pool structure and moderate hydraulic diversity. Despite its unimpressive origin as an urban ditch, Carlton Creek is identified in *Trout Streams in Michigan* as one of the best brook trout streams in western Michigan. According to a MDNR survey, it also supports a naturally reproducing population of steelhead/rainbow trout. It is a designated trout stream and enjoys protection under the Michigan Natural Rivers Act. Even though the WMP classifies Carlton Creek as run-off driven with moderate base flow and only fair peak flow, it has a cool mean of 19 – 22 C, with low variation. Fish habitat restoration work has taken place in some areas. There have been culvert replacements at Winston and at Arthur Roads. Sand .traps at McKinley and at Skeels Road have helped maintain gravel-bottom runs

Land use in the watershed is varied and has undergone significant changes. The WMP addresses land use and development issues in some detail, pointing out that there is significant agricultural development in the watershed, including especially intensive asparagus and other vegetable farming at the upper end and extensive orchards farther down. Development pressures include growth in and around the villages of New Era and Rothbury and dispersed residential development (1400 acres of residential development from 1978 to 2008), driven by good highway access and the presence of lakes. Surveys by MDEQ in 2002 and 2007 revealed generally good conditions and mesotrophic status, although elevated heavy metals were present in sediments below an industrial facility at Rothbury. The potential for significant NPS inputs from transportation existed along County B86 east of Harrison. Habitat and macro benthos community structure were rated excellent upstream of . .Winston Road, 96th Ave., andYale Road

Sampling sites for Carlton Creek watershed

(CTN1) Arthur Road: culvert replacement work has improved connectivity at this site, which lies just below an area of intensive crop cultivation and fruit orchards. (43.54343118 N,

-86.34007215 W)

(CTN2) Winston Road: this crossing is the site of an earlier MDEQ survey that included, habitat quality, benthic macro invertebrates, and nutrients. It lies adjacent to the village of Rothbury and just upstream of an industrial metalworking operation. The Hart-Montage Trail crosses Winston Road next to the creek. Culvert replacement has also taken place at this crossing. This site marks the lower end of a 2-mile run with the stream's highest pitch. (43.50697019 N, -86.34161174 W)

(CTN3) W. Roosevelt Road : site of earlier MDEQ survey of habitat and benthic macro invertebrates (43.48521692 N, -86.32013798 W)

(CTN4) Skeels Road: (43.47037816 N, -86.29621267 W) location of sand trap and of earlier MDEQ surveys.

The upper Main (South) Branch of the White River begins at the headwaters in a flat, marshy area north of White Cloud and east of Highway 37, soon thereafter forming a single channel with good gradients. Upon reaching Two Mile Road, the stream is cold, clear and flows over frequent gravelly riffles. Recent electrofishing surveys show that the brown and brook trout communities in this area are abundant (M. Tonello, personal communication). Riparian habitat is frequently forested but also includes some margins of agricultural fields. Stream banks are mostly stable, with few erosional features. Below Two Mile Road, gradients gradually become flatter until the stream merges with the pool behind the dam at White Cloud.

Survey site in the upper Main (South) Branch watershed

(SBW1) Two Mile Road: (43.583118 N, -85.755984 W) abandoned road crossing in a reach that has undergone extensive restoration work in the past, including bank stabilization with embedded planks, placement of large woody debris, and perhaps addition of gravel to the stream bed.

The **North Branch of the White River** is a watershed that begins at McLaren Lake and extends largely westward to the confluence with the Main (South) Branch near S. 148th Ave. and Johnson Road. Riparian habitat is mostly forested, with little residential development. Except for the stretch immediately below McLaren Lake, the North Branch is cold water habitat and exhibits fairly steep gradients characterized by gravelly riffles in many reaches. There are also some erosional features where the stream flow encounters sand and gravel banks that are common in this post-glacial terrain. Most of the intersecting rural roads have unpaved sand and gravel surfaces and several exhibit steep, eroding approaches.

Survey site in the North Branch watershed

(NBW1): 176th Ave.: (43.616589 N, -86.118876 W) site of recent replacement of a perched culvert with a timber bridge that allows unimpeded water flow and passage of organisms. Our survey team has established a benchmark 100 yards downstream from the road crossing, mapped both transverse and longitudinal gradients, and performed pebble counts at this site. Estimated erosion from the steep, unpaved approaches using the local soil types and gradients surveyed by WRWP lead to very high predicted erosion inputs to the stream.

A7. Data Quality Objectives

Accuracy is the degree of agreement between sampling result and the true value of the parameter or condition being measured. Accuracy is most affected by the equipment and the procedure used to measure the parameter. Precision refers to how well you are able to reproduce the result on the same sample, regardless of accuracy.

The purpose of this project is to gauge stream health by measuring the total diversity of macroinvertebrate taxa. Since there is inherent variability in accessing the less common taxa in any stream site and program resources do not allow program managers to perform multiple independent (duplicate) collections at the sampling sites, our goal for precision and accuracy is conservative. A given site's Stream Quality Index (SQI) score or total diversity (D) measure across macroinvertebrate taxa will be noted as 'preliminary' until three Spring sampling events and three Fall sampling events have been completed. Most of the sites in the current study meet this criterion and are therefore no longer considered preliminary.

Precision and accuracy will be maintained through following standardizes MiCorps procedures. The Program Manager must be trained in MiCorps procedures at the annual MiCorps training led by MiCorps staff. MiCorps staff also conduct a method validation review with the Program Manager to ensure their expertise. MiCorps staff may also verify the correctness of the program's macroinvertebrate identification. In WRWP's case, side-by-side visits were conducted several years ago with the same volunteers conducting the proposed study.

Precision and accuracy will be maintained by conducting periodic volunteer leaders training. At present, the WRWP team leaders are due for periodic retraining. Techniques under periodic review shall include:

- collecting style (must be thorough and rigorous);
- habitat diversity (must include all available habitats and be thorough in all);
- picking style (must be able to pick thoroughly through all materials and pick all sizes and types of macroinvertebrates
- variety and quantity of organisms (must ensure that diversity and abundance at site is represented in sample);
- transfer of collected macroinvertebrates from the net to the sample jars (specimens must be properly handled and jars correctly labeled).

Precision and accuracy will be maintained through careful macroinvertebrate identification. Volunteers may identify macroinvertebrates in the field, but these identifications and counts are not official. All macroinvertebrate samples are stored in alcohol to be identified at a later identification session. Volunteers can be identifies as identification experts as determined by the judgment of the Program Manager. All field identifications will be checked by an expert with access to a scope, keys, and field guides. The Program Manager or the designated expert will check at least 10% of the specimens identified by others to verify results (with a concentration on taxa that are hard to identify). If more than 10% of the specimens checked prove to have been misidentified, then the Program Manager will review all of the specimens processed by the individual in question and reassess if that person shall be given identification tasks for future sampling events.

Bias: At each site, a different team will do the sampling at least once every three years to examine the effect of possible bias due to individual collection styles. Measures of SQI and D for these samples will be compared to the median results from the past three years. Each should be within two standard deviations from the mean. If the sample falls outside this range, the Program Manager needs to conduct a more thorough investigation to determine which team or individuals are at fault. The Program Manager will accompany teams to observe their collection techniques and will note any divergence from the protocols. The Program Manager will also perform an independent collection (duplicate sample) no less than a week and no more than two weeks after the original collection.

The following describes the analysis used for the Program Manager's duplicate sampling.

Resulting diversity measures by teams are compared to the Program Manager's results and each should have a relative percent difference (RPD) of less than 40%. This statistic is computed using the following formula:

$RPD = [(Xm - Xv)/[(Xm + Xv/2] \times 100$, where Xm is the Program Manager's and Xv is the volunteer's measurement for each parameter.

Teams that do not meet quality standards are retrained in the relevant methods and the Program Manager will re-evaluate their collection during the subsequent sampling event.

It is also possible that the Program Manager will conclude that all sampling was valid and the discrepancy between samples is due to natural variation or unrepresentative sampling conditions.

Completeness: Completeness is a measure of the amount of valid data actually obtained as a fraction of the amount expected to be obtained according to the original sampling design. It is usually expressed as a percentage.

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

Representativeness: Study sites are selected to represent the full variety of stream habitat types available locally. All available habitats within the study area will be sampled and documented to assure a thorough sampling of all the organisms present. Result data from the monitoring program will be used to represent the ecological conditions within the watershed under study.

Sampling under extreme weather conditions may result in unrepresentative samples. The Program Manager will compare suspect samples to the long term record as follows:

Measures of SQI and D for every sample will be compared to the mean of the results from the past three years. Each should be within two standard deviations of the mean. If the sample falls outside this range, it can be excluded from the long term data record, although it can be included in an "outlier" database.

Comparability: Comparability is a measure of how well data from one stream study site can be compared to data from another. To ensure data comparability, all volunteers participating in the monitoring program will follow the same sampling methods and use the same units when reporting. The protocols for sampling reporting are based on MiCorps standards that are taught at annual training events by MiCorps staff. The Program Manager will train volunteers to follow these same methods to ensure comparability of monitoring results with those from other MiCorps programs. To the extent possible, the monitoring of all study sites will be completed on a single day, and certainly within a two-week time frame.

If a Program Manager leaves the position and a new Program Manager is designated, the new appointee will attend the next available training given by MiCorps staff.

A8. Special Training/Certifications

None

SECTION B: PROGRAM DESIGN AND PROCEDURES

B1. Study design and Methods

Macroinvertebrates

The benthic population is sampled within a two-week period, typically once in mid-April to mid-May, and again in mid-October to mid-November. Exact sampling dates are contingent on weather and in-stream conditions. Periods of high flow must be avoided due to low visibility and safety concerns.

To sample the benthic community, trained Collectors take multiple collections from each habitat type present at the site, including riffles, rocks or other large objects, leaf packs, submerged vegetation, depositional areas, etc. Sampling is mostly done with D-frame nets. Large objects are scraped with a knife or the like.   The collected organisms are transferred to white plastic buckets with tight-fitting lids that are labelled with team member names, date, time, location. These buckets are brought to the building where picking and processing take place.

Sampling operations are under the supervision of a Streamside Leader, who completes the Date Sheet for each site, recording factors such as water depth, habitats sampled, unusual conditions, altered site characteristics, etc. The Data Sheets provide places to record variations in procedures, or accidents such as spills (see Appendix II).

After the sample buckets arrive at the processing site, pickers sort through the contents thoroughly, transferring all macroinvertebrates to jars containing 70% ethanol preservative and a label written in pencil stating the date, location, team members' names, and total number of jars from each site. The

Program Manager is responsible for ensuring that jars contain correct labels, are sealed securely, and stored appropriately under identifications are undertaken. The corresponding Data Sheets remain on file indefinitely.

At the time of identification, the expert verifies that the data sheets and sample jar labels match, then conducts determinations of the taxa and number of organisms. These identifications may be verified by the Program Manager as specified in Section A7. The verified results are recorded on the corresponding Data Sheets, which are placed on file indefinitely.

Decontamination
After collections are made at any site, all equipment is inspected, cleaned, and thoroughly decontaminated using dilute bleach or a biocidal commercial preparation, such as 409 Cleaner, or dried a minimum of 5 days before reuse.

The following instructions apply to all contact between persons, their gear, and any given sampling site.

Before you leave your monitoring site, thoroughly inspect and remove all plants, dirt and mud, and any other visible debris like seeds, shoots, animals, insects, and eggs from clothing and equipment.

Some aquatic invasive species can survive on equipment for many hours, even days, after leaving their home waterbody. If you are planning on using the equipment again before it fully dries, disinfect and towel dry all equipment before leaving the site.

Always use gloves and safety glasses when handling undiluted bleach.

- After the "Inspect and Remove" step (page 7-8) and before you leave your monitoring site, use diluted bleach solution to spray equipment that directly contacts plants, mud, and river water (nets, waders, trays, etc). Do this away from the waterbody so the diluted bleach will not enter the waterbody.
- After 10 minutes of contact time with the bleach solution, use the tap water spray bottle to rinse the bleach o prior to loading the equipment into your vehicle.
- Use bleach wipes to wipe down waders and other equipment with lesser contact with foreign substances.
- Dry equipment. Towel off before using in another waterbody. Equipment may need two to five days to air dry depending on invasive species that are encountered.

It is particularly important that all team members be trained to recognize invasive New Zealand mud snails and be aware of the importance of reporting their presence if found. Because of the tenacity with which they cling to gear and apparel, and their high resistance to chemical decontaminants and desiccation, special precautions are mandatory if their presence is known or suspected. In particular, gear and apparel that has been in contact with waters where NZ mud snails are known to be present should not be used elsewhere until subjected to special decontamination procedures such as the use of high temperature and pressure washes.

Habitat analysis
The Program Manager, Technical Specialist, and senior volunteers will complete a Habitat Assessment once a year at any sites that show evidence of substantive change since the previous assessment. These

assessments will follow the protocols shown in Appendix III. An up-to-date site sketch will accompany the assessments, with any recent changes noted.

Personal bias is inherent in the subjective evaluation of the factors that make up the Habitat Assessment. To account for interpersonal discrepancies, the Team Leader will refer to a copy of MiCorps' Stream Monitoring Procedures, which details the qualitative criteria. The Team Leader may choose to read questions to the group of observers and form consensus on their answers. Final decisions on scoring remain the responsibility of Team Leaders who have undergone training and have been certified by the Program Manager, who will review assessments for accuracy and completeness. A critical role of the Habitat Assessments is to highlight any areas of habitat degradation that could adversely impact water quality. Accordingly, any concerns noted will be reviewed by the Program Manager, who will address needs for action including informing appropriate authorities.

B2. Instrument/Equipment Testing, Inspection, and Maintenance

Equipment will be stored at the homes of the Program Manager and Technical Specialist, who will inspect equipment before and after use, noting any discrepancies. The Program Manager will be responsible for needed repairs or replacement, both to be completed before the next sampling event.

B3. Inspection/Acceptance for Supplies and Consumables

The Program Manager will purchase and inspect supplies and consumables, keeping a list of purchase and usage dates, and of quantities on hand. Supplies will be stored at the homes of the Program Manager and Technical Specialist for subsequent distribution to volunteers.

B4. Non-direct Measurements

Non-direct measurements will not be a part of this study.

B5. Data Management

- Trained volunteers will make data entries on the appropriate datasheets.
- The Program Manager will check data sheets for completeness.
- The Program Manager will file the physical data sheets, transmit photocopies to MiCorps as requested, and archive scanned electronic copies.
- The Program Manager will upload data to the Micorps website as appropriate.

SECTION C: SYSTEM ASSESSMENT, CORRECTION, AND REPORTING

C1. System Audits and Response Actions

Performance audits
As required by uncertainties regarding data quality, the Program Manager may see fit to 1) collect a separate sample at one or more sites, independent of the volunteer team; and 2) visit a minimum of two sites to observe the volunteer team and assess the extent to which QAPP procedures are being followed.

Team Leaders will complete and sign a Quality Assurance Checklist for each site sampled and turn the checklists in to the Program Manager.

Data quality assessments
Any fields volunteers may leave blank on the Habitat Assessment or Macroinvertebrate Data sheets will be accompanied by a written explanation. The Program Manager will review any data sheets with unexplained blanks, rejecting them if a satisfactory explanation is not forthcoming.

Corrective actions
The Program Manager may delete from the dataset any samples s/he determines reflect material deviations from the QAPP when it is not feasible to re-sample the site within a short time. The Program Manager will document and communicate any such corrective actions to Micorps.

C2. Data Review, Verification, and Validation

These management actions will include the following elements:

- Use of standardized forms without exception
- Reconfirmation by the Program Manager or Technical Specialist of all taxonomic determinations made by volunteers
- Re-sampling of sites that do not meet DQOs
- Deletion of datasets that do not meet DQOs and cannot be resampled
- The Program Manager will conduct a final review before submitting data to the Micorps Database
- The Program Manager will submit reports to Micorps that note all quality issues that have arisen and corrective actions taken

C3. Reconciliation with Data Quality Objectives

Following completion of taxonomic work by the Technical Specialist, he/she and the Program Manager will compare all datasheets to 1) check for agreement with prior quality ratings at each site to make sure successive ratings meet data quality objectives; and 2) to insure that there are no unexplained material changes to successive habitat assessments. The Program Manager will be responsible for resampling or reassessing sites that do not meet these criteria, if possible within two weeks of the original dates.

Due to natural variations in the benthic macroinvertebrate community, stream quality ratings and habitat assessments shall remain preliminary until successive sampling events create data that are sufficient to support characterization by accepted statistical methods.

C4. Reporting

The Program Manager will submit reports to Micorps management following the relevant guidelines for format and content. In particular, these reports will detail any data quality issues that may have arisen.

Project Narrative

A. Project Description

The White River Watershed Partnership has been conducting a MiCorps Volunteer Stream Monitoring Program in the Upper White River Watershed since receiving a start-up grant in 2012, which was followed by a full VSMP grant the next year. Since then, the WRWP has supported continuation of the program using its own resources, largely endowment funds from local community area foundations.

One of our WRWP Board members is certified to conduct family-level macroinvertebrate identifications, and two other volunteers have several years of training and experience with identifications to the order level. Most of our other volunteers also have two or more years experience with in-stream activities.

In 2017, 2018 and 2019, our monitoring efforts were bolstered by student interns from Muskegon Community College, who were enrolled in for-credit independent study projects.

Because of the ongoing COVID-19 pandemic, 2019 was the last year WRWP conducted macroinvertebrate sampling. That year, we sampled 10 sites in May and again in October, each campaign involving deployment of about a dozen volunteers. Our current plans are to continue work at these same sites whenever circumstances permit. Because of uncertainties associated with persistence of the COVID-19 pandemic, we have not set a date for a Spring sampling event but are prepared to do so on short notice.

Budget narrative

Staffing: WRWP has no paid staff. Our fiduciary, the Muskegon Conservation District, is working gratis.

Fringe benefits: not applicable because of the absence of paid staff.

Indirect costs: WRWP does not charge indirect costs on small grants.

Contractual: no contractors will be involved in this work.

Equipment: Jars and preservative are expendables. Other items are mostly to make up for wear and tear or loss.

Travel: mileage is charged for travel by car to an annual MiCorps meeting and one training event at the prevailing US government rate. Lodging for two attendees to the MiCorps annual meeting is charged at the prevailing MiCorps rate.

Local match: volunteer hours, charged at rates appropriate to qualifications and the nature of the work. Professional tasks include project management, sample identification, and report preparation.

B. <u>Audit letter</u>

MUSKEGON
Conservation District

February 8, 2021

Mr. William Bowen, WRWP Treasurer
PO Box 416
Hesperia, MI 49421-0416

Dear Mr. Bowen:

Muskegon Conservation District agrees to act as fiduciary for a MiCorps grant awarded to the White River Watershed Partnership. Muskegon Conservation District obtains an audit annually.

In regard to this grant, Muskegon Conservation District may choose to charge an administration fee. This fee shall not exceed one-hundred dollars.

Sincerely,

Sue Hatting

Sue Hatting
Assistant Executive Director
Muskegon Conservation District
sue.hatting@macd.org
(231) 828-5097

APPENDIX I: EQUIPMENT LIST

Equipment	Before Use Inspection/Maintenance	After Use Inspection/Maintenance
Waders	Check that waders are clean, dry, and free of holes.	Rinse waders thoroughly and dry completely before storing.
D-Frame Nets	Check that nets are free of holes and are securely fastened to poles. Check that nets are clean and free of all sediment or organic matter.	Rinse nets thoroughly and dry completely before storing.
Specimen sorting trays	Check that trays are clean and clear of all substances.	Clean thoroughly and dry completely before storing.
Specimen Storage Jars and Lids	Check that jars are clean and unused with polyseal tops that seal tightly.	Ensure that all used jars are labeled correctly and that lids are tightly sealed. Unused jars and lids are returned to storage after ensuring that they are clean and free of any substances.
Preservative (70% ethyl alcohol)	Check that there is sufficient preservative to fill at least 3 specimen storage jars for each site to be sampled and that preservative is not past the expiration date.	Check that there is enough preservative for the next sampling event and that it will not expire before that time.
Forceps	Check that forceps are clean and functioning properly (tips meet).	Rinse forceps thoroughly and dry completely before storing.
Hand Lenses	Check that hand lenses are intact and free of smudges or debris.	Clean hand lenses of any smudges or debris. Dry completely before storing.
Pipettes	Check that pipettes are intact and clear of any sediment or organic matter.	Clean thoroughly and dry completely before storing.
Spray Bottles	Check that spray bottles function properly and are free of all sediment or organic matter.	Clean thoroughly and dry completely before storing.
Thermometers	Check for accuracy in ice water and boiling water (before first sampling event only). Check that the mercury has not separated or that there are no bubbles. Swing thermometer downward to reunite mercury or immerse in hot water at about 130°.	Check that thermometers are clean and dry before storing.
Reel-style Measuring Tape	Check that tape is properly wound and clear of any sediment or organic matter.	Clean and dry tape thoroughly and wind tightly before storing.
Yardsticks	Check that yardsticks are clean and that the numbers can be read clearly.	Rinse yardsticks thoroughly and dry completely before storage.

APPENDIX II: STREAM MACROINVERTEBRATE DATA SHEET

MiCorps Site ID#:_______________

Michigan Clean Water Corps

Stream Macroinvertebrate Datasheet

Site Name: ____

Date:______________________________ Collection Start Time:_______________(AM/PM)

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

Latitude:___________________________ Longitude:____________________________

Names of Team members: ____

Stream Conditions:

Average water depth:______________________feet

Notable weather conditions of the last week:_____________________________________

Are there any current site conditions that may impede normal macroinvertebrate sampling? (weather, flooding, poor visibility, etc?)

Habitat Types: Check the habitats that were sampled. Include as many as possible. Remind the Collector to

____Riffles ____Backwater areas ____Submerged Wood
____Rocks ____Leaf Packs
____Aquatic Plants ____Pools
____Runs ____Undercut banks/Overhanging Vegetation

Did you see any crayfish? #:___________, Clams/mussels? #_______________

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

Do not take crayfish, fish, clams, and mussels from the water.

Collection Finish Time: _____________(AM/PM) Picking Finish Time:__________(AM/PM)

Identifications made/supervised by:____

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

Datasheet checked for completeness by:_______________________________________ Datasheet version 11/13/2020

Data entered into MiCorps database by:_______________________________________ Date:_______________

MiCorps Site ID#:_______________

Michigan Clean Water Corps

IDENTIFICATION AND ASSESSMENT

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

Taxa are listed from most pollution sensitive to most pollution tolerant

Count	Common Name	Scientific Taxa	Sensitivity Rating (0-10)	Count x Sensitivity
	Helgrammite (Dobsonfly)	Megaloptera, Corydalidae	0.0	
	Clubtail Dragonfly	Odonata, Gomphidae	1.0	
	Sensitive True Flies (water snipe fly, net-winged midge, dixid midge)	Athericidae, Blephariceridae, Dixidae,	1.0	
	Stonefly	Plecoptera	1.3	
	Caddisfly	Trichoptera	3.2	
	Mayfly	Ephemeroptera	3.5	
	Alderfly	Megaloptera, Sialidae	4.0	
	Scud	Amphipoda	4.0	
	Dragonfly	Odonata	4.0	
	Beetle	Coleoptera	5.1	
	Somewhat Sensitive True Flies	Dipterans (those not listed elsewhere)	6.0	
	Crayfish	Decapoda	6.0	
	Bivalves/Snails	Pelecypoda, Gastropoda	6.9	
	True Bug	Hemiptera	7.7	
	Damselfly	Odonata	7.7	
	Sowbug	Isopoda	8.0	
	Tolerant True Fly (mosquito, rat-tailed maggot, soldier fly)	Culicidae, Syphridae, Stratiomyidae	8.7	
	Leech	Hirundinae	10.0	
	Aquatic Worm	Oligochaeta	10.0	

	Total Abundance	**Sum of (Count x Sensitivity):**	

First: If your total abundance is Less than 30 → Automatically give it a WQR of 10 (Very Poor rating)
Less than 60 → Automatically give it a WQR of 7 (Poor rating)

Water Quality Rating		Degree of Organic Pollution
0.0-3.50	excellent	Pollution unlikely
3.51-4.50	very good	Slight pollution possible
4.51-5.50	good	Some pollution possible
5.51-6.50	fair	Fairly substantial pollution likely
6.51-7.50	fairly poor	Substantial pollution likely
7.51-8.50	poor	Very substantial pollution likely
8.51-10.0	very poor	Severe pollution likely

Water Quality Rating =

Sum of (Count x Sensitivity)
Divided By
Total Abundance

= ______________________

Datasheet checked for completeness by:________________________________ Datasheet version 11/13/2020
Data entered into MiCorps database by:________________________________ Date:____________

APPENDIX III: HABITAT ASSESSMENT

Stream Habitat Assessments

A. GENERAL INSTRUCTIONS

With your team (3-5 members preferably, though it can be done with 2 people), slowly walk the length of the 300 foot station length, taking in the stream's features as you go. It will be helpful to have each member be familiar with the datasheet ahead of time, so that the team knows what to look for. After observing the creek, start answering the questions together, with one member reading the questions and the other team members giving their opinions. The datasheet is filled out in a democratic method, attempting to come to agreement on the answer. If a majority agreement can't be reached, record both answers on your datasheet or where appropriate, take an average result.

Always take photos while conducting the Stream Habitat Assessment. 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.

As the team walks and afterwards fills out the assessment, one team member is in charge of drawing a site sketch (there is no MiCorps template for this; you can choose your methodology). The goal of a site sketch is to make the location understandable for anyone who has never been there, to make it easier to plan future outings, and to track long term changes. Draw a bird's eye view of the study site. It is important to include a north arrow, the direction of water flow, both sides of the stream channel, upland areas, parking location, and roads in the sketch, if applicable.

B. DATA SHEET

1. Stream, Team, Location Information

MiCorps Site ID#: You should create a unique numbering system for your sites. A suggested approach would be to use your organizations abbreviations and combine it with a

number. For example, HRWC-1. You want to pick a numbering system that won't accidently copy another organization's numbering system. MiCorps staff will contact you if your numbering system is not unique.

Date: Record the month, day and year. Time: Record the time when the monitoring activity began.

Site Name: Use a combination of the stream name and location from which you access the study site. For example, Arms Creek at Walsh Road.

Stream name: Use the stream or river name found on the U.S. Geological Survey (USGS) topographic map for the area and note also 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, or name of the public park. 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”).

Location Information: Record the latitude and longitude coordinates of the study site. Ideally, these coordinates will correspond to the midpoint of the stream study reach. Google Maps now allows for very easy latitude/longitude identification. Just right click on the map and these coordinates will be given.

Names of Team members: Record the name of all the team members participating in the assessment, and circle the one recording the data, in case questions come up later.

2. Stream and Riparian Habitat

A. General Information

1. Avg. Stream Width (ft): Circle the range that represents the average stream width in feet. This can be a best guess, or you can choose to 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.

2. Avg. Stream Depth (ft): Circle the appropriate depth range in feet. Take depth measurements at several points within the 300-foot assessment area and take the average depth. 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.

3. Has this stream been channelized? Stream shape constrained through human activity- look for signs of dredging, armored banks, straightened channels. Yes, currently: You see active construction, or vegetation removal, or scraping of banks, and the river lacks turns and meanders.

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Yes, sometimes in the past: The river lacks turns and meanders, but there are signs of water flow induced erosion, and vegetation has recovered from any construction at the site. No: The stream has bends and meanders and you do not see the signs noted above. (note that you might only notice bends and meanders in small creeks; rivers bend and meander at a much higher geographic scale)

4. Estimate of current stream flow: All of these pieces of information can help you make this determination. 1) The volunteers knowledge of recent weather conditions (e.g. how much it has rained recently). 2) Visual stream observations (look for event related conditions water running off the land into the stream, fast stream water velocity, increased water turbidity, an increase in the amount of debris being carried by the stream), 3) The teams knowledge (or best guess) of what is typical flow for that (or a similar) stream, in that geographic area, for that season of the year.

Dry = No standing or flowing water, sediments may be wet. Stagnant = Water present but not flowing, can be shallow or deep. Low = Flowing water present, but flow volume would be considered to be below average for the stream. Medium = Water flow is in average range for the stream. High = Water flow is above average for the stream.

5. Highest water mark (in feet above the current level): Look for signs that the water was once higher: debris trapped against bridges, or trees, and erosion along banks above the water level.

6. Which of these habitat types are present?

Good quality streams have a wide variety of habitat available to fish and macroinvertebrates to: (1) protect them from predators, (2) avoid certain stream conditions such as fast flow velocities or direct sunlight, and 3) provide surfaces and structure on which food grows, collects, or tries to hide. Circle all the habitat types on the data form that are present in the stream reach for your 300 foot station. Types of habitat include the following:

Riffles: Riffles are areas of naturally occurring, short, relatively shallow, zones of fast moving water, typically followed by a pool. The water surface is visibly broken (often by small standing waves) and the river bottom is normally made up of gravel, rubble and/or boulders. Riffles are not normally visible at high water and may be difficult to identify in large rivers. The size of, and distance between, riffles is related to stream size. In large mainstream reaches, such as the Manistee or Muskegon rivers, riffles may be present. in the form of rapids.

Pool: Pools are areas of relatively deep, slow moving water. The key word here is “relatively”. Water depth sufficient to classify an area as a pool can vary from around 8 inches in small streams, to several feet in wadable streams, to tens of feet in large rivers. Pools are often located on the outside bend of a river channel and downstream of a riffle zone or obstruction. The water surface of a pool is relatively flat and unbroken. The presence of pools in large rivers may be difficult to identify because of an increase in relative scale, and an often-limited ability to see to the bottom of deep or turbid stream reaches.

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Large woody debris: Logs, branches, and roots both above and below the water surface.

Large rocks: rocks that are 10 inches in diameter or larger.

Undercut Banks: Stream banks that overhang the stream because water has eroded some of the material beneath them.

Overhanging Vegetation: Terrestrial vegetation that extends out from shore over the surface of the stream within a foot or two of the water surface (includes trees, shrubs, grasses, etc.). This category also includes sweeping vegetation, which is terrestrial shoreline vegetation that extends into the water itself (such as low hanging branches on shrubs) and is therefore often “swept” in a downstream direction by the current.

Rooted Aquatic Plants: Aquatic macrophytes provide breaks in water flow, cover, and a food source, becoming good habitat for both fish and macroinvertebrates.

7. Estimate of turbidity: Water appears cloudy—it is rarely transparent, and the level of the cloudiness is called turbidity. Turbidity is caused by suspended particulates such as silt, sand, algae, or fine organic matter. Highly 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.

8. Is there a sheen or oil slick visible on the surface of the water? 9. If yes to #8, does the sheen break up when poked with a stick?

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.

10. Is there foam present on the surface of the water?

11. If yes to #10, does the foam smell soapy and look white and pillow like or look gritty with dirt mixed in?

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. If the suds are a bright white color, billowy and pillow-like, soapy, or smell perfumed, it is not natural foam. Volunteers used to touch the foam to feel for grittiness, but MiCorps does not advise that anymore as the foam could be PFAS, which you should not handle.

The following are optional measurements not currently funded by MiCorps *(water temperature, dissolved oxygen, pH, water velocity)*

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B. Streambed 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 and Sizes *Boulder:* Rocks 10 inches diameter or larger.

Cobble: Rocks 2.5 inch to 10 inches in diameter. *Gravel:* 0.1 -2.5 inch diameter *Sand:* Coarse grained, <.1 inch diameter particles

Silt-Muck-Detritus: Silt is usually clay, very fine sands, or organic soils, 0.004 to 0.06 millimeters in diameter. Muck is decomposing organic material of very fine diameter. Detritus is small particles of organic material such as pieces of leaves, sticks, and plants.

Hardpan-Bedrock: Solid surface. Hardpan is usually packed clay. Bedrock is a solid rock surface (the tops of buried boulders are not bedrock).

Artificial: Human made, such as concrete piers, sheet piling or rock riprap (that portion of shoreline erosion protection structures that extends below the water surface is considered substrate).

Other (specify): If something doesn't fit into the above categorizes, it goes here. *Can't see:* 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.

C. Bank stability and erosion

Bank erosion may occur as a result of natural flow conditions, or may be caused by human activities. Determine the severity of erosion that has taken place through the

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explanations given for the categories excellent, good, marginal, and poor, and then circle one of the numbers in that category to give a more specific rating.

Excellent: Banks Stable. No evidence of erosion or bank failure. Little potential for problems during floods. < 5% of bank affected.

Good: Moderately stable. Small areas of erosion. Slight potential for problems in extreme floods. 5-30% of bank in reach has areas of erosion.

Marginal: Moderately unstable. Erosional areas occur frequently and are somewhat large. High erosion potential during floods. 30-60% of banks in reach are eroded

Poor: Unstable. Many eroded areas. > 60% banks eroded. Raw areas frequent along straight sections and bends. Bank sloughing obvious.

D. Plant Community

Estimate the percentage of the stream covered overhanging vegetation/tree canopy? Circle one: <10%, 10-50%, 50-90%, >90%. These are very wide windows because a general sense of the situation is all that is needed. Is the stream fully exposed to the sun, fully shaded, or somewhere in between? The level of sun exposure will affect how biota hides and water temperature fluctuations.

For the various type of plants listed, rate each group as absent, rare, common, or abundant. The groups are:

Plants in the Stream: Floating Algae: The abundance of suspended algae (single celled organisms that may or may not form colonies) or algae on the surface or rocks or plants should be recorded 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 waterbody.

Macrophtyes: This category refers to aquatic plants. 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.

Plants on the bank/riparian zone Shrubs: Woody, low lying plants. Trees: Woody, tall plants. Herbaceous: Non-woody plants including grasses, forbs, and so on.

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E. Riparian Zone

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 stormwater runoff control). Agricultural crop land and lawns are not considered natural vegetation for the purposes of this question. A stream with grass mowed to the very edge is said to have no riparian zones. A stream set in a deep forest will have a riparian zone that spreads further than you can even see.

For both the left and right bank (which is determined by looking downstream), circle the landuse types that you can see along your 300 foot stretch.

Then, rate the riparian zone from excellent to poor, and then circle one of the numbers in that category to give a more specific rating, similar to how you rated bank erosion in C.

Excellent: 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.

Good: Width of riparian zone 75-150 feet; human activities have impacted zone only minimally.

Marginal: Width of riparian zone 10-75 feet; human activities have impacted zone a great deal.

Poor Width of riparian zone ,10 feet; little or no riparian vegetation due to human activities.

III. Sources of Degradation

The intent of this section is to evaluate the relative importance of potential sources in terms of pollutant contribution to the waterbody 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 (like erosion, changes to substrate, oil, foam, etc) were evaluated previously.

Evaluating potential sources of pollutants to a waterbody is a three step process: identification of potential sources, evaluation of pathways for pollutants to get to the waterbody, 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 waterbody at the site being surveyed.

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(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 waterbody? 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 waterbody 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 waterbody provide a likely pathway for sediment to get to the waterbody.

• Maintained lawns to the edge of a waterbody provide a likely pathway for nutrients and pesticides to the waterbody.

• Land disturbance/use activities to the edge of a waterbody provide a likely pathway for various pollutants to the waterbody.

• 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 waterbody 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.

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• 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 judgement 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 waterbody – generally the closer the use, or land disturbance activity, is to the waterbody, the greater the likelihood for pollutant delivery.

• Slope to waterbody – generally the steeper the slope/topography to the waterbody, the greater the likelihood of overland pollutant delivery.

• Conveyance to waterbody (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 waterbody, 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.

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Potential Source Category Definitions:

Source Category	**Use this Source Category if ...**

Crop Related Sources	... there is a reasonably clear pathway for pollutants to enter the waterbody from the farmed area. Possible pathways: farming to the edge of the drain, gully/rill erosion off field, tile discharge, wind erosion off field.
Grazing Related Sources	... there is clear evidence that grazing of animals near or in the waterbody has resulted in the degradation of streambanks or stream beds, sedimentation, nutrient enrichment, and/or potential bacterial contamination.
Intensive Animal Feeding Operations	... there is a reasonably clear pathway for pollutants to enter the waterbody from either runoff from the operation or land application of animal manure. Possible pathways: overland flow, tile discharge.
Highway/Road/Bridge Maintenance and Runoff (Transportation NPS)	... there is clear evidence that transportation infrastructure is creating increased flow, runoff of pollutants, or erosion areas in or adjacent to the waterbody.
Channelization	... there is clear evidence that the natural river channel has been straightened to facilitate drainage.
Dredging	... there is clear evidence that a waterbody has been recently dredged. Evidence might include: spoil piles on side of waterbody, disturbed bottom, disturbed banks.
Removal of Riparian Vegetation	... there is clear evidence that vegetation along the waterbody has been recently removed (within the last few years).
Bank and Shoreline Erosion/ Modification/Destruction	... there is clear evidence that the banks or shoreline of a waterbody have been modified through either through human activities or natural erosion processes.
Flow Regulation/ Modification (Hydrology)	... there is reasonably clear evidence that flow modifications in the watershed have created unstable flows resulting in streambank erosion.
Upstream Impoundment	... there is reasonably clear evidence that an upstream impoundment has contributed to impacts on downstream sites. Impacts may be: nuisance algae, increased temperatures, streambank erosion from unstable flows.
Construction:Highway/ Road /Bridge/Culvert	... there is clear evidence that on-going or recent construction of transportation infrastructure is contributing pollutants to the waterbody.
Construction: Land Development	... there is clear evidence that on-going or recent land development is contributing pollutants to the waterbody.
Urban Runoff (Residential/	... there is a reasonably clear pathway for pollutants to enter the waterbody

Urban NPS)	from an urban/residential area. Possible pathways: gully/rill erosion, pipe/storm sewer discharge, wind erosion, runoff from lawns or impervious surfaces.

Land Disposal

... there is a reasonably clear pathway for pollutants to enter the waterbody from an area where waste materials (trash, septage, hazardous waste, etc.) have been either land applied or dumped. Possible pathways: gully/rill erosion, pipe discharge, wind erosion, or direct runoff.

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On-site Wastewater Systems (e.g. septic systems)	... there is reasonably clear evidence of nutrient enrichment and/or sewage odor is present, and there is reason to believe the area is unsewered.
Silviculture (Forestry NPS)	... there is a reasonably clear pathway for pollutants to enter the waterbody from the forest management area. Possible pathways: logging to the edge of the waterbody, gully/rill erosion off site, pumped drainage, erosion from logging roads, wind erosion off site.
Resource Extraction (Mining NPS)	... there is a reasonably clear pathway for pollutants to enter the waterbody from the mined area. Possible pathways: gully/rill erosion off site, pumped drainage, runoff from mine tailings, wind erosion off site.
Recreational/Tourism Activities (general)	... you are unable to clearly identify the recreational source as related to a golf course, or recreational boating activity. Foot traffic causing erosion would fall into this category.
Golf Courses	... there is a reasonably clear pathway for pollutants to enter the waterbody from the golf course area. Possible pathways: overland runoff, gully/rill erosion off course, tile discharge, wind erosion off course.
Marinas/Recr. Boating (water releases)	... if you can reasonably determine that releases of pollutants to a waterbody such as septage or oil/gasoline are due to recreational boating activities.
Marinas/Recr. Boating (streambank erosion)	... you can reasonably determine that streambank erosion is due to wake from recreational boating activities.
Debris in Water	... debris in the water either is discharging a potential pollutant,or is causing in stream impacts due to modifications of flow. Possible examples: Leaking barrel, Refrigerator, Tires, etc. This does not include general litter (e.g. paper products).
Industrial Point Source	... there is reasonably clear evidence that an upstream industrial point source has contributed pollutants.

Municipal Point Source	... there is reasonably clear evidence that an upstream municipal point source has contributed pollutants.
Natural Sources	... there is reasonably clear evidence that natural sources are contributing pollutants. Possible examples: streambank erosion, pollen, foam, etc.
Source(s) Unknown	... if you see an impact but are unable to clearly identify any likely sources.

Additional Comments:

Any observations about the site that were not covered elsewhere on the survey form should be recorded in this section. If certain survey responses require clarification or elaboration, those should be described here as well. The comment section can also be used to add detail to the site characterization, such as listing the types of aquatic plants or algae present, if known.

In addition, any unique conditions or issues that arose or were observed during the assessment process should be noted here.

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IV. Optional Quantitative Measurements

A. Transects and Pebble Counts

To take quantitative stream habitat measurements, conduct 10 transects of your stream reach. A transect is a measuring tape line stretched out perpendicularly across the stream, going from bank to bank. At 10-20 locations along this line, you will take depth measurements and record the substrate type.

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 1⁄2 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. If it is a mix of substrates, randomly pick one of them, and the next time you find a similar grouping, pick the other(s).

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 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

Completeness: A volunteer team member other than the person who filled out the data sheets must check the data sheet for completeness before the team leaves the site. This verification of completeness should be noted at the bottom of each page.

Name of person who entered data into data exchange: This field is for use in case problems come up with the data entry.

Date of date entry: This field is for use in case problems come up with the data entry.

North Branch White River at 176th Ave. Site NBW1

Downstream of 176th Ave. crossing of the North Branch of the White River

North from M-20 on 176th Ave. Park on roadside where safe to do so. Watch for soft shoulders.

Site extends from the downstream side of the crossing 300 ft in direction of flow. Downstream end marked by orange tape on left bank.

Poison ivy is plentiful on road embankment!