Final Report

Stream Habitat and Land Use Assessment for North Central Tributaries to Lake Erie

Prepared by

Dr. Linda Cornell, Project Director
Sharon Reed, undergraduate assistant
Dr. David Baker, Water Quality Laboratory Director

Water Quality Laboratory
Heidelberg College
Tiffin, Ohio 44883

Submitted in partial fulfillment of Grant SG 80-98, Lake Erie Protection Fund

Table of Contents

List of Tables

List of Figures

Introduction

This project evaluated stream habitats in the Huron River Basin and in the Honey Creek watershed of the Sandusky Basin and determined land use in areas contiguous to the riparian zones. The ODNR modified QHEI: Stream Habitat Screening Tool, approved by the OEPA for volunteer groups, was used to evaluate the stream habitats and land use. An additional stream and bank inventory form, developed by the Water Quality Laboratory of Heidelberg College (WQL), was used to evaluate the physical habitat along transects within each selected reach. The Huron Volunteer Stream Monitors (HCVSM) assisted the Water Quality Lab in the evaluation of the Huron River.

Limited habitat assessment evaluation information is available in the Huron River and Honey Creek watersheds. This project provides physical habitat information for the watershed that can provide a basis for watershed management decisions and target best management practices in agriculture and in urban development. The results of this study may also be useful to the OEPA in updating their Nonpoint Source (NPS) Assessment of the Lake Erie East Region. Also, this is one of the first field applications of the new ODNR modified QHEI: Stream Habitat Screening Tool. An evaluation of the assessment method is provided.

Stream habitat and land use is evaluated in the Honey Creek watershed and the Huron River watershed. In the Honey Creek watershed, evaluation sites are located on Honey Creek, Buckeye Creek, Brokenknife Creek, and Silver Creek. In the Huron River Watershed, evaluation sites are located on the Huron River, the West Branch Huron River, the East Branch Huron River, Cole Creek, Rattlesnake Creek, Norwalk Creek, Walnut Creek, and at Holiday Lake.

The contributions of many have made this project possible. Volunteer monitors in the Huron River Watershed include Jan Tkach, Caleb Tkach, Levi Tkach, Sister Mary Gail, Anna Cornell, Matt Schwab, and Orin Stanforth. Their dedication and spirit made this project possible. Sharon Reed and Virginia Boroff completed all the surveys in the Honey Creek Watershed and provided staff support for the project. They were supported by private donation for undergraduate research opportunities through the Water Quality Lab. Dan Kush, ODNR, directed the training session and provided maps and expertise. Katie McKibbon, OEPA, determined stream miles on the Huron River and provided support. The Seneca Soil Water Conservation District and the Huron Soil and Water Conservation District helped determine site locations and landowners, provided maps, and publicized the project in their newsletters. Funding for the project was provided by the Lake Erie Protection Fund, with matching funds provided by private donations to the Water Quality Laboratory of Heidelberg College.

In Section I: Methods, the site selection process and the Stream Reach Screening Tool and the stream and bank inventory form are described. Descriptions of specific parameters and methods of assessment are included. In Section II: Honey Creek Watershed and in Section III: Huron River Watershed, site descriptions and assessment

WATER QUALITY LABORATORY

Heidelberg College
310 East Market Street
Tiffin, Ohio 44883-2462

(419) 448-2198 FAX: (419) 448-2124

Huron River and Honey Creek Volunteer Stream Habitat Survey

LANDOWNER PERMISSION FORM

In order to properly conduct the river survey, we are asking each landowner's permission to allow our volunteers to walk along the river bank on your property. We appreciate your support for this project.

[ ] Yes, your volunteers may walk along the river bank on my property in order to perform a survey of the river.

[ ] No, Your volunteer may not walk along the river bank on my property in order to perform a survey of the river.

[ ] I have some concerns, please call me. The best time to reach me is:

_____

Please fill out this form whether you are granting permission or have concerns:

_____ _____

Print Name Signature Date

_____ _____

Street Address City and Zip

_____

Phone Number

[ ] I am interested in volunteering to take part in the survey with members from the Heidelberg College Water Quality Lab and the Huron County Volunteer Stream Monitors.

Figure 2: Permission Forms Sent To Landowners

details were established with the landowner. Landowners were contacted again within 24 hours of the survey to reconfirm arrangements. Their presence at the survey was encouraged.

Ic. Stream Reach Assessment Methods

Most stream reaches were 200 m long. Some stream reaches of 150 m were used due to physical impediments to surveying or landowner boundaries. All sites at bridges were started a minimum of 30 m from the bridge to minimize bridge effects in the site. Transect lines within in the reach were marked at 50 m intervals with pink survey tape. The physical habitat and land use for the stream reach was evaluated using the ODNR modified QHEI: Stream Reach Screening Tool (Figure 3) and the Stream and Bank Inventory (Figure 4).

Ic1. Equipment

Equipment used for the surveys included:

- digital YSI thermometer or alcohol thermometer for temperature measurement
- Keson 50 meter tape or a Keson 165 ft double graduated tape for linear measurement
- water depth poles (made from 4 ft. x 1" dowel rods) marked in inches and centimeters to measure water depth,
- range finder for long distance measurement
- pink tape for marking transects
- clip boards
- pencils
- plastic bags
- insect repellent
- tall waterproof boots

Ic2. Survey Protocol

Teams of 2 to 5 persons surveyed each site. Each team included at least one Water Quality Lab personnel. A standard protocol was followed for each site evaluated, as described below.

Before surveying the stream, information concerning the team members, date, location of site, and weather conditions was completed on the first page of the ODNR Stream Reach Screening Tool.

Then, the length of the stream reach was measured and marked. One boundary of the site was located 30 m from the bridge. Transect lines were established at 50 m intervals up to 200 meters. The WQL Stream and Bank Inventory Form was completed at each transect line. The width of the stream at water level and at full bank, bank height (left and right), and stream side vegetation width (left and right) were measured at each transect line. Water depth measurements were made at 1m or 2m intervals across the

Stream Reach Screening Tool

DRAFT

Name of person(s) completing form:_____; Phone:_____

Group affiliated with:_____; Today's Date:_____

Precipitation:	Heavy	Steady	Intermittent	None
Now: (Check all	____	____	____	____
Past 48 hrs: that apply)	____	____	____	____

Air temperature now: _____ (circle one) °F °C

Stream name:_____; Stream order:_____

County:_____ Township/city:_____

Length of reach being evaluated: ____150 m; ____ 200 m; ____ 500 m; Other:_____

Describe reach location using roads, bridges, river mile (if known), nearest identifiable landmarks, etc. Attach a 8 1/2x11 inch copy of best available map showing reach location (USGS quad (indicate quad name on map), gazetteer, plat, aerial, county, etc.). If possible, provide latitude and longitude for up and downstream ends.

Upstream end:_____

Latitude:____° ' " Longitude:____° ' "

Downstream end:_____

Latitude:____° ' " Longitude:____° ' "

Water level today: ____ High; ____Medium; ____Low; ____ Standing pools

Average depth:_____; Average width:_____; Water temperature:_____ °F °C (circle one)

After completing the remainder of this form, return to this page and sketch the reach below. Indicate up and downstream ends, landmarks (bridges, roads, etc.), locations of especially good or poor quality habitat and riparian zone, pollution sources and signs including pipes, etc.

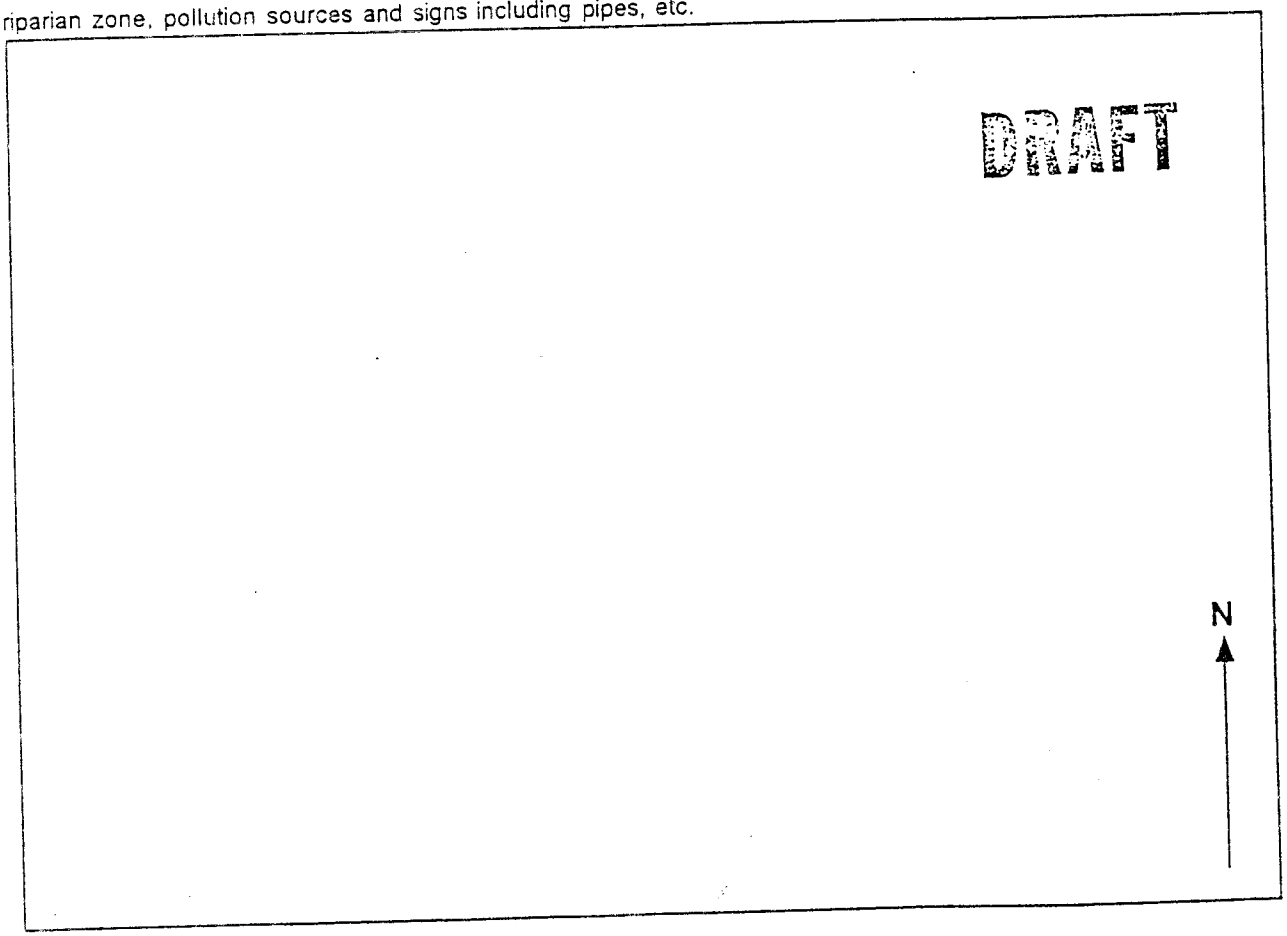


Figure 3: The Stream Reach Screening Tool Form

Signs of Water Pollution

For pollution sources suspected of impacting the reach, use this table to describe any signs of impact by checking the applicable ☐'s or providing the requesed information.

Litter: ☐ No litter visible; ☐ Small litter occasionally (cans, paper); ☐ Small litter common; ☐ Large litter occasionally (tires, carts); ☐ Large litter common; ☐ Piles of trash (illiegal dump); ☐ Yard waste disposal (grass, leaves)

Algae Appearance: ☐ Light green; ☐ Dark green; ☐ Brown coated; ☐ Hairy; ☐ Close growing;

Located: ☐ Every-where; ☐ In Spots; ☐ Attached to Objects; ☐ Matted on Stream bed; ☐ Floating; ☐ Other:_____

Water Appearance: ☐ Clear; ☐ Clear, but Tea colored; ☐ Oily sheen; ☐ Foamy; ☐ Milky; ☐ Muddy; ☐ Black; ☐ Grey; ☐ Other:_____

Stream Bed Deposit: ☐ Grey; ☐ Orange/red; ☐ Yellow; ☐ Black; ☐ Brown; ☐ Silt; ☐ Sand; ☐ Other:_____

Water Odor: ☐ Rotten Egg; ☐ Musky; ☐ Petroleum; ☐ Sewage; ☐ Fishy; ☐ Chlorine; ☐ Soapy; ☐ Chemical; ☐ Manure; ☐ Ammonia; ☐ None; ☐ Other:_____

Discharge Pipes: Total # in segment:___; Kind (# of each): ☐# Field tiles; ☐# Storm sewer; ☐# Industrial wastewater; ☐# Municipal wastewater; ☐# Home sewage; ☐# Unknown kind; ☐# Other:_____

Hydromodification: ☐ Channelization (straightening); ☐ Near bank vegetation removed; ☐ Dam construction; ☐ Vehicle crossing; ☐ Streambank modification; ☐ Dredging; ☐ Bridge construction; ☐ Draining and/or filling wetlands/floodplain; ☐ Other:_____

Other: ☐ Dead fish observed; ☐ Dead wildlife observed; ☐ Fish absent; ☐ Macroinvertebrates absent; ☐ Evidence of extreme flow fluctuations ☐ Gully erosion in nearby fields; ☐ Other:_____

Riparian Zone: (Area from top of bank to first change in land use not to exceed the floodplain) Note: determine left and right side by facing downstream.

					Left Side	Right Side
Vegetative width (Pick one for each side):	>100 m (20 points)	50-100 m (10 points);	10-50 m (5 points);	0-10 m (1 point);		
Vegetative coverage (Pick one for each side):	>90% (5 points)	70-90% (3 points)	50-70% (1 point)	<50% (0 points)		
Vegetative variety (Pick one for each side):	Good mix of shrubs, trees, and non-woody plants (5 points);	Fair mix, one kind not well represented (3 points);	Poor mix, two kinds not well represented (0 points)			
Vegetative disruption/maintenance (Pick one for each side):	Plants allowed to grow naturally (5 points)	More than half of potential plant stubble remains (3 points)	Less than half of potential plant stubble remains (1 point)	Plants 2 inches or less in stubble height (0 points)		
				Totals:		

Comments:_____

Figure 3, Cont.: The Stream Reach Screening Tool Form

SECTION I. LAND USE DETAILS Please checkmark all responses that apply, unless other instructions are given, then complete the comment sections as appropriate.

AGRICULTURE

Crops (___Corn; ___Soybeans; ___Wheat; ___Other:_____)

Livestock (___Cows; ___Pigs; ___Poultry; ___Other:_____)

___Feedlot; ___Pasture; ___Grazed Woodland;

___Manure in stream; Livestock access to reach is: ___Fenced ___Unfenced

Comments:_____

LOGGING

Timber Harvest (___Clearcut; ___Selective)

___Logging Road

Comments:_____

URBAN

Residential (___Single Family; ___Multi Family)

Commercial (___Retail; ___Office/Warehouse)

Industrial (___Light; ___Heavy)

Transportation(___Parking lot;___ # lanes/___# RR tracks) —only those parallel to reach—

___Park/Grass

___Construction Sites (type):_____

This development is: (Check one): ___Dense ___Medium ___Sparse (Check one): ___Rural ___Suburban ___Urban

Comments:_____

MINING & EXTRACTION

Coal Mining(___Underground; ___Surface)

___Sand & Gravel; ___Oil & Gas; ___Access Roads

___Mine Tailings; ___Mine seepage entering reach

Status: (Check any that apply) ___Active ___Abandoned ___Reclaimed ___Unreclaimed

Comments:_____

WASTE DISPOSAL

Land application of waste (___Livestock; ___Human)

___Publicly Owned Landfills;

___Home sewage systems (Estimated #_____)

Comments:_____

OTHER (describe the other land use(s)):_____

Any Other Comments:_____

SECTION II: LAND USE WATER QUALITY IMPACTS

Please respond to the following statements/questions about land uses along the reach

	Agriculture	Logging (commercial)	Urban	Mining & Extraction	Waste Disposal	Other
A. Checkmark land uses having a negative impact on water quality						
OPTIONAL: Rank negative impact on water quality						
-high						
-moderate						
-slight						
B. Estimate distance from top of bank to land use (Indicate units used: ___Feet; ___Meters) (Put "NA" if land use not present on the side)						
-left side Note: determine left and right						
-right side side by facing downstream						

DRAFT

Figure 3: The Stream Reach Screening Tool Continued

Date: | River Name: | River Mile: | River/Site: | Final Score

Citizen's Qualitiave Habitat Evaluation Index

Substrate (Bottom-Type) — Score:

a.) Size

- ☐ Mostly Large (Fist Size or Bigger) — 14 pts (finish bedrock)
- ☐ Mostly Medium (Smaller Than Fist Bigger Than Fingernail) — 10 pts
- ☐ Mostly Small (Smaller Than Fingernail, But Still Coarse) — 6 pts
- ☐ Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky) — 0 pts

b.) "Smothering"

- ☐ Yes — 0 pts
- ☐ No — 5 pts

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

Symptoms: Hard to Move Large Pieces, Often Black on Bottom w/Few Insects

b.) "Silting"

- ☐ Yes — 0 pts
- ☐ No — 5 pts

Are Silts and Clays Distributed Throughout Stream?

Symptoms: Light Kicking of Bottom Results in Substantial Clouding of Stream for More than a Minute or Two

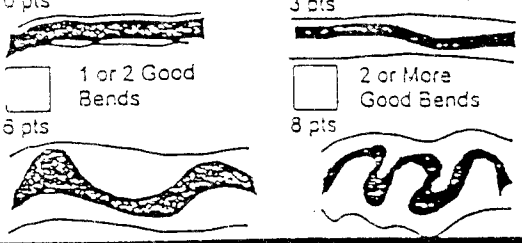
Fish Cover (Hiding Places) -2 Points For Each One Present — Score:

- ☐ Underwater Roots (Large Diameter) — 2 pts
- ☐ Boulders — 2 pts
- ☐ Downed Trees, Branches — 2 pts
- ☐ Water Plants — 2 pts
- ☐ Deep Areas (Chest Deep) — 2 pts
- ☐ Downed Trees, Branches — 2 pts
- ☐ Underwater Roots (Fine Diameter) — 2 pts
- ☐ Backwaters, Oxbows or Side Channels — 2 pts
- ☐ Shallow, Slow Areas for Small Fish — 2 pts
- ☐ Shrubs, Small Trees That Hang Close Over the Bank — 2 pts

Stream Shape and Human Alterations — Score:

a.) "Curvyness" or "Sinuousity" of Channel

- ☐ Very Straight — 0 pts
- ☐ Mostly Straight Some "Wiggle" — 3 pts
- ☐ 1 or 2 Good Bends — 6 pts
- ☐ 2 or More Good Bends — 8 pts



a.) How Natural Is The Site?

- ☐ Mostly Natural — 12 pts
- ☐ Some Man-made Changes (e.g., large bridge, some streambank changes) — 8 pts
- ☐ Heavy, Man-made Changes (e.g., channelized, leveed,) — 0 pts

DRAFT

Stream Forests & Wetlands — Score:

a.) Width - Mostly:

- ☐ 5 pts — Wide (Can't Throw A Rock Through It)
- ☐ 3 pts — Narrow (Can Throw A Rock Through It)
- ☐ 0 pts — None

b.) Land Use - Mostly:

- ☐ 0 pts Urban/Commercial
- ☐ 1 pts Suburban
- ☐ 5 pts Forest/Wetland
- ☐ 2 pts Park (Grass)
- ☐ 2 pts Row Crop
- ☐ 3 pts Overgrown Fields
- ☐ 2 pts Fenced Pasture
- ☐ 0 pts Open Pasture
- ☐ 4 pts Shrub

Depth & Velocity — Score:

a.) Deepest Pool Is At Least:

- ☐ 8 pts - Chest Deep
- ☐ 6 pts - Waist Deep
- ☐ 4 pts - Knee Deep
- ☐ 0 pts - Ankle Deep

a.) Check ALL Flow Types That You See:

- ☐ 2pts - Very Fast: Hard to Stand in Current
- ☐ 3 pts - Fast: Quickly Takes Objects Downstream
- ☐ 1 pt - Moderate: Slowly Takes Objects Downstream
- ☐ 1 pt - Slow: Flow Nearly Absent

Riffle/Runs (Areas Where Current is Fast or Turbulent, Surface May be Broken) — Score:

a.) Riffle/Runs Are:

- ☐ 8 pts - Knee Deep or Deeper and Fast
- ☐ 6 pts - Ankle/Calf Deep and Fast
- ☐ 4 pts - Ankle Deep or Less and a Bit Slow
- ☐ 0 pts - Do Not Exist

b.) Riffle/Run Substrates Are Mostly:

- ☐ 7 pts - Fist Size or Larger
- ☐ 4 pts - Smaller Than Your Fist, But Larger Than Your Fingernail
- ☐ 0 pts - Smaller Tha. Your Fingernail

Huron Ri and Honey Creek Volunteer Stream Habitat Survey

Date _____ Stream Segment Name_____ Team Members: _____

Stream Segment ID: _____

Stream Segment Leader: _____

STREAM INVENTORY

	Stream Bottom Substrate (all present)	Water Depth at Transect (taken at 1m intervals or 10 measurements maximum) L ----------> R										Stream Obstructions (note size)	Unitque Features	Stream Litter Type and Severity	Point Sources Flow Characteristics	
															left	right
0 - 50 m																
50-100 m																
100-150 m																
150-200 m																

BANK INVENTORY

	Stream Width (Water)	Stream Width (Bank Full)	Bank Height		Stream Side Vegetation Width		Dominant Vegetation		Land Use		Bank Erosion		Erosion Control Measures		Bank Litter		Unique Features	
			Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
0 - 50 m																		
50-100 m																		
100-150 m																		
150-200 m																		

Figure 4. Copy of the WQL Stream and Bank Inventory Form.

stream at each transect line. The following stream characteristics were noted for each 50 m interval: *stream bottom substrate, obstructions, unique features, litter, and point sources.* The following bank characteristics were noted: *dominant vegetation, land use, bank erosion, erosion control measures, litter, and unique bank features.*

The ODNR Stream Reach Screening Tool was completed as the team members walked back to the beginning of the site. Answers to the Stream Reach Screening Tool were averages of the whole reach. Each question was answered as a consensus of the team members.

Ic3. Survey Terms and Definitions

ODNR Stream Reach Screening Tool

The Stream Reach Screening Tool (Figure 3) is comprised of six sections: 1) site and weather information, 2) an area to sketch the reach, 3) signs of water pollution, 4) riparian zone assessment, 5) land use assessment, and 6) citizen's qualitative habitat evaluation index (QHEI) . The Stream Reach Screening Tool was completed as per the instruction guide in **Appendix B.** In the riparian zone section, the riparian zone is considered to be the land from the top of the bank to the nearest change in land use. In addition to the instructions given for **vegetative variety** in the riparian zone section, a tree or shrub was considered well represented if more than five were present. A maximum possible score of 35 is possible for the left and right riparian zones. In the **land use section**, *Land Use Water quality Impacts part A: check mark land uses having a negative impact on water quality* was not evaluated because teams could not make an accurate assessment based on the survey and information available.

In the Citizen's QHEI section, **substrate size** is based on appearance compared to fist or fingernail size. **Smothering** was considered present when rocks could not be removed from the stream bed. **Silting** was considered present when kicking the stream substrate resulted in clouding of the stream bed. Presence of any of the categories of **fish cover** within the stream reach was considered sufficient for the box to be marked. **Stream shape and human alteration** was evaluated only within the 200 m boundaries of the reach. If a bridge or road was located on the outer boundary of the survey site it was included a a manmade alteration. The width of the **stream forests and wetlands** was considered to be the width of the riparian zone (stream side vegetation width) measured in the Stream Inventory. **Land use** was also considered to be in and adjacent to the riparian zone. Stream depth and velocities were assessed after walking through the stream. Occasionally small twigs were thrown into the stream to rate the velocity of the stream. **Depth of riffle/run areas and substrate sizes** were assessed while walking through the stream. A sketch of the stream reach was completed last. The **sketch** included transect lines and site boundaries, direction of water flow, location of riffles and pools, natural and manmade features, and land use surrounding the site.

WQL Stream and Bank Inventory Form

For the Stream Inventory (Figure 4), **Stream Bottom Substrate** was classified as boulder (>25.4 cm or 10"), cobble (6.4-25.4 cm or 2.5 -10 "), pebble (1.2-6.4 cm or 0.5 - 2.5 "), or silt and sand. **Water depth** was measured in cm. or inches, using the depth poles, and converted to meters after survey completion. Depth measurements at each transect were taken every 1m (or 2m when the stream width exceeded 10 m). **Stream obstructions** included downed trees and trash. **Unique features** included riffles, and pools. **Stream litter** was noted and marked severe (> 20 pieces), moderate (10-20 pieces), or slight (<10 pieces). **Point Sources** were recorded for the left and right banks. Stream obstructions, unique features, litter, and point sources were assessed for each 50 m interval in the reach.

For the Bank Inventory (Figure 4), **Stream width (water)** is the width of flowing water and **Stream width (bank full)** is the width of the stream at fullest height. **Bank height** is measured from the surface of the water to the top of the first bank. **Stream side vegetation width** was measured from the top the bank to the nearest change in land use. Stream widths, bank height, and stream side vegetation width are measured at each transect. **Dominant vegetation** includes the following categories: tree, shrub, grass, aquatic plants, and non-woody plants. Definitions for these are located in Appendix B. **Land use** was considered to be the zone immediately adjacent to the riparian zone which was measured as the Stream side vegetation width. Examples of land use types are: cornfield, woods, and meadow. Conventional or no-till fields were noted. **Bank erosion** was determined by the amount of bank exposure and signs of bank undercutting. Erosion was deemed either sever (>40% of bank exposed), moderate (20-40% bank exposed), or slight (1-20% of bank exposed. **Erosion control measures** and unique features along the banks were recorded. **Bank litter** was considered severe, moderate, or slight as defined above. The bank categories were recorded for left and right bank separately for each 50 m interval.

Section II. Honey Creek Watershed

II a. Site Locations and Landowner Response

There were 87 land permission forms sent out during May and June for the Honey Creek watershed (Figures 1 and 2). There were 14 negative responses along with an additional 5 letters returned with no forwarding addresses. A total of 44 letters were received indicating either a yes or no response. Several landowners expressed that they wanted to help or be present at the survey. The survey resulted in 30 positive responses to the project. Several of the sites used were known contacts and letters were not sent to them. This gave us a 32% rejection level and an acceptance level of 68%. Rejection does not include the forms that were never returned since it is not know if the letters reached the correct owners or if the owner lost the form and did not really object to the study.

A total of 23 sites were surveyed on Honey Creek in Seneca, Huron, and Crawford Counties. There were 3 sites for Buckeye Creek in Seneca County and 5 sites for both Silver Creek and Broken Knife Creek in Seneca and Crawford County. Locations of the sites in the Honey Creek Watershed are illustrated in Figure 5.

II b. Physical Habitat Assessment and Land Use Results

The results of the habitat surveys in the Honey Creek Watershed are shown in Table 1. The range for scoring for the Citizen's Qualitative Habitat Evaluation Index was 16-92. The maximum possible score for this survey, as used in this project, was 106. The Average Citizen's Qualitative Habitat Evaluation Index for the Honey Creek Watershed was 57.5. On the second page of the Screen Reach Survey Tool there is a scoring section for riparian areas. The riparian zone is considered the land from the top of the bank to the nearest change in land use. The maximum score for both the right and left banks is 35. The range of scores for the right side is 6-35 and for the left side is 6-33. The average riparian scores for both the right side and left side were 18. In most surveys, the scores for the right and left side were identical.

II c. Site Summaries

In this study, a description of each site in Honey Creek Watershed was written in July 1998 after the completion of all the sites. These summaries were developed from notes that were taken at each site along with information given to the stream surveyors by the landowners. Elements of the surveys that were unique to each site are also discussed in the summaries.

Site 1 for Honey Creek had one riffle zone and three different sandbars and showed evidence of fluctuating water levels. The water appearance was very clear. The creek showed signs of having been diked sometime in the past. There was a severe logjam present due to four fallen trees. The owner explained that he has removed log jams in the past to allow the creek to flow naturally. The owner of the property indicated that the

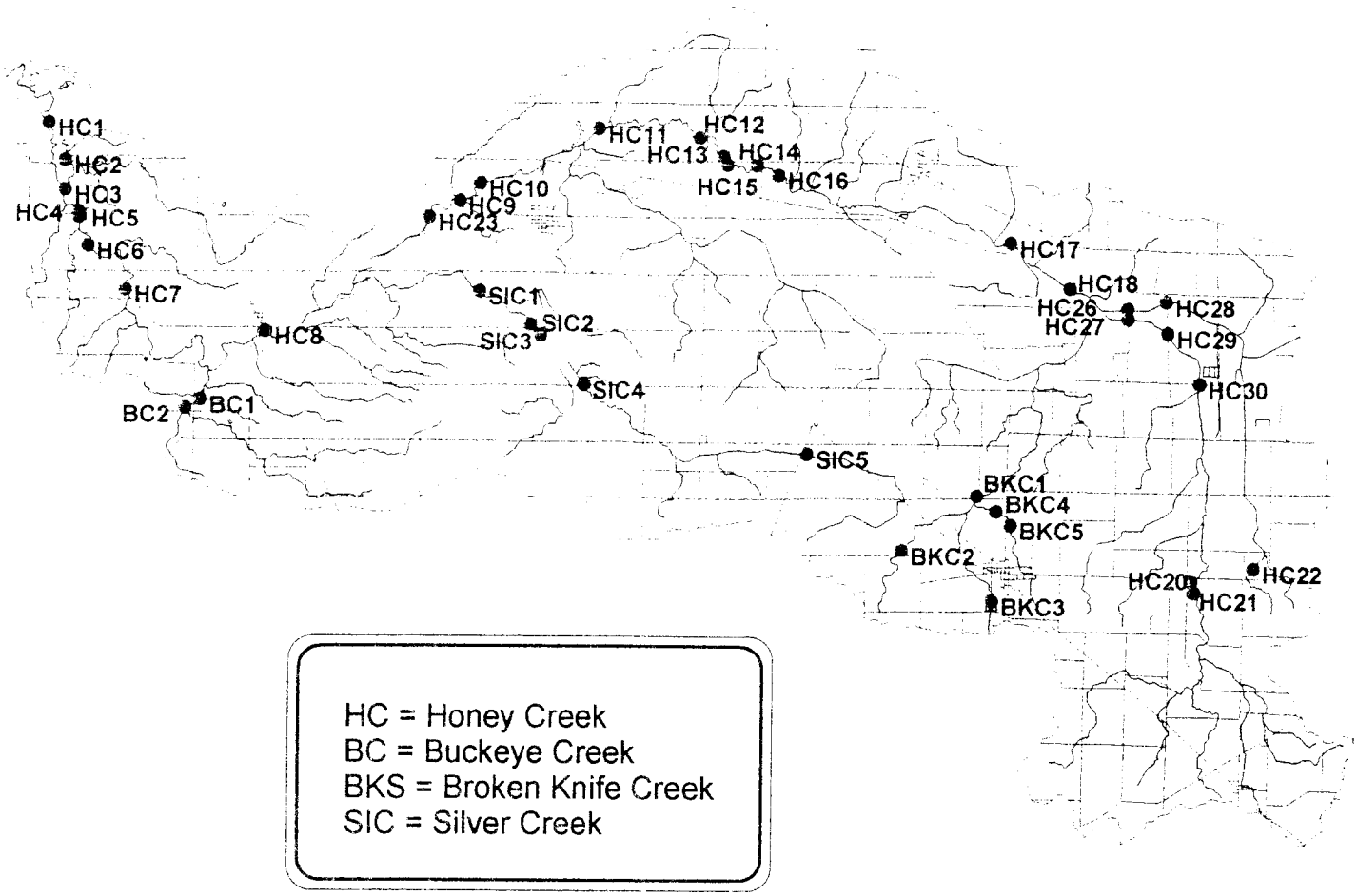


Figure 5. Location of sites in Honey Creek Watershed.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Site I.D. Number	River Miles	Stream Name	Total QHEI Score*	Riparian Zone Score (Right Side) MAX=35*	Riparian Zone Score (Left Side)*	County (H=Huron, S=Seneca, C=Crawford, E=Erie)	Township Site	Lattitude	Longitude	Length of Reach(m)	Precipitation Now	Precipitation in the Past 24 hrs.	Water Level Today	Average Depth(m)	Average Width(m)	Air Temp. Now (C)	Water Temp (C)	**Section II: Signs of Water Pollution**	Litter	Algae Appearance	Algae Location	Water Appearance	Stream Bed Deposit
HC1	2.40	HC	83	20	25	S	1	41.04.37	83.11.01	200	N	I	M	0.322	14.47				2	2	2,3	1	5,6,7
HC2	3.47	HC	80	11	18	S	1	41.04.15	83.10.38	200	N	I	L	0.152	4.42	33.7	26.4		2	1,3	2,3	1,6	1,5,6
HC3	4.47	HC	74	20	16	S	1	41.03.21	83.10.44	200	N	I	H	0.264	19.07	24.7			1	2	2,3	6	5,6,7
HC4	4.99	HC	81	20	29	S	1	41.03.53	83.09.38	200	N	N	L	0.083	12.80	21.1			2,4	2	2,3	1,4,6	5,6,7
HC5	5.10	HC	41	16	23	S	1	41.03.01	83.09.47	100	N	N	M		20.00	21.1			2	2	5	1,6	4,6
HC6	5.76	HC	79	11	23	S	1	41.02.33	83.10.12	200	N	I	M		23.27	30.0	24.2		2	2,5	2,3	4,6	7
HC7	7.30	HC	86	20	25	S	1	41.01.51	83.09.25	200	N	I	M	0.240	22.70	33.7			1	1,5	2,3	1,6	5,6,7
HC8	12.55	HC	85	14	16	S	1	41.01.18	83.06.44	200	N	I	M	0.275	17.30	40.0	25.5		2,4,6,7	2,5	1	4,6	5,6
HC9	17.82	HC	92	20	23	S	2	41.03.23	83.02.19	200	I	I	M						2,4	2,5	2,3	1	5,6,7
HC10	18.17	HC	62	16	18	S	2	41.03.36	83.02.05	200	N	I	M		16.20	19.3	17.1		2,4	2,3,5	2,3	1,6	5,6,7
HC11	20.64	HC	49	20	20	S	2	41.03.26	83.59.45	200	N	I	H	0.762	21.20	23.0	19.0		2			6	5,8
HC12	23.34	HC	76	20	35	S	2	41.04.24	82.58.30	200	N	I	M		13.23				2	2,3	2,3	6	5,6
HC13	24.20	HC	62	23	16	S	3	41.04.02	83.57.02	200	N	H	M	0.339	10.00	23.4	15.6		4	8		6	5,6,2
HC14	24.31	HC	58**	35	20	S	3	41.03.00	83.57.02	200	N	I	H	0.762	19.90	28.6	19.4		2,6			6	6
HC15	25.09	HC	88	25	25	S	3	41.03.50	83.56.21	200	N	H	M	0.322	7.75	23.2	16.8		2,4,6	8		3,6	4,5,6
HC16	25.33	HC	52	35	35	S	3	41.03.06	83.56.07	200	N	H	M	0.239	7.67	30.6	17.0		1	8		3,6	4,5,6,7
HC17	30.70	HC	51	18	16	S	3	41.02.39	82.51.03	200	N	I	M		6.95				2	2	2	6	4,5,6,7
HC18	31.99	HC	35	18	15	S	3	41.01.46	83.09.09	200	N	I	M	1.300	15.25	31.5			1			6	5,6,7
HC19	32.13	HC	19	11	11	H	23	41.01.58	82.89.41	200	N	N	M	0.914	13.90				1			6	5,6,8
HC20	39.77	HC	64	18	19	C	8	20.57.39	82.47.16	200	N	N	M	0.277	4.98				3	8		1,6	5,7
HC21	39.89	HC	70	18	20	C	8	40.57.39	82.47.16	200	N	N	M	0.256	9.58	34.7			2,6	8		1,6	4,5,6,7,
HC22	38.77	HC	40	9	9	C	8	40.57.26	82.45.52	200	N	N	M	0.145	0.84	28.5	16.6		2	3,4	1,3,5	1	5,6
HC23	16.07	HC	71	20	20	S	2	41.02.54	83.03.17	200	N	I	M	1.000		21.1			2	2,4	3	2	5
BC1	1.73	BC	44	11	11	S	1	41.07.15	83.08.0	200	S	H,I	M	0.100	2.75	19.4	15.3		1	1,2,3,4,5,6	2,3,4,5	1	5,6
BC2	1.81	BC	48	13	13	S	1	41.00.02	83.08.01	200	I	I	L	0.091	3.00	19.4	15.3		1	1,2,3,4,5	1,3,4,5	1	1,5,6,7
BC3	4.21	BC	60	33	33	C	4	41.59.18	83.06.04	200	N	H,S,I	M	1.057	3.12	26.0	18.5		1	2,3,5	2,3	6	5,6
SIC1	2.38	SIC	76.5	18	18	S	2	41.01.58	83.02.07	200	N	N	L	0.109	3.70	21.1			2	2,3,5	2,3,4	1,3	5,6
SIC2	3.55	SIC	69	35	16	S	2	41.01.22	83.01.00	200	N	I	M	0.250	3.27				2,4	2,5	2,3	1,9	1,5,6
SIC3	3.82	SIC	45	25	20	S	2	41.01.20	83.00.57	200	N	N	M	0.375	5.08	29.0	29.5		1	2	2,3	6	5,6,7
SIC4	4.29	SIC	21	18	6	S	2	41.00.29	83.00.10	200	I	I	H	0.400	5.90				2	2,4	2,5	6	5,6
SIC5	9.81	SIC	16	14	14	C	6	40.59.28	82.55.28	200	N	N	M	0.240	2.90	29.4	20.0		1			1,6	4,5,6
BKC1	4.75	BKC	41	15	9	C	7	41.58.49	82.51.52	150	N	I	M	0.170	1.87	30.3	24.2		2	2,3,5	2,3	1,6	5,6,7
BKC2	7.03	BKC	40	10	10	C	6	41.57.57	82.53.26	200	I	I	M	0.260	3.23	20.5	17.9		1	8		6	5,6,7
BKC3	7.29	BKC	36	6	6	C	7	41.58.04	82.51.30	200	N	H	H	0.602	4.80	25.6	21.1		2			6	6,8
BKC4* **	5.00	BKC	39	14	14	C	7	40.58.36	82.51.24	200	N	N	M	0.279	2.33	31.0	20.3		2	2,4	2,3,4	6	4,5,6
BKC5* **	5.25	BKC	46	11	9	C	7	40.58.21	82.51.13	200	N	N	L	0.167	1.18				2	1,2,3,4,5	2,3,4,5	1	5,6

* See the Sample Forms in the Appendix for components of scoring

**Survey does not reflect a complete score due to heigth of water during survey

*** Kibler Ditch

Table 1. Habitat Survey Data for the Honey Creek Watershed.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Site I.D. Number	River Miles	Stream Name	Total QHEI Score*	Riparian Zone Score (Right Side) MAX=35*	Riparian Zone Score (Left Side)*	County (H=Huron, S=Seneca, C=Crawford, E=Erie)	Township Site	Lattitude	Longitude	Length of Reach(m)	Precipitation Now	Precipitation in the Past 24 hrs	Water Level Today	Average Depth(m)	Average Width(m)	Air Temp. Now (C)	Water Temp (C)	**Section II: Signs of Water Pollution**	Litter	Algae Appearance	Algae Location	Water Appearance	Stream Bed Deposit
HC1	2.40	HC	83	20	25	S	1	41.04.37	83.11.01	200	N	I	M	0.322	14.47				2	2	2,3	1	5,6,7
HC2	3.47	HC	80	11	18	S	1	41.04.15	83.10.38	200	N	I	L	0.152	4.42	33.7	26.4		2	1,3	2,3	1,6	1,5,6
HC3	4.47	HC	74	20	16	S	1	41.03.21	83.10.44	200	N	I	H	0.264	19.07	24.7			1	2	2,3	6	5,6,7
HC4	4.99	HC	81	20	29	S	1	41.03.53	83.09.38	200	N	N	L	0.083	12.80	21.1			2,4	2	2,3	1,4,6	5,6,7
HC5	5.10	HC	41	16	23	S	1	41.03.01	83.09 47	100	N	N	M		20.00	21.1			2	2	5	1,6	4,6
HC6	5.76	HC	79	11	23	S	1	41.02.33	83.10.12	200	N	I	M		23.27	30.0	24.2		2	2,5	2,3	4,6	7
HC7	7.30	HC	86	20	25	S	1	41.01.51	83.09.25	200	N	I	M	0.240	22.70	33.7			1	1,5	2,3	1,6	5,6,7
HC8	12.55	HC	85	14	16	S	1	41.01.18	83.06.44	200	N	I	M	0.275	17.30	40.0	25.5		2,4,6,7	2,5	1	4,6	5,6
HC9	17.82	HC	92	20	23	S	2	41.03.23	83.02.19	200	I	I	M						2,4	2,5	2,3	1	5,6,7
HC10	18.17	HC	62	16	18	S	2	41.03.36	83.02.05	200	N	I	M		16.20	19.3	17.1		2,4	2,3,5	2,3	1,6	5,6,7
HC11	20.64	HC	49	20	20	S	2	41.03.26	83.59 45	200	N	I	H	0.762	21.20	23.0	19.0		2			6	5,8
HC12	23.34	HC	76	20	35	S	2	41.04.24	82.58.30	200	N	I	M		13.23				2	2,3	2,3	6	5,6
HC13	24.20	HC	62	23	16	S	3	41.04.02	83.57.02	200	N	H	M	0.339	10.00	23.4	15.6		4	8		6	5,6,2
HC14	24.31	HC	58**	35	20	S	3	41.03.00	83.57.02	200	N	I	H	0.762	19.90	28.6	19.4		2,6			6	6
HC15	25.09	HC	88	25	25	S	3	41.03.50	83.56.21	200	N	H	M	0.322	7.75	23.2	16.8		2,4,6	8		3,6	4,5,6
HC16	25.33	HC	52	35	35	S	3	41.03.06	83.56.07	200	N	H	M	0.239	7.67	30.6	17.0		1	8		3,6	4,5,6,7
HC17	30.70	HC	51	18	16	S	3	41.02.39	82.51.03	200	N	I	M		6.95				2	2	2	6	4,5,6,7
HC18	31.99	HC	35	18	15	S	3	41.01.46	83.09.09	200	N	I	M	1.300	15.25	31.5			1			6	5,6,7
HC19	32.13	HC	19	11	11	H	23	41.01.58	82.89.41	200	N	N	M	0.914	13.90				1			6	5,6,8
HC20	39.77	HC	64	18	19	C	8	20.57.39	82.47.16	200	N	N	M	0.277	4.98				3	8		1,6	5,7
HC21	39.89	HC	70	18	20	C	8	40.57.39	82.47.16	200	N	N	M	0.256	9.58	34.7			2,6	8		1,6	4,5,6,7,
HC22	38.77	HC	40	9	9	C	8	40.57.26	82.45.52	200	N	N	M	0.145	0.84	28.5	16.6		2	3,4	1,3,5	1	5,6
HC23	16.07	HC	71	20	20	S	2	41.02.54	83.03.17	200	N	I	M	1.000		21.1			2	2,4	3	2	5
BC1	1.73	BC	44	11	11	S	1	41.07.15	83.08.0	200	S	H,I	M	0.100	2.75	19.4	15.3		1	1,2,3,4,5,6	2,3,4,5	1	5,6
BC2	1.81	BC	48	13	13	S	1	41.00.02	83.08.01	200	I	I	L	0.091	3.00	19.4	15.3		1	1,2,3,4,5	1,3,4,5	1	1,5,6,7
BC3	4.21	BC	60	33	33	C	4	41.59.18	83.06.04	200	N	H,S,I	M	1.057	3.12	26.0	18.5		1	2,3,5	2,3	6	5,6
SIC1	2.38	SIC	76.5	18	18	S	2	41.01.58	83.02.07	200	N	N	L	0.109	3.70	21.1			2	2,3,5	2,3,4	1,3	5,6
SIC2	3.55	SIC	69	35	16	S	2	41.01.22	83.01.00	200	N	I	M	0.250	3.27				2,4	2,5	2,3	1,9	1,5,6
SIC3	3.82	SIC	45	25	20	S	2	41.01.20	83.00.57	200	N	N	M	0.375	5.08	29.0	29.5		1	2	2,3	6	5,6,7
SIC4	4.29	SIC	21	18	6	S	2	41.00.29	83.00.10	200	I	I	H	0.400	5.90				2	2,4	2,5	6	5,6
SIC5	9.81	SIC	16	14	14	C	6	40.59.28	82.55.28	200	N	N	M	0.240	2.90	29.4	20.0		1			1,6	4,5,6
BKC1	4.75	BKC	41	15	9	C	7	41.58.49	82.51.52	150	N	I	M	0.170	1.87	30.3	24.2		2	2,3,5	2,3	1,6	5,6,7
BKC2	7.03	BKC	40	10	10	C	6	41.57.57	82.53.26	200	I	I	M	0.260	3.23	20.5	17.9		1	8		6	5,6,7
BKC3	7.29	BKC	36	6	6	C	7	41.58.04	82.51.30	200	N	H	H	0.602	4.80	25.6	21.1		2			6	6,8
BKC4* **	5.00	BKC	39	14	14	C	7	40.58.36	82.51.24	200	N	N	M	0.279	2.33	31.0	20.3		2	2,4	2,3,4	6	4,5,6
BKC5* **	5.25	BKC	46	11	9	C	7	40.58.21	82.51.13	200	N	N	L	0.167	1.18				2	1,2,3,4,5	2,3,4,5	1	5,6

* See the Sample Forms in the Appendix for components of scoring

**Survey does not reflect a complete score due to heigth of water during survey

*** Kibler Ditch

Table 1. Habitat Survey Data for the Honey Creek Watershed.

1	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
Site I.D. Number	Water Odor	Total Number of Discharge Pipes	Discharge Pipe Type and Number	Hydromodifications	Other	**Riparian Zone**	Vegetative Width (Left side)	Vegetative Width (Right side)	Vegetative Cover (Left side)	Vegetative Cover (Right side)	Vegetative Variety (Left side)	Vegetative Variety (Right side)	Vegetative Disruption (Left side)	Vegetative Disruption (Right side)	Riparian Score (Right side)	Riparian Score (Left side)	Average Riparian Score (Right)	Average Riparian Score (Left)	**Section II: Land Use Details**	Agricultural	Livestock Acess to Reach	Logging	Urban	Transportation	Industrial	Development Description
HC1	9	0			5		10	5	5	5	5	5	5	5	20	25	18	18		1,5	1			LA2		3R
HC2	5	1	FT1	2,7			5	5	5	3	3	0	5	3	11	16							1			2R
HC3	11	0		5	5		5	5	5	5	5	5	1	5	20	16				1,2						3R
HC4	5,11	1	FT1	7	5		15	5	5	5	5	5	4	5	20	29				2	2,12,9	1				
HC5	1	0		1,7			10	5	5	3	5	5	3	3	16	23				2	2		1	LA2		2R
HC6	9	0		5,6	5		10	5	5	3	5	0	3	3	11	23				1,2,5,9,10,11	2			LA2		3R
HC7	5,11	1	FT1		5		10	5	5	5	5	5	5	5	20	25				1	1					2R
HC8	8	1	SS1	7			5	1	3	3	5	5	3	5	14	16				1			1,5			2R
HC9	11	0		0	5		10	5	5	5	5	5	3	5	20	23				1			6			2R
HC10	11	0		7			5	1	5	5	3	5	5	5	16	18				1	1					
HC11	11	0		7			5	5	5	5	5	5	5	5	20	20				2,3			1			3R
HC12	2,9	1	FT1	4	5		20	5	5	5	5	5	5	5	20	35				1,2	2		1			3R
HC13	11	0		9,7			5	10	3	3	3	5	5	5	23	16				4			1			3R
HC14	11	0		7	6		5	20	5	5	5	5	5	5	35	20				1,2			1			3R
HC15	8	0		7			10	10	5	5	5	5	5	5	25	25				4				LA2		3R
HC16	11	0					20	20	5	5	5	5	5	5	35	35										3R
HC17	9,11	2	FT2	1,5	5		3	3	5	5	3	5	5	5	18	16				1,2				LA2		3R
HC18	11	0		1,2,5	5		5	5	5	5	0	3	5	5	18	15				1						3R
HC19	11	1	FT1	1,5	5		1	1	5	5	0	0	5	5	11	11				2						3R
HC20	2	1	FT1	9	5		5	3	3	5	5	5	3	5	18	19				1						3R
HC21	2	1	FT1	9	5		5	5	5	5	5	3	5	5	18	20				1			2,5			2R
HC22	8	0		1			1	1	5	5	0	0	3	3	9	9				2						3R
HC23	11	2	FT1, HS1				5	5	5	5	5	5	5	5	20	20				10	2	2	1			3R
BC1	11	2	FT2	1,7,9			1	1	5	5	0	0	5	5	11	11				1						3R
BC2	5	1	FT1	1,5	2		5	5	3	3	0	0	5	5	13	13				1						3R
BC3	11	0		1	5		20	20	5	5	3	3	5	5	33	33								LA2		3R
SIC1	5,11	1	FT1	7	2		5	5	5	5	3	3	5	5	18	18				3	1					
SIC2	1,4,7	1	HS1	1	5		1	20	5	5	5	5	5	5	35	16				1	1		1	LA2		2R
SIC3	2,5	0		1			5	10	5	5	5	5	5	5	25	20				1			1			3R
SIC4	11	0		1	5,6		1	5	5	5	0	3	0	5	18	6				2	2		1			3R
SIC5	4	1	FT1	1,6			1	1	5	5	3	3	5	5	14	14				1,2						3R
BKC1	2	3	FT3	1,5,7	2,5		1	5	3	5	0	0	5	5	15	9				1						3R
BKC2	12	2	FT2	1,2,5,7			1	5	0	4	1	5	0	4	10	10				1,2			1			3R
BKC3	11	7	FT6,U1	1,7	5		1	1	5	5	0	0	0	0	6	6							4,5	PL		3R
BKC4* **	2	3	FT3	1,7			1	1	5	5	3	3	5	5	14	14				2,3			1			3R
BKC5* **	2	3	FT2,U1	1,10	5		1	1	5	5	0	0	3	5	11	9				2,3,9,13	1					3R
* See the S																										
**Survey d																										
*** Kibler																										

Table 1. Continued.

	1	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
Site I.D. Number		Mining and Extraction	Mine Status	Waste Disposal	**Section II: Land Use Water Quality Impacts**	Top of Bank to Land Use(m) Left side	Top of bank to Land Use(m) Right side	**Citizen's QHEI**	Substrate Bottom Size	Substrate Smothering	Substrate Silting	Fishcover	Stream Shape	Human Alterations	Stream and Forest Width	Land Use Mostly	Deepest Pool	Flow Type	Riffle/Run Depth	Riffle /Run Substrate	QHEI SCORE	Average Citizen's QHEI
HC1						O20	A20		10	5	0	14	6	12	3	7	6	7	6	7	83	57.51
HC2						O10-50	O10		14	5	0	12	6	8	3	8	6	5	6	7	80	
HC3						A17	A17		10	5	0	12	6	8	3	7	6	7	6	4	74	
HC4						A200	A0-50		12	5	0	10	6	12	5	11	6	4	6	4	81	
HC5						U100	A50		0	0	0	14	3	8	3	7	5	1	0	0	41	
HC6						A75	A30		10	5	5	10	6	4	2	13	6	6	8	4	79	
HC7						A50-100			14	5	2	14	3	12	4	10	4	5	6	7	86	
HC8						U10-20	A20,U15		14	5	5	14	3	8	5	5	6	7	6	7	85	
HC9						O100	A50		14	5	0	16	6	12	5	11	6	4	6	7	92	
HC10						A15	A10		14	5	0	12	3	8	3	11	4	2	0	0	62	
HC11						A10	A30					10	0	10	5	11	8	5	0	0	49	
HC12						A100	A5-50		10	5	0	10	6	8	5	7	8	7	6	4	76	
HC13						A10,U200	A50-100		5	0	0	14	6	8	4	10	4	2	0	0	53	
HC14						A20	A71					16	3	8	5	14	8	4	0	0	58	
HC15						A100	A10-50		14	5	0	14	6	12	4	12	6	2	6	7	88	
HC16						A100	A100		0	2	0	14	8	12	5	5	4	2	0	0	52	
HC17						A5	A5		6	5	0	8	3	0	3	7	6	5	4	4	51	
HC18						A50-70	A5-50		0	5	0	12	0	0	3	5	8	2	0	0	35	
HC19						A10	A10		0	5	0	4	0	0	0	2	6	2	0	0	19	
HC20						A20	O20		0	0	0	18	3	12	5	9	8	5	4	0	64	
HC21						A30-50	U30		2	5	0	12	6	12	5	9	6	5	6	2	70	
HC22						A10	A10		6	5	0	8	0	0	0	2	4	5	6	4	40	
HC23				4		A1.25	A1.25		14	5	0	8	6	12	3	5	4	1	6	7	71	
BC1						A2	A5		14	5	0	6	0	0	0	2	4	2	4	7	44	
BC2						A20	A20		8	5	5	8	3	0	0	5	4	2	4	4	48	
BC3						O400	O400		12	0	0	8	3	8	0	3	6	5	8	7	60	
SIC1						A50	A50		14	2.5	0	12	3	12	5	12	4	1	4	7	76.5	
SIC2						A15,U10			14	5	0	12	3	8	3	7	4	2	4	7	69	
SIC3						A20-40			0	0	0	14	3	8	5	7	6	2	0		45	
SIC4						A5	A10-20		0	0	0	4	0	0	3	7	6	1	0	0	21	
SIC5				2		A5	A5		0	0	0	8	0	0	0	2	4	2	0		16	
BKC1						A6	A25		2	5	0	8	3	8	0	5	4	2	4	0	41	
BKC2						A50	A10,U50		0	5	0	6	3	6	0	2	6	4	4	4	40	
BKC3						O20	O5		10	5	0	6	0	0	0	2	8	5	0	0	36	
BKC4* **						A10	A10		6	5	0	4	0	8	0	2	4	2	4	4	39	
BKC5* **						A10	A10		10	5	0	6	3	8	0	4	0	2	4	4	46	
* See the S																						
**Survey d																						
*** Kibler																						

Table 1. Continued.

Table 1 Legend
Computer Data Entry Key

1.	Site Identification Number: (Number)
3.	Stream Name: HC=Honey Creek, BC=Buckeye Creek, EB=East Branch, Huron R., CC=Cole Creek, RSC=Rattlesnake Creek, SIC=Silver Creek, BKC=Brokenknife Creek, WB=West Branch, Huron R., NC=Norwalk Creek, HL=Holiday Lake
7.	Name of County: H=Huron S=Seneca C=Crawford E=Erie
8.	Township of Site: 1=Eden 2=Bloom 3=Venice 4=Texas 5=Lykens 6=Chatfield 7=Cranberry 8=Auburn 9=Lyme 10=Ridgefield 11=Norwalk 12=Townsend 13=Hartland 14=Bronson 15=Peru 16=Sherman 17=Norwich 18=Greenfield 19=Fairfield 20=Fitchville 21=Ripley 22=New Haven 23=Richmond 24=Milan 25=Huron
9.	Latitude in degrees, minutes, and seconds
10.	Longitude in degrees, minutes, and seconds
11.	Length of Reach (m): 150 m 200 m 100 m
12.	Precipitation now: H=heavy S=steady I=intermittent N=none
13.	Precipitation in past 24 hrs: H=heavy S=steady I=intermittent N=none
14.	Water Level Today: H=high M=medium L=low S=standing pools
15.	Average Depth (m): (numbers)
16.	Average Width (m): (numbers)
17.	Air Temperature now (degrees Celsius): (numbers)
18.	Water Temperature (degrees Celsius): (numbers)
20.	Litter: 1=No Litter Visible 2=Small Litter Occasionally 3=Small Litter Common 4=Large Litter Occasionally 5=Large Litter Common 6=Piles of Trash 7=Yard Waste
21.	Algae Appearance: 1=Light Green 2=Dark Green 3=Brown Coated 4=Hairy 5=Close Growing 6=Red 7=Black 8=None
22.	Algae Location: 1=Everywhere 2=In Spots 3=Attached to Objects 4=Matted on Stream Bed 5=Floating
23.	Water Appearance: 1=Clear 2=Clear and Tea Colored 3=Oily Sheen 4=Foamy 5=Milky 6=Muddy 7=Black 8=Gray 9=Brown/Orange
24.	Stream Bed Deposit: 1=Gray 2=Orange/Red 3=Yellow 4=Black 5=Brown 6=Silt 7=Sand 8=Mud 9=Clay
25.	Water Odor: 1=Rotten Egg 2=Musky 3=Petroleum 4=Sewage 5=Fishy 6=Chlorine 7=Soapy 8=Chemical 9=Manure 10=Ammonia 11=None 12=Other
26.	Total Number of Discharge Pipes: (numbers)
27.	Discharge Pipe Type and Number: FT=Field Tile SS=Storm Sewer HS=Home Sewage IW=Industrial Waste MW=Municipal Wastewater UK=Unknown Kind O=Other *(Number following the label symbolizes the number of pipes of that type)

28. Hydromodfications: 1=Channelization 2=Near Bank Vegetation Removed 3=Dam Construction 4=Vehicle Crossing 5=Streambank Modifications 6=Dredging 7=Bridge Construction 8=Draining and Filling Wetlands or Floodplains 9=Rip-Rap 10=Culvert

29. Other: 1=Dead Fish 2=Dead Wildlife 3=Fish Absent 4=Macroinvertebrates Absent 5=Evidence of Extreme Flow Fluctuations 6=Gully in Extreme Flow Fluctuations 7=Gully Erosion in Nearby Fields 8=Other

Key of General Information for Vegetative Width:
>100m = 20 points
50-100m = 10 points
10-50m = 5 points
0-10m = 1 point

31. Vegetative Width (Left Side): (number of points)
32. Vegetative Width (Right Side): (number of points)

Key of General Information for Vegetative Coverage:
>90% = 5 points
70-90% = 3 points
50-70% = 1 point
<50% = 0 points

33. Vegetative Coverage (Left Side): (number of points)
34. Vegetative Coverage (Right Side): (number of points)

Key of General Information for Vegetative Variety:
Good Mix = 5 points
Fair Mix = 3 points
Poor Mix = 0 points

35. Vegetative Variety (Left Side): (number of points)
36. Vegetative Variety (Right Side): (number of points)

Key of General Information for Vegetative Disruption:
Plants Grow Naturally = 5 points
More Than Half the Plant Stubble Remains = 3 points
Less Than Half the Plant Stubble Remains = 1 point
Plants Less Than Two Inches = 0 points

37. Vegetative Disruption (Left Side): (number of points)
38. Vegetative Disruption (Right Side): (number of points)

44. Agricultural Use: 1=Corn 2=Soybean 3=Wheat 4=Hay 5=Cows 6=Pigs 7=Poultry 8=Field Lot 9=Pasture 10=Grazed Woodland 11=Manure in Stream 12=Horses 13=Sheep

45. Livestock Access to Reach: 1=Fenced 2=Unfenced

46. Logging: 1=Clear Cut 2=Selective 3=Logging Road

47. Urban: 1=Single Family 2=Multi-Family 3=Retail 4=Office Warehouse 5=Park (grass) 6=Construction Site

48. Transportation: PL=Parking Lot RR=Rail Road LA=Lanes (followed by the number of tracks or lanes)

49. Industrial: H=Heavy L=Light

50. Development Description: 1=Dense 2-Medium 3=Sparse R=Rural S=Suburban U=Urban

51. Mining and Extraction: 1=Coal Mining Underground 2=Coal Mining Surface 3=Sand and Gravel 4=Oil and Gas 5=Access Road 6=Mine Tailings 7=Mine Seepage

52. Mine Status: 1=Active 2=Abandoned 3=Reclaimed 4=Unreclaimed

53. Waste Disposal: 1=Livestock Application of Waste 2=Human Application of Waste
3=Publicly Owned Landfill 4=Home Sewage Systems

55. Top of Bank to Land Use in Meters (Left Side): A=Agriculture L=Logging
U=Urban M=Mining Extraction W=Waste Disposal O=Other

56. Top of Bank to Land Use in Meters (Right Side): A=Agriculture L=Logging
U=Urban M=Mining Extraction W=Waste Disposal O=Other

Key for Substrate Bottom Size:
Mostly Large = 14 points
Mostly Medium = 10 points
Mostly Small = 6 points
Mostly Very fine = 0 points

58. Substrate Bottom Size: (number of points)

59. Substrate Smothering: Y0 = yes, zero points N5 = no, 5 points

60. Substrate Silting: Y0 = yes, zero points N5 = no, 5 points

61. Fishcover: A2=Underwater Roots (large diameter) B2=Boulders C2=Downed Trees
D2=Water Plants E2=Chest Deep Areas F2=Underwater Roots (fine diameter)
G2=Backwaters, Oxbows or Side Channels H2=Shallow Slow Areas for Fish
I2=Shrubs, Small Treas That Hang Close Over the Bank

Stream Shape Key:
Very Straight = 0 points
Mostly Straight/Some Wiggle = 3 points
One or Two Good Bends = 6 points
Two or More Good Bends = 8 points

62. Stream Shape: (number of points)

Human Alterations Key:
Mostly Natural = 12 points
Some Man-Made Changes = 8 points
Heavy Man-Made Changes = 0 points

63. Human Alterations: (number of points)

Stream/Forest Width Key:
Wide = 5 points
Narrow = (can't throw a rock through it) = 3 points
None = 0 points

64. Stream/Forest Width: (number of points)

65. Land Use Mostly: A0=Urban/Commercial B2=Park/Grass C2=Fenced Pasture
D1=Suburban E2=Row Crop F0=Open Pasture
G5=Forest/Wetland H3=Overgrown Field I4=Shrub

Deepest Pool Key:
Chest Deep = 8 points
Waist Deep = 6 points
Knee Deep = 4 points
Ankle Deep = 0 points

66. Deepest Pool: (Number of points)

67. Flow Type: Very Fast (2 points)=VF2 Fast (3 points)=F3
Moderate (1 point)=M1 Slow (1 point)=S1

Riffle/Run Depth Key:
Knee Deep or Deeper and Fast = 8 points
Ankle/Calf Deep and Fast = 6 points
Ankle Deep or Less and a Bit Slow = 4 points
Do Not Exist = 0 points

68. Riffle/Run Depth: (number of points)

Riffle/Run Substrate Key:
Fist Size or Larger = 7 points
Smaller than Fist/Larger than Fingernail = 4 points
Smaller than Fingernail = 0 points

69. Riffle/Run Substrate: (number of points)

70. Total QHEI Score: (number of points)

stream bed originally ran farther east of its present path. A filter strip had recently been placed along the creek to prevent flooding of a cornfield on the right hand side. Due to flooding, the owner had turned an agricultural field into a walnut grove for erosion prevention.

At **Honey Creek Site 2**, the creek doubled back on itself in the 150-200m segment. There were steep banks in the 0-50m segment on the left side. There were signs of burned trash on the left bank in the 100-150m segment. Concrete and construction debris were occasionally present on the stream bottom. The near bank vegetation had been removed on both the right and left side in the 50-100m segment. Erosion was only severe on the left side from the 100-200m section of the reach. There were two riffle zones present in the 50-100m segment and one at the 150-200m segment.

Site 3 for Honey Creek was diked 5-8 years ago. The landowner believed the creek had originally flowed 500m east of its present site. The streamside vegetation is removed partially about once a year. This streamside vegetation removed consists of woody vegetation and shrubs. There was evidence of extreme flow variations at the site. The reach surveyed contained one sandbar and two riffles. The bank height and vegetative width was nearly uniform on both sides of the bank.

Site 4 of Honey Creek was characterized by rocks fist size or larger on the streambed. There was a point bar at 50m. There were riffle zones in the segment from 150-200m. There were orange deposits on the sediments on both of the banks at 150m. The left bank showed signs of severe erosion in all transects. There was undercutting of the stream bank and slumping. Transects spanning from 50-150m contained water greater than 2.5m deep. Sandy soil was noted at this site. There was a large eroding cliff on the left side in the 150-200m segment. Water flow was fast and the area seemed to contain good macro-invertebrate habitat.

Site 5 of Honey Creek was mainly a bog area that fed into Honey Creek when the water level was high enough for it to cross a soybean field. The bog was 30m wide and located in a forested area. To the north was a road and a field was to the south beside Honey Creek. The bog itself seemed deep and had many air pockets in it. The bog was covered with duckweed and seemed to support a large variety of small non-woody plants. The riparian zone was a good mix of trees, shrubs, grasses, and non-woody plants. The access channel to Honey Creek was a grassed waterway showing little erosion.

Site 6 of Honey Creek showed evidence of extreme flow fluctuations. The owner supported this by saying that the water level changed drastically. The owner also stated that the streambed originally ran southeast of the present streambed. There was extreme erosion undercutting SR231 and the owner indicated the need of some erosion control measures to prevent further erosion. The velocity of the stream at this reach was very fast. The soil was sandy which seemed to further erosion problems. Cattle did have access to the stream and manure was present. The reach showed signs of have been diked on the right side at some time.

Site 7 for Honey Creek was in a largely wooded area. There was a meadow beside the site that had a small swamp section in the center. The substrate was large and the creek had several varying depths. Overall, there was a high percentage of good habitat for fish and micro-invertebrates. There was litter present on the banks and in the creek but this was probably due to recent flooding. There was not an excessive amount of algae compared to other reaches evaluated in the watershed. The water appearance was clear. The stream bed deposit was mainly silt with a few areas of sand. There was a sand bar present within the reach. One field tile was found in the 200m stretch. The agricultural impact on the stream seemed to be small considering the low level of algae and the large riparian zone.

Site 8 for Honey Creek contained 5 riffle zones and 1 sandbar. This reach was located along a residential area. On the left side there were signs of erosion being present. Two side channels were found. One was on the left side in the100-150m segment and the other was found on the right side in the 150-200m segment. There was foamy water found in the 200m segment. The vegetative variety at this site was a good.

Site 9 of Honey Creek was originally surrounded completely by forested areas but some forested areas had been removed due to construction. There was a good mix of trees, shrubs, aquatic plants, and non-woody vegetation. Riffle zones and large boulders were present.

Honey Creek Site 10 was nearly obstructed by a dense stand of aquatic macrophytes shortly before the 0 m point in our survey. Bank erosion throughout the reach was slight and there was rip rap along the bridge to prevent erosion. There was a moderate amount of stream and bank side vegetation. The reach seemed to contain good habitat for fish and macroinvertebrates. There were no riffles or runs in the reach.

Honey Creek Site 11 was fast moving with water over 2.5m deep. This reach was channelized. The riparian zones for both banks consisted of wooded areas with agricultural fields beyond the riparian zone. There were three downed trees in the middle segments of the reach but they did not extend across the whole channel.

Honey Creek Site 12 showed signs of severe erosion such as slumping and cut banks. There was a good vegetative variety and the riparian width was large in most segments. There was one vehicle crossing found at the 0m segment. The water was over 1m deep in all segments except 0-50m. There was either a manure or musky smell to the water in different areas. There was evidence of smothering and no macroinvertebrates were found. Several portions of the bank were eroding into the water.

Honey Creek Site 13 had an extremely muddy bottom. Both the right and left banks showed signs of slumping and were undercut. Rip rap was present on both sides in the 100-150m segment. The site was mostly natural and was surrounded by forest/wetland and overgrown fields. There were no riffles present.

Honey Creek Site 14 had an oxbow in the 50m segment of the reach. There was a side channel present on the left side in the 150-200m segment. There was evidence of slumping and cut banks contributing to a high level of erosion. The area flooded frequently and there was a large dump present.

Honey Creek Site 15 had a riffle zone laying just beyond the reach evaluated. There was severe litter in the creek at the 100-150m segment due to a downed tree stopping the flow of surface water in the creek. Severe erosion was noted on both sides of the bank. Cut banks and slumping of the bank were present. The site was mostly natural with forest/wetland, shrubs, and overgrown fields surrounding it.

Honey Creek Site 16 had relatively the same bank height on both sides of the stream. The vegetative width was over 100m in the 0-50m segment. There was good vegetative variety and cover on both sides. The banks of the creek showed signs of slumping in some areas. There was a side channel on the left side in the 50-100m segment. Three trees were obstructing the stream in various points of the reach. There was a green oil slick found on water in the 100-150m segment.

Honey Creek Site 17 had two riffle zones at 150m and 200m. There was also a sand bar in the 150-200m segment. Trees and shrubs were dominant between 100-200 with grasses and non-woody vegetation dominant from 0-100m. The land use was a bean field. There was very little algae present at this site. There was a manure odor in one of the segments. The creek seemed to be diked and channelized at this site. Bank erosion was severe in each segment of the site. The depth was over 0.83m from 0-100m. There was evidence of extreme flow fluctuations and there were few macroinvertebrates.

Honey Creek Site 18 was completely diked. The owner said that the creek had been channelized in the 1950's. The owner also wanted to dike more of the property but was being restrained by the Soil and Water Conservation District. It was also mentioned that property further downstream had several stream obstructions that were causing flooding. The creek at this site floods the crops 1-2 times a year and the near bank vegetation was removed. The stream depth was approximately chest deep throughout the evaluated reach.

Honey Creek Site 19 was extensively channelized. There was evidence of stream flow fluctuations and it was reported that the water floods the field approximately two times a year. The owners had removed all of the tress from the bank side. Severe erosion was plainly seen throughout all of the reach surveyed. The stream bottom was too muddy for surveyors to enter the creek. Due to diking, the stream width, height, vegetative width, and bank full width are all fairly uniform throughout the reach. The owner's nephew stated that it was believed that the stream had been altered upstream due to a drastic change in water depth during the past two years. He also stated that there was a serious need for some form of erosion control.

Honey Creek Site 20 contained riffle zones in three out of the four segments. Erosion was present in each segment along with the formation of cut banks. The substrate

throughout the reach was extremely sandy. There was a campground on the right side of the creek. The creek also had a musky smell to it in several sections. There were tree obstructions in all of the segments except 0-50m. Rip rap was present at the 150m mark for erosion control.
Honey Creek Site 21 also had a campground on the right side along with a large maintained lawn. There was a litter pile a few meters beyond the reach we surveyed. It was not included because it was in the 30m marked off from the bridge area. There were cut banks and slumping present, which indicated that erosion was severe. The bank in the 0-50m segment was steep. There were four riffle zones, one in each segment. There was also one logjam in each segment of the reach. The soil was very sandy.

Honey Creek Site 22 had a riffle zone at 0-50m. The water was fast moving and there was a lot of "hairy" algae. There was a pool knee deep in the 100-150m segment. The vegetation growing in the stream was obstructing flow in each of the segments between 0-150m. The banks were undercut in several areas at this site. The creek also showed signs of having been channelized.

Honey Creek Site 23 had dark green algae and hairy algae present. There was a good vegetative variety and coverage in the riparian zone. The site also had grazed woodland with unfenced access for livestock. There was also a home sewage system present along with wildlife habitat. Silting was present in the creek with substrate size being fist size or larger. The stream had natural curvature represented by two bends in the creek. There were also riffle areas present.

Buckeye Creek Site 1 was a narrow channelized section of the creek flowing though a cornfield. In the riparian zone, the dominant vegetation was grass. This grass also had a few non-woody herbaceous plants in it. Despite channelization there were still several curves in the reach. Habitat at the curves was better due to a few trees being present , along with larger substrate and riffle/run areas. Erosion seemed to be slight in this area. There was one curve where large construction blocks had been placed to slow erosion. A large number of crayfish were observed. Another notable observation was the presence of red algae that had not been seen at any other sites. The algae level in the stream was quite high and seemed to point to a high level of nutrients in the water.

Buckeye Creek Site 2 had algae covering the entire bottom of the creek. These algae included forms that were light green, dark green, brown, hairy, close growing, floating, and matted on the streambed. Walking along the streambed was difficult due to the algae. The stream had been channelized. The bank height was equal on both side of the creek. Crayfish were seen in several of the segments along with a few dead crayfish. Water in the creek had a fishy smell sometimes. The creek showed only slight erosion.

Buckeye Creek Site 3 had overgrown fields on both sides of the creek. There was a waist deep pool at the 0-50m segment. There were also three different riffle zones in the reach. The creek was channelized and had a steep bank. There was a secondary bank at 170m.

Silver Creek Site 1 showed a large variation in the width of the creek. At 70m flow decreased to zero. Then at 80m the creek once again had flowing water in it. The water from 0-70m was shallow with algae and an apparent oil slick covering it. There were pools present at the 80-100m, 100-150, and 150-200m segments. This site was the best for habitat, substrate size, and low erosion over all the other Silver Creek sites.

Silver Creek Site 2 had water with an orange-brown cast to it. The water also had a slight sewage odor to it, apparently caused by a home sewage pipe releasing gray and white water at 110m. The bank on the right side of the 150-200m segment was covered with broken glass. The bank on the left side at 0-50m had been used to park old farm machinery. Most of the machinery was overgrown by tall weeds and brambles. There was riprap present along the left bank in the 150-200m segment. There were sandstone slabs along the bank in the segments from 0-150m but it was unclear if they were natural or if they had been placed there. The creek had been channelized for most of the reach. The silt had either a black or gray color to it. A few macroinvertebrates were seen.

Silver Creek Site 3 was channelized. The banks had moderate erosion and there were no signs of any erosion control measures being used. A dried up ravine was found at 50m. High amount of vines and vegetation made access to the stream bank from the water almost impossible in some areas. There were tree obstructions in all segments except the 50-100m segment of the reach. There was also a musky smell reported in the 50-100m segment along with dead fish. The riparian zone on the right side of the creek was wooded and the left side was partially wooded and partially cultivated.

Silver Creek Site 4 was very channelized. There was also evidence that part of the creek had been diked. There were some downed trees causing stream obstructions. In the 0-50m segment there was some gully erosion. Floating algal mats were found between 150 and 200m. Along the left bank there were trees and grass present while the right bank had forested regions. The substrate was silt and clay along the whole reach.

Silver Creek Site 5 was beside a municipal sewage discharge from New Washington. This reach was channelized. The near bank vegetation was mainly grass with a few shrubs and small trees. The substrate was black in color. There were also large mats of grass under the water surface. This area showed no signs of erosion. The water level did fluctuate a large amount between different visits to the site.

Broken Knife Creek Site 1 was very sandy. There was severe erosion on both banks from 50-200m. The stream was nearly choked by grassy vegetation at 145m. There were sandbars forming riffle zones in the 50-100m segment. The creek was channelized and had a very muddy bottom. There were ditches along the right and left side at 100m.The land on the right and left side of the creek seemed to be terraced in the first 50m of the survey. Several dead crayfish were observed in the water.

Broken Knife Creek Site 2 was a channelized area of the creek. Almost all trees and shrubs were absent from the stream bank or adjacent land. Some undercutting of the

bank was occurring throughout the reach surveyed. The stream bed deposit was mainly fine particles of sand and silt. There was a grassy strip a few meters wide on both sides. The land use after this was maintained lawn followed by a cornfield. There was one house in the immediate vicinity of the site. Two field tiles were observed on the left bank.

Broken Knife Creek (unnamed tributary) Site 3 had five tiles and one grated pipe feeding into the 200m segment beside the New Washington Reservoir. The water level was very high due to a recent rainfall. Flow fluctuated a great deal between the several visits to this site. There was no evidence of erosion but this may be due to floodwaters being so high. The creek was channelized throughout the whole reach. There was a small constructed dam in the 50-100m segment with foamy water. Dredging of this site was set for July or August. A water plant was at the 0m mark, there was also a man made waterfall present at this point.

Broken Knife Creek tributary (Kibler Ditch) Site 4 was very sandy and often had a muddy bottom. At times it was even hard to move in the streambed. The riparian zone consisted of 5-7m of grassy and non-woody plants. A soybean field was the main land use on the right side and a wheat field was the main use on the left side. The stream was channelized. There was only a slight amount of erosion throughout the entire reach. A few macroinvertebrates were seen while the survey was being completed.

Broken Knife Creek tributary (Kibler Ditch) Site 5 had seven riffle zones spread out among the different segments. Once again, the creek was channelized in this area. There was a large amount of algae covering the stream bed and bottom substrates. The water often had a musky smell to it. There was also evidence of extreme flow fluctuation at this site.

II d. Discussion of Habitat Conditions and Comparisons with Biological Assessments.

The QHEI scores for stations in the Honey Creek watershed are illustrated in Figure 6 in relation to the mile points for each stream. For Honey Creek, the QHEI scores were high in the lower portions of the stream (low mile points), intermediate in the mid-portion of the stream and lowest in the upper portion of the stream. The average QHEI score for Honey Creek was 63. QHEI indices for the tributaries to Honey Creek (Buckeye Creek, Silver Creek and Broken Knife Creek) were generally lower than the average for Honey Creek. Only two stations on Silver Creek had scores above the average score for Honey Creek.

The relationship between the QHEI score and the riparian score for all of the Honey Creek watershed stations is shown in Figure 7. In general, as the QHEI scores increase, the riparian scores also increase. While the QHEI score does include a riparian component, its maximum value is about 15 out of 106 points.

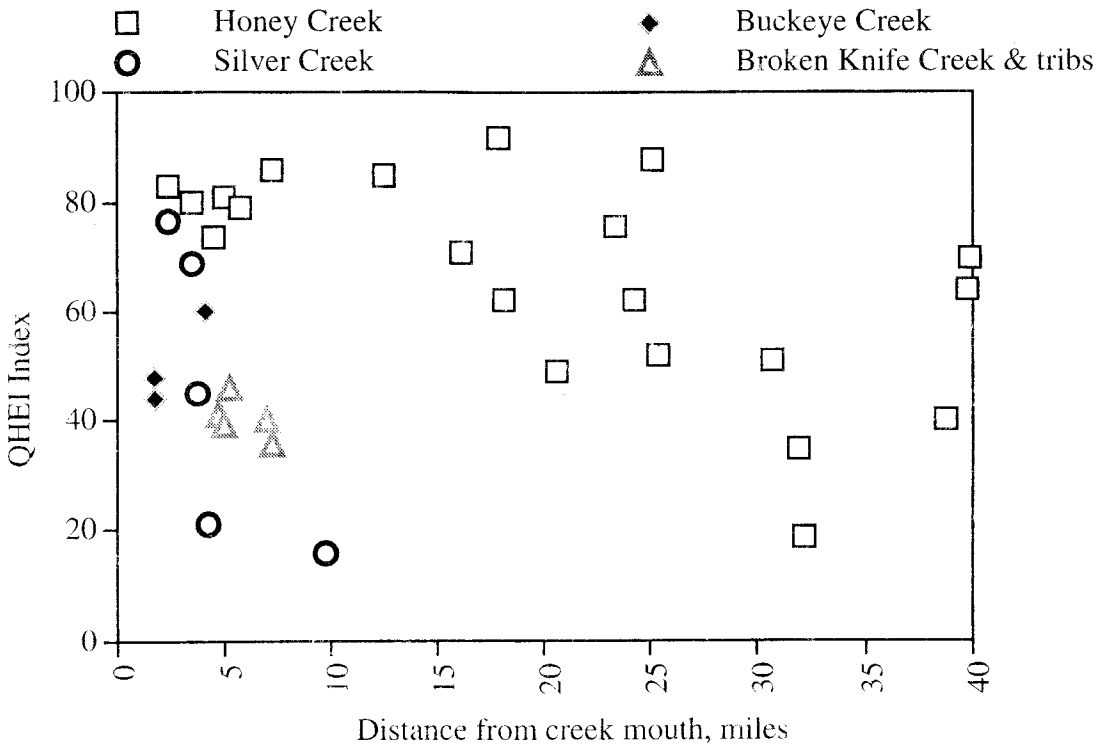


Figure 6. QHEI scores in relation to stream mile points.

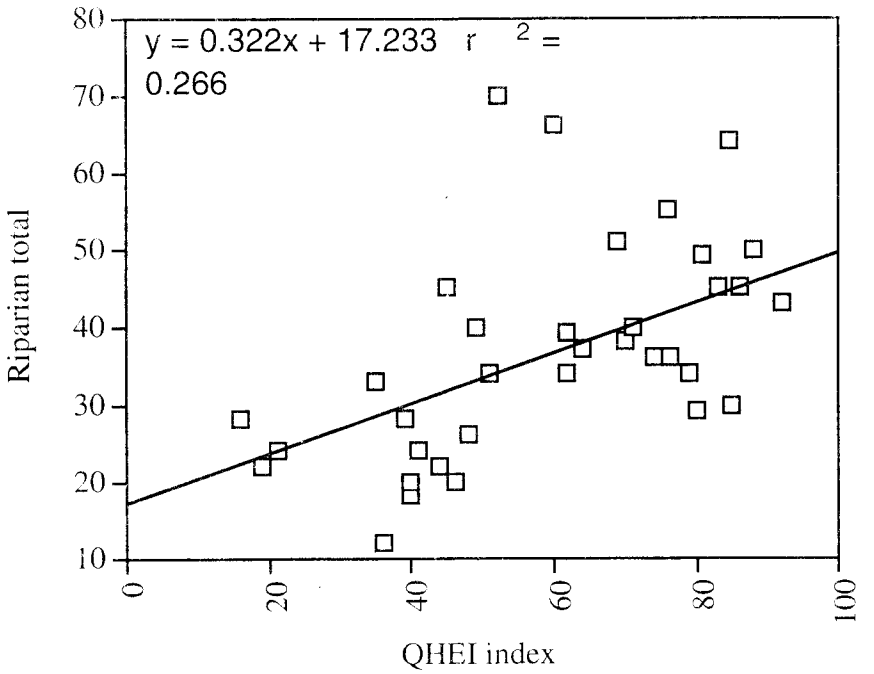


Figure 7. Relationship between QHEI scores and Riparian Scores for stations in the Honey Creek Watershed.

Upper Waters of Honey Creek

According to the OEPA, the upper waters of Honey Creek are partially attaining for the biological criteria of a warm water habitat (Ohio EPA 305(b) Report). Sites 19-22 (mile points >31) of Honey Creek in Crawford County represent this area in this survey. The scores for Honey Creek in the upper region ranged from 19-70 in the Citizen's Qualitative Habitat Evaluation Index (Table 1 and Figure 6). The average for the entire Honey Creek watershed was 58. Two of the sites in this area were over the average Citizen's Qualitative Habitat Evaluation Index, one site score surpassed it by two points and another by 12 points.

The scores for the riparian zones in this area were between 9 and 20. Sites 20 and 21 were close to the average of 18 but sites 19 and 22 were considerably lower at 9 and 11. The main difference in riparian zones was the scorings for vegetative width and vegetative variety. In sites 19 and 22 of Honey Creek, the riparian zones were small and lacked a variety of vegetation. This lack of vegetative variety was due to the low population of trees found in the area.

In the Citizen's Qualitative Habitat Evaluation Index, the largest score loss for sites in the upper watershed were produced by the first category: substrate size. The substrate at the two lowest scoring sites had either muddy or very fine substrate consisting of sand. Geologically, this area had a larger proportion of sand in the stream than other regions of the watershed. This suggests that the geology of the area may play a large role in the reduced habitat for bio-organisms.

Another problem for physical habitat in this area was the channelization of the stream. Both low scoring sites lost several points for not being natural and having a straight shape.

Overall, it seems that this area has enough beneficial attributes to support some aquatic life, but optimum capacity will not be reached unless the stream habitat is improved. In the OEPA stream quality assessments, habitat alterations were noted as the main cause of impaired biotic communities. A larger riparian zone seems to be needed for these areas to help shield the effects of chemical runoff and soil erosion into the stream. This may help improve the substrate. Also, allowing the stream to flow in a natural course would improve the score. It is possible that creeks in this area would not be able to receive the high score that others might due to the higher occurrence of sand in the geology of the stream bed. It seems that the physical habitat scores in this area support the OEPA's finding of partial attainment for biological criteria of warm water habitats.

Broken Knife Creek

According to the OEPA all sites for Broken Knife Creek were fully attaining their biological criteria (OEPA's 305(b) report). This is somewhat surprising, since the QHEI scores for Broken Knife Creek were rather low. The scores for the riparian zones in the Broken Knife Creek area were also below the average score of 18 for both sides of the

creek. In Broken Knife Creek, one of the main problems seemed to be small riparian zones as the stream flows through the middle of agricultural fields. The riparian zone consisted of a grassed strip 5-8m wide along the banks. The riparian zones lacked any vegetation other than grass and a few wild shrubs. Water levels at these sites were also low and slow moving. Proper habitat for fish and macro-invertebrates was limited due the small size of the substrate and the lack of large underwater roots, boulders, downed tree branches, shrubs, and deep pool areas.

It seems that this area could benefit from the incorporation of a better vegetative variety such as trees along the creek and wider protection strips along the bank. Many of these sites along Broken Knife Creek are ditches running through agricultural fields. Algae in these segments were noticeable but not as high as seen in Buckeye and Silver Creek. This suggests that the nutrient loading of the creek may be less in this area. This may be caused by differences in farming practices or local geology. Once again, the substrate size, the lack of fish habitat, and the heavy channelization of the creek in this region impacted the scoring of the QHEI. The Citizen's QHEI scores and the riparian scores suggest do not match with the OEPA's assessment of the biological communities in this stream.

Middle Waters of Honey Creek

The sites for Honey Creek 9-18 have a range of Citizen's QHEI Scores of 35-92. The score of 92 was the highest for the survey. The average for these sights was 62, just above the average for the whole watershed. Citizen's QHEI Scores for sites 11 and 14 were not true reflections of their habitat because the substrate category could not be included due to high, fast moving water. Records for Honey Creek sites 9-18 indicate good vegetative variety and the presence of trees in the riparian zone. Erosion seems to be a problem in these areas, which is noted in the records by the high incidence of slumping and undercutting of the banks. Since the water was deeper in Honey Creek sites 9-18 it seems that the habitat is better for aquatic life than in Broken Knife Creek. The survey indicates that small substrate size, a lack of naturalness of the site, and lack of riffle zones diminish the QHEI scores for these sites. High silting may be caused by the extensive stream bank erosion that is occurring. The small substrate size may also be due to the high amounts of erosion that have been occurring over time. Many of the Honey Creek sites lost points due to their channelization. This seems to be a common problem throughout the watershed.

The scores for the riparian zone in this section range from 15 to 35. Most scores are above the average of 18. Points were lost in riparian zone scoring due to the small to moderate widths of riparian zones. Many of these areas have a riparian zone of 10-50m or 50-100m. The riparian zone score heavily stresses a very large riparian zone in this survey, which may not be entirely realistic.

Biological assessments in this area indicate non-attainment. The OEPA concluded that the cause of non-attainment in this region was due to unknown toxicity. Since the QHEI scores for this portion of Honey Creek were above average for the Honey Creek

watershed as a whole, it does appear that factors other than habitat may be limiting to aquatic life is this segment of the stream.

Silver Creek

The Silver Creek sites lie in the region beside the non-attaining portion of Honey Creek. According to maps produced from the 1996 Ohio Water Resource Inventory (305(b) report), Silver Creek has not been evaluated. The Citizen's QHEI scores for this region range from 16 to 77. The score of 77 is in the lower portion of the reach. The scores progressively decline for sites surveyed up stream. The average Citizen's QHEI score of this area is 46 points, well below the average of 58. The riparian zone scores for the sites ranged from 6-35.

The lower portion of the creek has a high score with a few problem areas in the substrate category due to silting and smothering. The riparian zone is 10-50m (small) and there seems to be a high occurrence of algae in the creek. The creek at this site has a high amount of habitat structure available for fish. Stream bank erosion does not seem to be a problem at this site.

As the survey continues up the creek, conditions seem to decline. Silting and smothering become more of a problem and the substrate size gives way to smaller particles. The upper creek region starts with only slight modifications and then progressively becomes more channelized as progressing upstream. As previously mentioned, there seems to be a high occurrence of algae in the area, suggesting high nutrient enrichment --possibly from agriculture.

The width of the vegetation strips is usually 10-50m and the vegetative variety decreases in upper areas of the creek. It seems that a riparian zone between 10 and 50m is not sufficient to stop run-off of sediments into the stream. Based on the QHEI scores for Silver Creek, we would predict full or partial attainment of biological criteria for the lower portion of Silver Creek and non-attainment for the upper portions of the creek.

Lower Waters of Honey Creek

The lower portion of Honey Creek has been determined to be fully attaining for warm water biocriteria by the OEPA (305(b) Report). The sites that covered this section of the creek were Honey Creek sites 1-8. The Citizen's QHEI scores ranged from 83-74. The score of 41 is being ignored in this comparison because it was a bog area only connected to Honey Creek when large rainfalls were observed. Therefore, the site could not be scored on the same basis as the other sites.

The scores for riparian zones fell in the range of 25 to 11. Once again the riparian score was low due to most areas having slightly less than 50m of riparian zone. At most of the sites, the vegetative cover was a good mix or had only one of the three components missing. Algae were observed at most of the sites but only as a slight covering on larger

rocks. There were no excessive amounts of algae as seen at other sites in the watershed.

In the Citizen's QHEI, site scores were lowered due to large amounts of silting in the stream bed. Occasionally, a site would have a small substrate size but still had a large quantity of cobbles and boulders. Due to the good mix of vegetation the scores for fish habitat were also high. The creek has been diked in some areas or moved but still has curvature. This may be due to the speed of the water being able to overcome the boundaries that were set by engineering. The relatively high QHEI scores for this section of the stream support high scores for the biological communities in this area.

Buckeye Creek

The three sites along Buckeye Creek scored 44, 48, and 60 for the Citizen's QHEI. The reasons for the lower scores vary from site to site. Overall, the substrate size was in the middle range. There were some problems with silting at these sites. Points were also lost due to the straightness of the stream and the channelization of the area. Flow was lower than in other reaches and this affected the rate of flow. All the sites showed signs of good habitat for fish cover. The highest amounts of algae in the watershed were found in Buckeye Creek. This suggests a high level of nutrient enrichment from the surrounding area.

The riparian scores varied between 11 and 33. All three sites showed a lack of vegetative variety since they were mostly grasses. Site 3 had a large riparian zone due to an overgrown field. It was also noted that crayfish were a common site in this creek.

IIe. Honey Creek Watershed: Conclusions

ODNR's Stream Reach Screening Tool was applied to 36 locations in the Honey Creek Watershed. This tool included the Citizen's Qualitative Habitat Evaluation Index (QHEI). QHEI values determined is this study were in general agreement with the results of biological assessments done by the OEPA in the watershed. Lower QHEI scores were found in the in the upper portions of Honey Creek. OEPA studies found this area to be in partial attainment of water quality criteria, with impairments caused by habitat factors. In this study, QHEI values were highest in the lower portion of Honey Creek. The OEPA found the lower portions of Honey Creek to be in full attainment. Although the middle portions of Honey Creek were found to have intermediate QHEI values in this study, aquatic communities for this area were in non-attainment. However, OEPA identified unknown toxicity as the likely cause of non-attainment in this region, rather than habitat factors. Only for Broken Knife Creek did the biological results of the OEPA differ from the QHEI scores of this study. For this stream, low QHEI scores were accompanied by full attainment of biological water quality.

It is apparent from the data in Figure 5 and 6 that, as streams become smaller, citizens QHEI values tend to decrease. These results are consistent with observations of the OEPA for the agricultural watersheds of northwestern Ohio. The habitat of small

streams seems to reflect surrounding land use more closely than larger streams. Low order streams in northwest Ohio typically have poor aquatic life.

Overall, it seemed that the Honey Creek watershed would benefit from a size increase in riparian zones and an improvement in vegetative variety. Since most of the watershed has been channelized it would be hard for most sites to reach high QHEI scores. Also, the low gradient of the stream bed in some areas seems to result in a large amount of sand accumulation. This also reduces the possible score on the Citizen's QHEI because of the large point spread credited to substrate size. Stabilization of stream banks would also improve stream habitats.

This project covered 36 different sites. The sites for the survey were spread out across the watershed but it would be beneficial if more sites along Honey Creek in Huron County and Bloom Township were surveyed. Finding more sites along the three smaller creeks would be beneficial in determining where problems were occurring in these creeks. Another area of concern is having almost all of the sites near a road or bridge site. In this survey, this was usually the easiest place to access the stream but it may have built a bias into the survey.

Section III. Huron River Watershed

IIIa. Landowner Response and Site Locations

Possible survey sites were identified from topographic maps and subsequent drive-by surveys. As a result, 86 permission forms (Figures 1 and 2) were sent to those land owners in May and June 1998. 24 completed forms were returned: 22 were positive and 2 were negative. The written inquiry yielded a response rate of 28%: 25% were positive, 2% were negative and 72% did not respond. An additional 8 sites were obtained by direct verbal communication, or were previous sites for the Huron River Stream Monitoring program or located on public/park land with public access.

A total of 19 sites were surveyed in the Huron River Watershed. One site was located in Erie County:

1 on Rattlesnake Creek (RSC)

Sixteen (16) sites were located in Huron County:

4 in the East Branch (EB) watershed
1 in the Cole Creek (CC) watershed
4 in the Norwalk Creek (NC) watershed
7 in the West Branch (WB) watershed
1 on Walnut Creek (WC)
1 at Holiday Lake (HL)

Site locations are illustrated on the Huron River Watershed map in Figure 8.

IIIb. Physical Habitat Assessment and Land Use Results

The results of the ODNR Stream Reach Screening Tool are presented in Table 2 a.-e. Average stream width and depth were calculated from the transect data reported on WQL Stream Inventory Forms and are included in Table 2a. A key to the symbols used in Table 2 is located in Figure 7. Table 2a includes site location, weather conditions, water level, average stream width and depth (calculated from transect data), and the total QHEI and Riparian Zone Scores. Table 2b contains signs of water pollution for each site. Table 2c has the detailed riparian zone evaluation. Table 2d contains land use and land use water quality impact data. Table 2e has the detailed Citizen's QHEI evaluation results for all the sites.

The Citizen's QHEI scores range from 32 to 93 (30% - 88%) out of a maximum of 106. The average score for all the sites is 64 (60%). The riparian zone scores range from 9 to 35 (26% to 100%) out of a maximum of 35. The average riparian score is 20 (57%). A direct correlation between the percentage QHEI scores and riparian scores can be seen

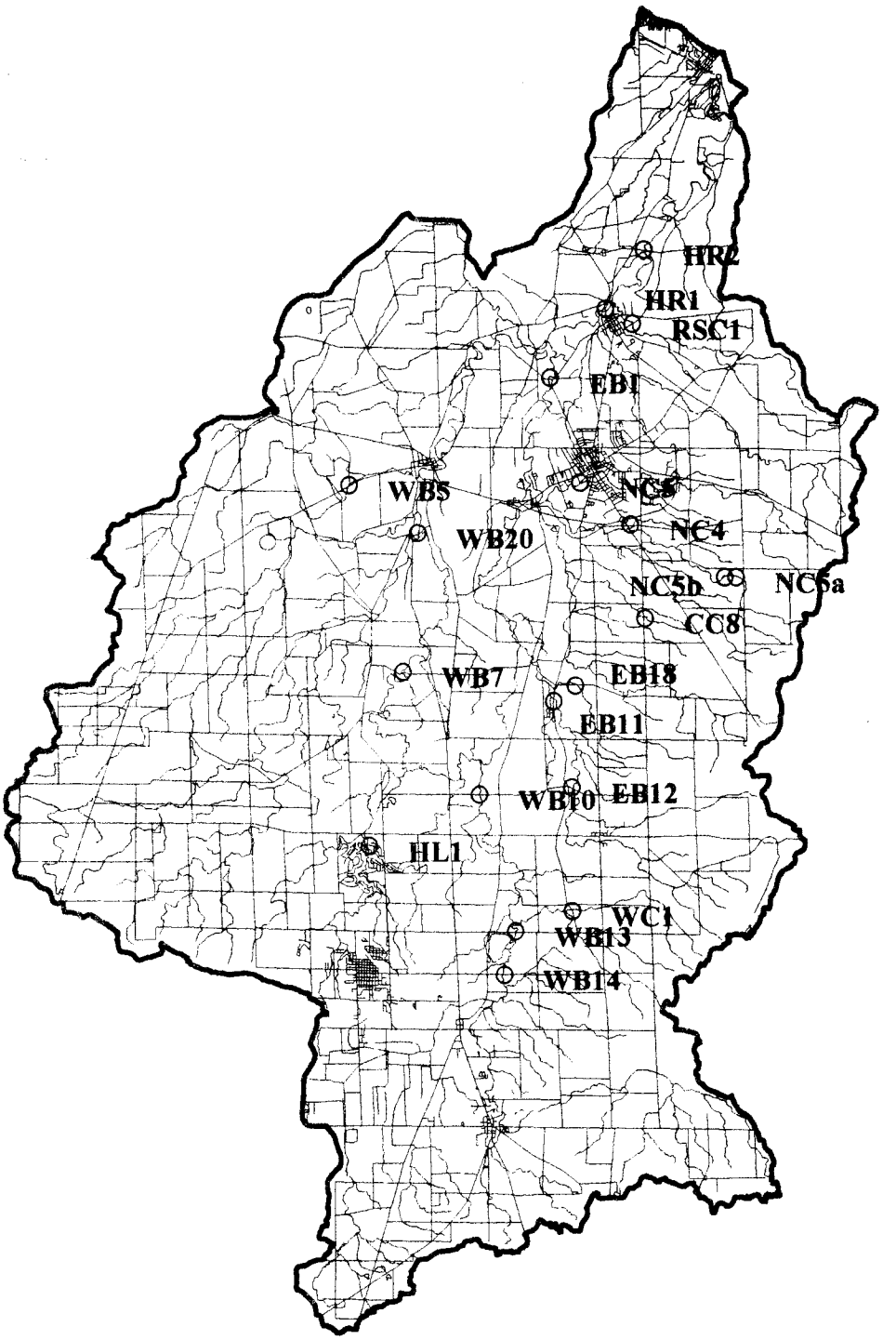


Figure 8. Location of sites in Huron River Watershed.

Table 2a: Huron River Basin Site Locations, Conditions, and Summary

Site ID Number	River Miles	Stream Name	5. County	LOCATION	8. Lattitude	9. Longitude	7. Length of Reach (m)	1. Precipitation Now	2. Precipitation in the past 24 hours	10. Water Level Today	11. Average Depth (m)	12. Average Width (m)	13. Air Temp. Now (C)	14. Water Temperature (c)	Total QHEI Score*	Riparian Zone Score(Right Side)	Riparian Zone Score(Left Side)
CC08		East Branch Huron River-Trib	H	East Branch Huron River trib on 1700 Old State Rd	41d10'57"	82d35'23"	150	N	H	L	0.07	1.1	33	30.8	**19**	**9**	**12**
EB01	1.47	East Branch Huron River-tributary	H	Schaeffer Rd N side of bridge, Norwalk	41d16"32"	82d38'13"	200	N	I	M	0.23	14.4	32	26.8	**77**	**0**	**24**
EB11	15.9	East Branch Huron River	H	Ridge Rd. near #555 AT BRIDGE	41d9'20"	82d38'4"	200	N	H	M	0.23	7.5	28.3	22.6	**83**	**25**	**30**
EB12		East Branch Huron River	H	Hanville Corners Rd, bridge, North Fairfield	41d07'19"	82d37'30"	200	N	N	M	0.24	5.8	20.1	22	**83**	**25**	**20**
EB18		East Branch Huron River-trib	H	954 West Peru Olena Rd., Norwalk	41d09'38"	82d37'22"	200	N	H	L	0.13	3.1	30.4	24.8	**79**	**21**	**9**
HL01		Holiday Lake Tributary	H	N of dam of Holiday Lake, Greenfield			150	N	N	S	0.18	0.65			**42**	**18**	**23**
HR1	11.9	Huron River	E	End of Mudbrook Rd in Milan, downstream of Rt 250 bridge	41d18'22"	82d36'21"	1000	N	N	M	1	85	27	21	**78**	**35**	**35**
NC04		South Br. Norwalk Creek	H	Norwalk Creek -south branch, Norwalk	41d13'12"	82d35'46"	150	N	I	M	0.53	2.4		21.4	**60**	**31**	**20**
NC05		Norwalk Creek	H	Pleasant Park, Norwalk	41d13'48"	80d37'13"	200	N	N				25		**49**	**23**	**29**
NC05A		South Br. Norwalk Creek	H	Greenwich-Milan Townline Rd S of Zenobia Rd, Norwalk	41d12'4"	82d32'32"	150	N	H	M	0.37	5.53	26.1	18.9	**52**	**25**	**25**
NC05B		South Br. Norwalk Creek	H	Greenwich-Milan Townline Rd S of Zenobia Rd, Norwalk	41d12'5"	82d32'55"	150	N	H	M	0.35	4.5	28	19.9	**32**	**9**	**9**
RSC1		Huron River-tributary	E	Berlin Rd, Edison Park, Milan at bridge	41d17'47"	82d35'39"	150	N	I	M	0.22	3.9	22.8		**59**	**25**	**12**
WB05		West Branch Huron River - tributary	H	3536 St. Rt. 547 Monroeville	41d14'11"	82d44'9"	150	N	N	L	0.11	1.87	26.7	NA	**24**	**9**	**9**
WB07	16.59	West Branch Huron River	H	Snyder Rd. bridge, Peru	41d9'55"	82d42'36"	200	N	N	L	0.36	13.9	23.8	NA	**89**	**25**	**20**
WB10	27.58	West Branch Huron River	H	Hanville Corners Rd, Greenfield			200	N	N	L	0.22	11.9	23.8	NA	**85**	**20**	**25**
WB12	32	West Branch	H	Bridge crossing on Olive Rd between Rt 61 and Walnut Rd			150	N							**73**	**35**	**33**
WB13	33.46	West Branch Huron River	H	Townline Rd 12, bridge			200	N	I	M	0.16	18.2			**87**	**35**	**25**
WB14	34.79	West Branch Huron River	H	Boughtonville Rd bridge, New Haven			200	N	I	M	0.36	14			**93**	**20**	**35**
WB20	10.5	West Branch Huron River	H	Standardburg Rd bridge	41d13'4"	82d42'7"	200	N	N	M	0.25	18.05	23.8	NA	**80**	**25**	**12**
WC01		Walnut Creek	H	W of Walnut Rd, Greenfield	41d02'58"	82d38'30"	200	N	H, S	M	0.13	2.9	28.4	21.5	**67**	**8**	**16**

Table 2b: Section II: Signs of Water Pollution

Site ID Number	15. Litter	Algae Appearance	17. Field Location	18. Water Appearance	19. Stream Bed Deposit	20. Water Odor	21. Total Number of Discharge Pipes	22. Discharge Pipe Type and Number	23. Hydromodification	24. Other
CC08	2	2,4,5	2,3,4,5	1,5	9		4	FT3,HS1	1,5,6	3,5
EB01	2	2, 3,4	2, 3	6	5, 6	11	2	ST1,UK1	7	7-DEAD CRAYFISH
EB11	1	3, 4	2, 4	6	5, 7	11	0			5
EB12	2	1, 3	2, 3	6	5, 6	2, 5	0			
EB18	1	2,3,5	2,3	6	5,6	2,4	1	HS1	5	5
HL01	2			1	1,5,6	2, 4	0		9-RIPRAP	3, 4, 5, 6
HR1	1	1, 4	3	6	1, 5, 7					
NC04	3, 4	2, 4, 5	2, 3	1,4, 5, 8	1, 5, 6, 7	8	5	FT2,SS3	1,7	2, 3, 4
NC05	2, 3, 4	2	2, 3	1, 6, 8	5, 6, 7	4	2	SS, MW	1, 2, 5	5, 6
NC05A	2, 7			6	4, 5, 6, 7	11	0			
NC05B	2	2 ,3, 4	2, 3	6	4, 5, 6	11	1	FT1	1	3, 5
RSC01	2			1	7, 8 - GRAVEL	11	2	O2	7	5
WB05	2	8		5,6	1,5,6,7	- WHEN STEP IN MUCK ON BOTTC	1	HS1	1	3
WB07	2	3, 4	2, 3	1	5, 7	12	1	UK	7	5
WB10	2	3, 4, 5	2, 3, 4	1	2, 5, 6, 7	11	1	FT1		5
WB12	1	2	2,3	1	6	11, MANURE FROM FIELD	0		9, RECOVERED	
WB13	2	2,3,5	2,3	1	5,6	11	0		3	5
WB14	3	2, 3	2, 3	1	5, 6, 7	5	0		9-RIPRAP	5
WB20	1	2, 3, 4	2, 3	1, 6	5, 6, 7	11	0		7	5
WC01	1	4	2, 3,	6	5, 6, 7	11	0		1, 5	5

Table 2c: Riparian Zone

Site ID Number	25. Vegetative Width (Left Side)	26. Vegetative Width (Right Side)	27. Vegetative Cover (Left Side)	28. Vegetative Cover (Right Side)	29. Vegetative Variety (Left Side)	30. Vegetative Variety (Right Side)	31. Vegetative Disruption (Left Side)	32. Vegetative Disruption (Right Side)	Riparian Score (Left Side)	Riparian Score (Right Side)
CC08	1	1	5	5	3	0	3	3	12	9
EB01	10	0	5	0	5	0	4	0	24	0
EB11	15	10	5	5	5	5	5	5	30	25
EB12	5	10	5	5	5	5	5	5	20	25
EB18	1	8	5	5	3	5	0	3	9	21
HL01	10	5	3	3	5	5	5	5	23	18
HR1	10	10	5	5	5	5	5	5	35	35
NC04	5	20	5	5	5	3	5	3	20	31
NC05	20	10	5	5	3	5	1	3	29	23
NC05A	10	10	5	5	5	5	5	5	25	25
NC05B	1	1	5	5	0	0	3	3	9	9
RSC01	1	10	5	5	3	5	3	5	12	25
WB05	1	1	5	5	0	0	3	3	9	9
WB07	5	10	5	5	5	5	5	5	20	25
WB10	10	5	5	5	5	5	5	5	25	20
WB12	20	20	5	5	5	5	5	3	35	33
WB13	10	20	5	5	5	5	5	5	25	35
WB14	20	5	5	5	5	5	5	5	35	20
WB20	2	10	1	5	4	5	5	5	12	25
WC01	1	0	5	5	5	3	5	0	16	8

Table 2d: Section I: Land Use Details

Site ID Number	33. Agricultural	34. Livestock Acess to Reach	35. Logging	36. Urban	37. Transportation	38. Industrial	39. Development Description	40. Mining and extraction	41. Mine Status	42. Waste Disposal	Section II: Land USe Water Quality IMpac	43. Top of Bank to Land Use (m) Left Side	44. Top of Bank to Land Use (m) Right Side
CC08	1			1,5	LA2		1,R			4		3	5.5
EB01				1			2, R			4		80	0
EB11				1, 5			2, R			4		50	
EB12	1, 2			1			1, R					75	75
EB18	1			1	LA2		1,R					10	100
HL01	2			1			3,S					100	5 TO 50
HR1	1, 3			1	RR1, LA2		3, R						
NC04				1,5	PL		2,S					7	0.1
NC05				1,5	PL,		2,S						
NC05A	1	1					1,R					20	35
NC05B	1, 2											3.1	3.1
RSC01				1,5			1,S					0	100
WB05	2,3			1			3,R			4			
WB07	2						3, R					20	NA
WB10	1						3, R					100	20
WB12	CROPS												
WB13													
WB14	1						2,R						10
WB20	1			1			3, R			4			
WC01	1, 2, 4-HAY			1	LA2		1,R					10	50

Table 2e: Citizen's QHEI

Site ID Number	45. Substrate Bottom Size	46. Substrate Smothering	47. Substrate Silting	48. Fishcover	49. Stream Shape	50. Human Alterations	51. Stream and Forest Width	52. Land Use - Mostly	53. Deepest Pool	54. Flow Type	55. Riffle /Run Depth	56. Riffle / Run Substate	57. QHEI Score
NC04	5	N5	Y0	A2,B2,C2,F2,G2,H2,I2	8	8	3	D2	4	M1,S1	6	4	60
NC05A	0	N5	Y0	A2,C2,E2,F2,I2	6	12	4	E2,G2	6	M1,S1	0	0	52
NC05B	8	N5	Y0	D2,F2, H2	3	0	0	E2	4	F3,M1	0	0	32
CC08	0	N5	Y0	D2,F2,H2,I2	0	0	0	B2,C2	0	M1,S1	0	0	19
EB01	14	N0	Y0	A2, B2,C2,F2,H2,I2	6	12	3	D2	4	VF2,F2,M1,S1	6	7	77
EB11	14	N0	N5	B2,C2,F2,G2,H2,I2	3	12	5	G5	5	VF2,F3,M1,S1	6	7	83
EB12	10	N5	Y0	A2,B2,C2,D2,F2,H2,I2	6	12	5	E2,G2	6	F3,M1,S1	6	7	83
EB18	14	N5	Y0	A2,B2,C2,D2,F2,H2,I2	6	8	3	B2,G5	4	F3,M1,S1	6	7	79
HL01	7	Y0	Y0	C2,H2,I2	6	8	5	D1,G5	4	S1	0	0	42
HR1	10	N5	Y0	A2,B2,C2,E1,F2,G2,H2,I2	8	8	5	E2,G5,G3	8	M1, S1	4	4	78
NC05	8	Y0	Y0	C2, F2, H2, I2	6	8	3	B2	4	M1, S1	4	4	49
RSC01	0		N5	A2,C2,F2,G2,H2,I2	8	8	4	B2,G5	6	F3,M1,S1	4	0	59
WB05	0	N5	Y0	D2, F2, H2	6	0	0	E2	4	S1	0	0	24
WB07	14	N5	N5	B2, C2,E2,G2,H2,I2	6	12	5	E2, G5	8	F3,M1,S1	6	7	89
WB10	8	N0	Y0	A2, B2, C2,E2, F2, G2, H2, I2	6	12	5	E2, G2	8	F3, M1, S1	6	7	85
WB12	14	Y0	Y0	B2,F2,H2,I2	6	12	5	G5,I4	6	F3,M1	6	7	73
WB13	14	N5	Y0	A2,B2,C2,F2,G2,H2,I2	6	12	5	G5	6	VF2,F3,M1,S1	6	7	87
WB14	14	N5	Y0	A2,B2,C2,E2,F2,G2,H2,I2	6	12	5	E2,G2	8	VF2,F3,M1,S1	6	7	93
WB20	14	N5	Y0	B2, G2,H2, I2	6	12	4	B2,G5	6	F3, M1, S1	6	7	80
WC01	14	N5	Y0	A2,B2,C2,D2,F2,H2,I2	6	8	3	B2,D1,E1	4	F3,M1,S1	6	7	67

in Figure 9. As the riparian score increases, so tends the QHEI score. A linear regression of the data, shown in Figure 10, also illustrates this trend. A maximum of 5% of the QHEI score is attributed to Stream Forests and Wetlands width. After subtracting this portion from the QHEI score, the linear trend still remains, as seen in Figure 11. The results of the Citizen's QHEI surveys show trends: lower scores in suburban settings, highly channelized streams, narrow or no riparian zones, such Norwalk Creek in Pleasant Park (NC5) or drainage ditches (CC08). Little channelization, wide riparian zones with variety of vegetation, natural settings, such as EB12 or WB14, yield high QHEI scores.

IIIc. Comparison with OEPA QHEI Results

The Ohio EPA performed both QHEI and macro invertebrate surveys in the Huron River Watershed during the summer of 1998. Several OEPA site locations overlap the sites surveyed in this study during the same summer. It is useful then to compare the OEPA QHEI results with the Citizen's QHEI results to assess the accuracy of the Citizen's QHEI results.

On the West Branch, two sites overlap; the first is at river mile 10.5 where Standardsburg Rd. crosses the river. The second site is at river mile 16.6 at the Snyder Rd. bridge. Several other OEPA sites are within 2 river miles of the sites in this study. The OEPA and Citizen QHEI results for the West Branch are illustrated in Figure 12.

The QHEI values at the river mile 10.5 site agree very closely (2% difference). The difference between the QHEI values at river mile 16.6 is less than 20%. The Citizen's QHEI value tends to be higher than the OEPA value. The maximum total points for the Citizen's QHEI survey is 106 versus 100 for the OEPA QHEI survey. This could account for up to 6% difference in the values for the same site. The average Citizen's QHEI score for the West Branch sites is 87; the average OEPA QHEI score is 72, a difference of 21%.

IIId. Discussion of Habitat Conditions

Sites surveyed in this study are discussed briefly and unique characteristics highlighted. The average Citizen's QHEI scores are compared to the 1998 OEPA QHEI scores (Appendix C) for sites in each creek or river segment. The results of this survey are discussed in light of the Ohio NPS Assessment Status of Stream Segments (1990). Table 3 compares the average Citizen OEPA QHEI scores and the Ohio NPS Assessment Status for streams in the Huron River Watershed.

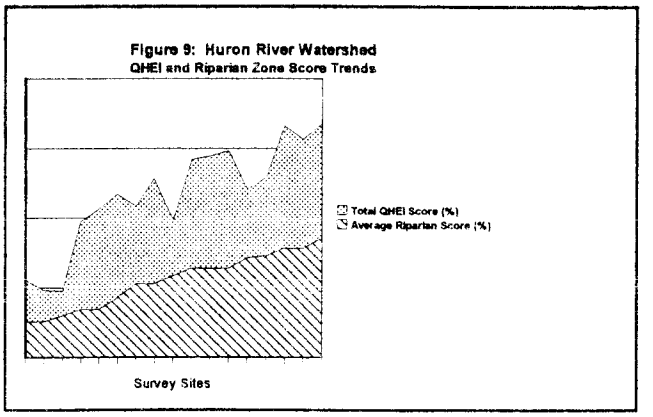


Figure 9: Huron River Watershed
QHEI and Riparian Zone Score Trends
Total QHEI Score (%)
Average Riparian Score (%)
Survey Sites

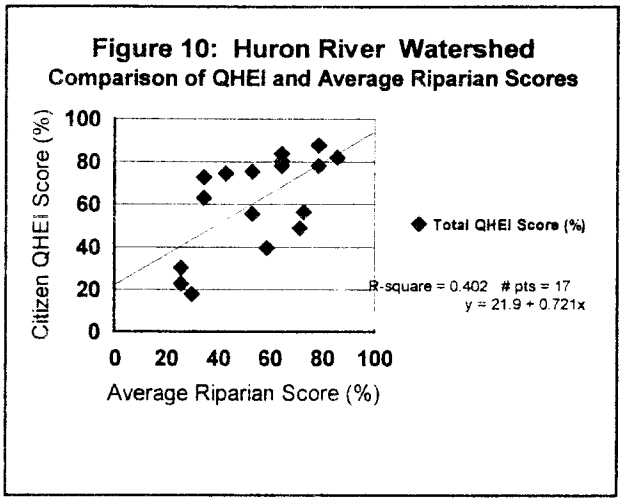


Figure 10: Huron River Watershed
Comparison of QHEI and Average Riparian Scores
Citizen QHEI Score (%)
100
80
60
40
20
0
0 20 40 60 80 100
Average Riparian Score (%)
Total QHEI Score (%)
R-square = 0.402 # pts = 17
y = 21.9 + 0.721x

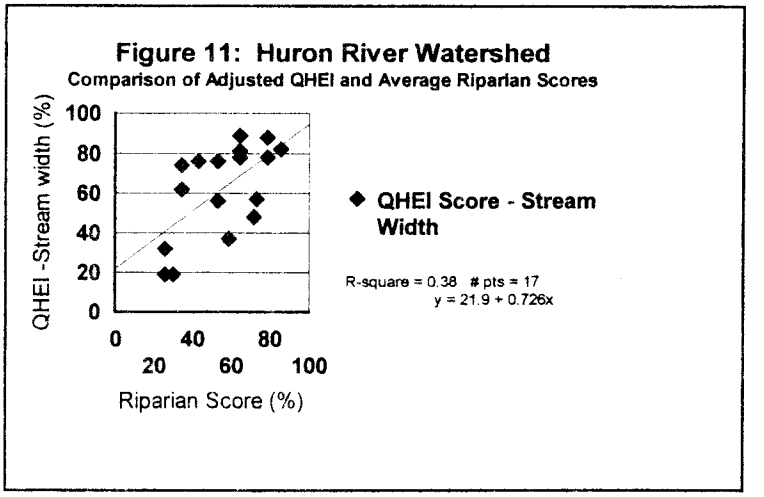


Figure 11: Huron River Watershed
Comparison of Adjusted QHEI and Average Riparian Scores
QHEI -Stream width (%)
100
80
60
40
20
0
0 40 80
20 60 100
Riparian Score (%)
QHEI Score - Stream Width
R-square = 0.38 # pts = 17
y = 21.9 + 0.726x

Figure 12: West Branch Huron River
Comparison of OEPA and Citizens QHEI Results

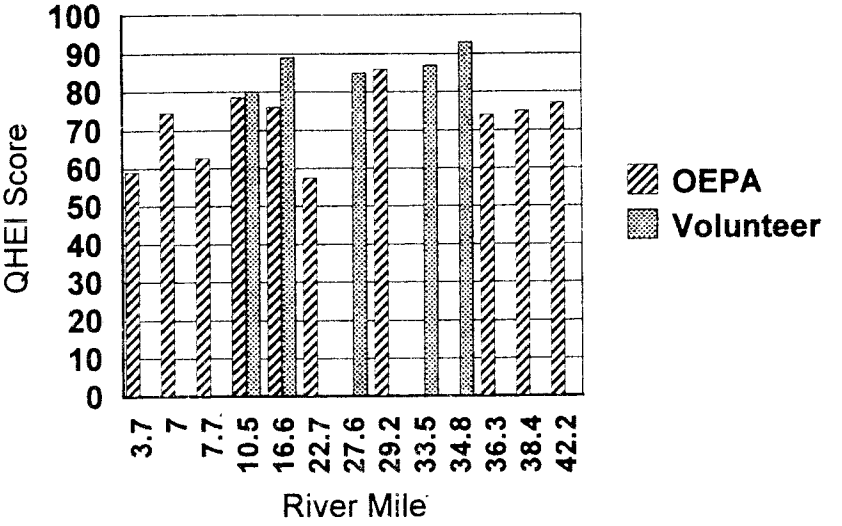


Table 3

Comparison of Average Citizen QHEI and OEPA Scores and NPS Assessment Status For Huron River Watershed

Stream	Citizen QHEI (Ave.)	(# of sites)	OEPA QHEI (Ave.)	(# of sites)	% diff.	NPS Status (segment #)
Huron River	79	one	70	three	13%	NPS Impaired (seg 1)
Rattlesnake Creek	58	one	77	two	-23%	NPS Impaired (seg 3)
Cole Creek	19	one	60	two	-68%	NPS Impacted (seg 6)
Norwalk Creek	48	four	65	three	-26%	NPS Impaired (seg 5)
East Branch Huron River	80	four	64.3	four	25%	PS&NPS Impacted (seg 4) NPS Impaired (seg 7)
West Branch Huron River	76	seven	72	ten	5%	PS&NPS Impacted (seg 18) Attaining Use (seg 8)
Walnut Creek	67	one	51.2	one	31%	NA

Cole Creek

One site, CC8, on a small tributary to Cole Creek was surveyed. The site can be characterized as an uniform, straight, channelized reach that serves as a drainage ditch for the surrounding corn fields and residential lawns. The substrate is classified as poor due to the fine grain sand and muck on the bottom of the channel. The riparian zone is narrow and is covered in grass only. Four field tiles and one drain tile from an on-site residential septic system outlet into the reach. The Citizen's QHEI score of 19 indicates a Limited Resource Water.

The OEPA QHEI average score is 60 for Cole Creek indicating that the sites are Modified Warm Water Habitats or Warm Water Habitats. The Citizen's QHEI score is 68% lower than the average OEPA score because site CC8 is located on a small channelized tributary that serves as a drainage ditch while the OEPA sites are located on the main stem of Cole Creek in a more natural settings and are not channelized. Cole Creek is listed as NPS Impacted.

Norwalk Creek

Four sites were surveyed on Norwalk Creek: 3 (NC5a, NC5b, NC4) are located on the south branch tributary and one (NC5) is located on the main stem of Norwalk Creek. Site NC5b is located upstream of NC5a on the same tributary that flows through crop land on both sides. Site NC5b appeared to be channelized and straight while downstream, site NC5a was more natural and had one natural bend in the reach. The substrate in the upstream site (NC5b) contained medium to small gravel and sand over large slabs of sandstone. Downstream (NC5a), the substrate was all sand. Neither site had riffles. Left and right side riparian zones of the upstream site were composed of grass filter strips, 3 meter wide. Downstream, the riparian zones contained woods ranging from 10 to over 100 m in width. The Citizen's QHEI scores for NC5b and NC5a are 32 and 52, respectively. The improvement in the habitat in the downstream site can be attributed to the wide, wooded, riparian zone.

Site NC4 is classified as recovering from channelization. The reach has several bends and appears to be natural. Residential lawns, and woods surround the stream. The substrate is medium size gravel in sections and mucky, fine sediment in other sections. The Citizen's QHEI score is 60.

Site NC5, flows through a city park; the upstream half is natural, with riffle zones, and surrounded by wide, wooded riparian zones. The downstream half is channelized, with mucky substrate, no riffles and surrounded by wide, grassy park land. The Citizen's QHEI score for site NC5 is 49., indicating that the stream can be considered a modified warm water habitat.

The average OEPA QHEI score is 65, 26% higher than the average Citizen's QHEI score for Norwalk Creek. The three OEPA sites on Norwalk Creek have good vegetative cover and substrate and only one is channelized resulting in higher QHEI scores. The OEPA QHEI score indicates that the stream can be considered a Warm Water Habitat.

Norwalk Creek (segment 5) is listed as NPS Impaired. Observations of sandy, mucky substrate within the Norwalk Creek watershed support this classification.

East Branch Of Huron River

Four sites in the East Branch of the Huron River were surveyed; three sites (EB12, EB11, and EB1) was located on the main stem and one site (EB18) was located on a tributary. All four sites were natural with no channelization, excellent substrate quality, and several riffle zones. The riparian zones for the sites were wide and forested. One bank of site EB1 was an exception due to the presence of a shale cliff. The primary land use surrounding all sites was agricultural with sparse residential development. Outlet pipes from home septic systems or field tiles were present in most of the sites. The average Citizen's QHEI score for the East Branch Huron River is 80.5 indicating Exceptional Warm Water Habitat.

The average OEPA QHEI score for four sites on the East Branch Huron River is 64, 25% lower than the Citizen's QHEI average score. One site, located at RM 21.0 near New London, was channelized with sparse cover. Another site was considered to be recovering from channelization. None of the sites in this survey were channelized and all had excellent riparian zones. The OEPA score would be considered Warm Water Habitat.

The East Branch Huron River, from its headwaters to Norwalk Creek (segment 7), is considered NPS Impaired. The Citizen's QHEI survey may not support this due to the excellent quality of the substrate and good riparian zones at sites EB 11,12, and 18. However the OEPA QHEI scores lend support to the NPS Impaired designation due to channelization and sparse cover at some of their sites.

The East Branch Huron River, from Norwalk Creek to the Huron River (segment 4) is listed as PS and NPS Impacted. The Citizen QHEI score for site EB1 is 77, slightly lower than the upstream sites due to the impact of residential lawns and outlet pipes. However the substrate, presence of riffles, and wooded riparian zones seems to provide good physical habitat. This section of the East Branch does pass through a higher populated area (west side of Norwalk) than the segments upstream.

West Branch Of Huron River

Seven sites in the West Branch Huron River were evaluated; six were located on the main stem (WB14, WB13, WB12, WB10, WB7, and WB20), and one on a tributary (WB5). One site (WC1) on Walnut Creek, a tributary to the West Branch, was also surveyed. All the sites on the main stem were natural with no channelization. Substrate quality was good to excellent with riffles present in the stream reaches. The sites had wide, wooded riparian zones (25 m to >100m) and the land use was primarily agricultural with sparse residential development.

The sites on the two tributaries were channelized. Site WB5 appeared to be a drainage ditch with poor substrate (sand and muck). The riparian zone was a grass filter strip (2-

4 m wide). The Walnut Creek site (WC1) had excellent substrate with riffles and fish cover. The riparian zone on one side was narrow grass and on the other, grass and shrubs 8 to 79 m wide. The land use of both was agricultural with sparse residential development.

The average Citizen's QHEI score for the West Branch Huron River (excluding WC1) is 76. The average OEPA QHEI score for 10 sites evaluated in the West Branch Huron River is 72. Eight of the OEPA sites had no channelization or were recovered from channelization. Seven sites had excellent to moderate cover while three had sparse cover. The close agreement (95%) between the Citizen's and OEPA scores can be attributed to larger number of sites evaluated and the similar characteristics of the sites; most of the sites in both studies had no channelization (or recovered) and good riparian zones. The average QHEI scores indicate that the West Branch Huron River can be considered a Warm Water Habitat designation.

The Citizen's QHEI score for the Walnut Creek site is 67, while the OEPA QHEI score for one site on Walnut Creek is 51 to 31% lower than the Citizen score. The OEPA site had sparse cover and recovering channelization. The Citizen site was channelized but had excellent substrate and fish cover.

The Nonpoint Source Assessment (1990) has designated the West Branch Huron River from Marsh Run to Slate Run (segment 18) to be PS and NPS Impacted. Sites WB14, WB13, WB12, WB10, and WB7 are located in this segment. The substrate at these sites is good to excellent with riffle zones in each reach. A reservoir was located about 75 m from site WB13. Some silting was noted at WB12 and WB10. The West Branch Huron River from Slate Run to the East Branch (segment 8) is designated as Attaining Use. Site WB20 is located in this segment. The Citizen's QHEI score for this site is 80, exceptional Warm Water Habitat seems to support the Attaining Use designation.

Rattlesnake Creek

One site was surveyed on Rattlesnake Creek (RSC1) at Edison Park in Milan, Ohio. The reach had no channelization except for the Berlin Rd bridge abutment. The primary substrate was poor: sandy and mucky, but the reach had one riffle area and good fish cover. The riparian zone contained grasses and woods and was 10 to 50 m wide. The land use was suburban park and residential. The Citizen's QHEI score is 59. The Modified Warm Water Habitat classification is appropriate due to the mucky bottom. However the stream has good fish characteristic of Warm Water Habitats. The average OEPA QHEI score for two sites on Rattlesnake Creek is 23% higher (77). The OEPA sites had no channelization and excellent substrate classification. Rattlesnake Creek (segment 3) is designated NPS Impaired.

Huron River

One site (HR1), 800 m long, on the main stem of the Huron River was surveyed by canoe. The reach was mostly natural, not channelized, with medium sized substrate and shallow riffle areas. The riparian zone was wide and wooded and the fish cover excellent. Two discharge pipes and a bridge crossing were located in the reach. The Citizen QHEI score for this reach is 78, well within the Warm Water Habitat range. The average OEPA QHEI score for three sites on the main stem is 13% lower (70). One site was recovering from channelization and two sites had sparse cover. The Huron River from the East Branch to Lake Erie (segment 1) is designated as NPS Impaired.

Section IV. Project Evaluation

The project goals were accomplished successfully. Stream habitats in the Huron River Basin and in the Honey Creek watershed and determine land use in areas contiguous to the riparian zones were evaluated using the ODNR modified QHEI stream Habitat Screening tool. Volunteers, college students and staff were trained, sites were selected using aerial and topographic maps and drive-by surveys. An additional survey tool was developed by the WQL and 36 sites were surveyed by WQL staff (summer college students) in the Honey Creek Watershed and 21 sites were surveyed by volunteers and staff in the Huron River Watershed. Ground truthing riparian GPS maps was not accomplished in this project as originally planned due to difficulty in obtaining GPS maps and time constraints. However, riparian widths were measured at 50 m intervals along each reach in the survey. Hence, the field data is available for future ground truthing when GPS maps are obtained and funding is available. The final report will be sent to the OEPA, Huron Soil and Water Conservation District, the Seneca Soil and Water Conservation District, the Sandusky River Watershed Coalition, and the ODNR.

IV a. Community Support

The survey tools and procedures are evaluated so that improvements can be made for the future projects. To expand community awareness and participation in the project, the following suggestions could be incorporated. Send out bulletins to local government agencies to support the program. Publicize the project and its goals and benefits in newspapers, community group meetings, etc. stressing that no chemical testing will be done at the site, and site owners remain anonymous.

IV. b. Site Selection

When sites are chosen they were checked with local agencies such as the Soil and Water district to guarantee that the correct owners are being asked. Finding the actual owners of the property can be difficult due to leasing of farm land and changes in ownership. Some owners refused to participate due to suspicion of EPA involvement or concern that the surveyors would bother their property. Several owners expressed that they had let other groups onto their land that had left behind materials that were not wanted. Letters sent to potential site owners should reinforce that the project is not a legal survey but rather is used for educational and research purposes, that the land owner is not liable, that owners need not be present, and that nothing is to be left behind after the survey.

Most of the sites in this project were located near bridge or road crossings to provide easy access. Future studies would benefit from sites that are more evenly spaced within the watershed and located elsewhere than beside a bridge or a road. This study may be skewed by the high number of sites by road areas and bridges due to channelization and increased run-off from the concrete and road surfaces.

Valuable insight was gained from the owners that were able to be present at the time of the survey. Perhaps an historical section could be added to the survey for such comments. This type of information could also be obtained by telephone or written survey.

IV. c. Survey Protocol

To minimize discrepancy in site evaluation in the field due to protocol, definitions of terms for each section of the Huron River and Honey Creek Volunteer Stream Habitat Survey should be kept with the forms. In this project, a list of key words and their definition was created to increase uniformity and comparability between site surveys.

Surveyors walked up and down the stream banks (both sides) before completing the survey forms to familiarize themselves with the reach and provide an average of the whole reach. It also provides an opportunity for the surveyors to look for litter and other unique characteristics of the reach. Depth poles (calibrated 4 ft. x 1" dowel rods) and surveyor's 50 m measuring tapes were used to measure stream depths and distances and were quite adequate and easily used. For very long distances, a range finder was beneficial although it was a rather bulky piece of equipment to carry around.

Surveying after a rainfall should be avoided especially in the lower reaches that have a delayed build up of water. This complicates measurements and impedes the ability to walk in the stream. The substrate bottom can not be evaluated under these conditions by getting into the stream. Surveyors should not be in the stream during rainfall or immediately after due to the change in stream flow, water appearance, and water height. High levels of water will cover up signs of riffle zones, make items such as small diameter roots unnoticeable, will give false impressions of the riparian zone, and change odor and color of the water due to changes in concentration.

The appearance of the water was evaluated by directly observing water in the stream. Sometimes it was difficult to distinguish the color of the water from the reflected color of the bottom substrate. This problem can be eliminated in the future by a sample of undisturbed water in a clear jar and observing the color against a white sheet of paper.

IV. d. Stream Reach Screening Tool

This project was the first field usage of the Citizen's QHEI form (Figure 4). Describing the difficulties the volunteers had will be useful in refining the form. The ***stream reach length*** of 150m or 200m may be too large. Some stream and bank characteristics vary greatly in a short distance. Also, one factor may be found in one small area but may not be a characteristic of the total reach. If the form allowed a 200 m reach to be subdivided into 50 m or 100m sections and then averaged the results, a more accurate representation of the stream habitat may be obtained. Evaluating the ***present water***

level is hard for a volunteer to do, especially if the volunteer is not familiar with the site; they will not know if the water flow is high, medium, or low for that particular area. Perhaps defining those descriptors in terms of level of water relative to the top of the bank (1/4 full, 1/2 full, 3/4 full) would be more definitive and measurable.

The term ***occasional litter*** needs to be clarified in the **Signs of Water Pollution** section. If one or two pieces of litter are found they may have washed up from a recent storm. This would not be a true representation of that reach. Designating how many pieces of litter are meant by the term "occasionally" would yield a more accurate survey. In the location of algae section, under the Signs of Water Pollution, the question arose, "Is ***Algae Located Everywhere*** the only box to be marked or should this be accompanied by other boxes, such as ***attached to objects*** and ***matted on stream bed***?" This ambiguity could be addressed in the instructions accompanying the form.

Odor designations such as musky or chemical smell are subjective and depends on the surveyor filling out the form. It was easier for surveyors to agree upon odor identifications such as chlorine, rotten egg, fishy, and petroleum. Particularly confusing was determining the difference between sewage and manure odors, since volunteers may not have experienced these in their past. The volunteers could learn the odors during training session. In the ***Discharge pipe section***, it would be helpful to note if the pipe seemed to be in use or not. Secondly, volunteers should be given a drawing or description of the different types of discharge pipes to make identification easier. In the ***Hydromodification*** section, two more choices should be added to the list: diked and Rip rap.

Scoring for the **Riparian Zone** was fairly straightforward. However, two questions arose. First, if a large forest surrounds the stream, should the entire forest be considered the riparian zone and where does the term "land use" apply? Clarification of the boundary of a riparian zone or its maximum width and land use surrounding a riparian zone is needed. Second, does the scoring differences between vegetative widths need to be so broad? It seemed in this survey that a riparian zone of 50-100m was just as effective in terms of physical habitat as a strip greater than 100 m. However the score for the wider zone is twice that of the 50-100 m zone. This discrepancy in score makes reaches that may have adequate physical habitat seem lacking in some manner. Exploring the question of how effective the different widths of riparian zone are would be beneficial to comparing the adequacy of different sites. The category of **Land Use Detail** detailed definitions of the terms "urban", "suburban", and "rural" are needed.

The **Citizen's QHEI** form has several areas of ambiguity. In the ***Substrate (Bottom - Type): size*** category, a large point loss (12 points) is incurred for streams with sandy bottoms due to the natural geography of the area. This decrease in score may overstate the negative impact of a naturally occurring sandy bottom on the ability of the stream to provide adequate habitat for organisms. There is a large point loss for any stream that does not have large substrate material.

Differentiating between "smothering" and "silting" was difficult for volunteers. Inclusion of examples or pictures of smothering and silting for identification in stream reaches would be useful. The degree of silting and smothering between creek reaches varied greatly. Adding a choice between light and heavy silting or smothering may give a more accurate description of the stream quality. In the section of ***Fish Cover***, a definition of "backwaters" would be helpful.

In the section, ***Stream Shape and Human Alterations***, it was debated if the stream shape was only to be applied to the immediate reach or if it was applied to the portion of the reach that was visible from the site. It was decided to use only the portion of the creek within the reach being studied. Clarification of this point should be added to the form. The section describing ***how natural the site is*** has a rather large point spread. In this study, it was found that some areas that had been diked or channelized seemed to have the same quality as other areas that were mostly natural. Most of these sites had not been touched for many years and had undergone many natural changes but evidence of human alterations remained due to equal bank heights.

Clarification of terms in the section, ***Stream Forests and Wetlands*** is a significant problem. In part A., the width was taken to mean the width of the riparian zone even though the survey stressed forests and wetlands. Instead of determining the width by how far a rock can be thrown, it may be better to have a set range of distances. The distance that an individual can throw is too subjective. In part B, the land-use categories were assumed to apply to areas beyond the riparian zone. This also needs to be clarified on the form.

In the ***Depth and Velocity*** section, depth designations of chest deep and waist deep are hard to apply in this survey. Most volunteers wear hip boots and are instructed to not go in water any deeper for safety reasons. Use of depth poles and including depth ranges in linear units would help.

IV. e. Water Quality Lab Huron River and Honey Creek Volunteer Stream Habitat Survey

Several corrections can be made to the Huron River and Honey Creek Volunteer Stream Habitat Survey Figure 6) produced by the Water Quality Lab to improve consistency. The WQL survey was used in conjunction with the ODNR Stream Reach Screening Tool. Terms and definitions for the screening tool were also applied to the WQL survey. However, to standardize the WQL form, terms and definitions must be included. For example, terms and their definitions for the **Stream Bottom Substrate** category should be provided. Standard descriptors for the **Stream Litter - Type and Severity** and for **Bank Erosion** should be included. A list of possible terminology and pictures or detailed descriptions for **point sources** should be added.

Clarification of the foot of the bank (at the water surface or below the surface) is needed when determining **bank height.** In this study, the bank height was measured from the

surface of the water to the top of the bank. Problems with this category were experienced when the water level was higher than usual. Sometimes the primary bank was underwater and its measurement was not possible. Terms for types of **dominant vegetation** should be adopted and applied to the form to make comparisons between forms easier.

Bibliography

Rankin, Edward T, Yoder, C.O., Mishne, D., 1997. Ohio Water Resource Inventory, Executive Summary, Ohio EPA Technical Bulletin MAS/1998-10-3.

Ohio EPA, 1990. State of Ohio Nonpoint Source Assessment, Vol 6. Lake Erie East Region, P.O. Box 1049, Columbus, Ohio 43266-0149.

Rankin, Edward T, The Use of the Qualitative Habitat Evaluation Index for Use Attainability Studies in Streams and Rivers in Ohio, Ohio EPA, Columbus, Ohio.

Ohio EPA, Benefits of Stream and Riparian Habitat Protection in Ohio, Fact Sheet, Ohio EPA, 1800 WaterMark Dr., Columbus, Ohio 43215.

Appendix A: Sample Letters

WATER QUALITY LABORATORY

Heidelberg College
310 East Market Street
Tiffin, Ohio 44883-2462

(419) 448-2198 FAX: (419) 448-2124

April 30, 1998

Dear Jan:

Thank you for volunteering to participate in the Stream Habitat and Land Use Assessment project funded by the Lake Erie Portection Fund. Your efforts are so important to the success of this project! Most importantly, I hope you will gain a new understanding of our local water resources, and have a safe and enjoyable experience.

The purpose of this work is to evaluate the stream habitats in the Huron River Basin and in the Honey Creek watershed of the Sandusky Basin and determine land use in areas contiguous to the riparian zones. This project will develop an important part of both watershed data bases which will provide a basis for watershed management decisions and identify critical problem areas as well as areas with good habitat conditions to better target best management practices in agriculture and in urban development, and improve community awareness and connection to their watershed by using trained volunteers (That's YOU!!!).

We will be holding a mandatory training session on **Saturday, May 16, from 9:30 a.m. to 2:00 p.m**. We will meet at **Pleasant Park, on Pleasant St. in Norwalk at 9:30 a.m.** Please bring a **sack lunch and drink**. I will have a cooler of water. You will need to bring your **own water-proof boots or extra stream-stomping shoes**. You will be walking in the streams. Dress for the weather. We will be out-of-doors. Bring a pencil and notebook to take notes.

Mr. Dan Kush, ODNR-Div. Soil and Water Conservation, will be leading our training session on physical habitat assessment. During the training session, we will have the opportunity to practice at several stream locations, including Pleasant Park, Camp Conger, and possibly on a near-by farm. Also at this time, we will discuss the stream segments to be evaluated in the project, evaluation procedures, safety, and determine stream segment evaluation assignments (who will cover which segments, how many segments you want to evaluate, etc.).

Thank you again for helping with this project. Please call me to confirm your attendence or with any questions (419) 499-3319. I look forward to seeing you on May 16th!

Sincerely,

Linda Cornell

Linda Cornell, Ph.D., PE
Project Director

WQL

WATER QUALITY LABORATORY
Heidelberg College
310 East Market Street
Tiffin, Ohio 44883-2462

(419) 448-2198 FAX (419) 448-2124

Huron River and Honey Creek Volunteer Stream Habitat Survey Program

AGREEMENT TO PARTICIPATE - RELEASE and WAIVER FORM

In Consideration of being allowed to participate in this Stream Habitat Survey and recognizing this program will involve activities which may b hazardous, I intending to be legally bound, hereby, for myself, my heirs, executors and administrators, voluntarily assume all risks of accident or injury and release and forever discharge the Heidelberg College Water Quality Laboratory (hereinafter referred to as SPONSOR), co-sponsors, and its respective employees, officers, agents, landowners and the community in which the stream habitat surveys are conducted, from any and all liability for personal injury or property damage of any kind sustained in association with participation in the program, whether such personal injury or property damage is caused by the negligence of the SPONSOR, co-sponsors, or their respective employees, officers, agents or otherwise.

I agree to indemnify and hold harmless the SPONSOR, co-sponsors, and its respective employees, officers and agents, landowners, as well as the community in which the Stream Habitat Surveys are conducted, from all liability, loss and expense, including but not limited to damages, legal expenses and cost of defense, in any matter arising from participation in the Heidelberg College Water Quality Laboratory's Stream Habitat Survey program.

I further agree to follow all applicable guidelines provided by the SPONSOR.

_____	_____
Participant (signature)	Guardian of Participant (signature)
_____	_____
Date	Date
_____	_____
Participant (please print)	Guardian of Participant (please print)

Appendix B: Instruction Guide

The Stream Reach Screening Tool

General Information Page

Name of lead person
Put the name of the lead person completing the form and their phone number. This is the person who can be contacted regarding questions about the information written on the form. This person must have been present in the field when the form was completed. Put daytime and evening phone numbers where the lead person can be reached.

Training completed
Indicate any water quality monitoring training the lead person has already received such as training from Izaak Walton League Save our Streams, Ohio EPA Qualitative Habitat Evaluation Index training, Master Watershed Stewards, ODNR SQM training, etc.

Group Affiliation
Indicate the group the lead person is affiliated with and the date the form was completed. Individuals and groups must register with Ohio EPA by completing a brief form. They will be assigned a number which they will put on the Stream Reach Screening Tool.

Precipitation
Indicate precipitation that occurred when you completed the form and that occurred within the past 48 hours of when you completed the form by checking the boxes for "Heavy", "Steady", "Intermittent", or "None". For instance, if periods of "Heavy" and "Intermittent" precipitation occurred within the past 48 hours, check both boxes next to "Past 48 hours".

The volume of streamflow is determined by precipitation. After a rainstorm and saturated soil conditions, stream flow follows a predictable pattern in which it rises sharply in response to the storm, and then falls, usually more gradually, in the hours or days following the storm. Usually the highest flow resulting from a storm does not happen at the same time as the highest rainfall intensity of the storm. It takes the stream a little time to catch up with the rainfall. Smaller streams respond faster than larger streams.

Temperatures
Measure air and water temperatures. Many biological, physical, and chemical principles depend on the temperature. For example, colder water holds more dissolved oxygen than warm water. Water temperature is important because elevated temperatures decrease dissolved oxygen in the water. Shallow streams and rivers are much more susceptible to temperature changes because their capacity to store heat over time is also relatively small. Lakes however, are more resistant to temperature change because the volume of water over a certain area is relatively great.

Use the following procedures to measure temperatures:

Air Temperature: Locate some place near your site to test the air temperature. Hang the thermometer on a tree out of direct sun and wind. Wait 2-3 minutes (no longer than 5) to allow

thermometer to equilibrate. Record the alue to the nearest degree on your sheet.

Water Temperature: Collect sample from moving water in a plastic or unbreakable quart-sized container. Remove container from direct sunlight and wind. If a smaller container is used, try not to hold the jar in your hands because your hands might begin to warm the water. Put the thermometer in the bucket for one and half minutes and record the value to the nearest degree. Read the thermometer while the bulb and lower part of the thermometer are under water.

Indicate on the sheet whether your measurement is in degrees Celcius or Fahrenheit.

Stream/Site
Indicate the stream for which you are going to complete the form. You may also indicate which site this is, such as Site A, if you have more than one site on the stream.

Stream Order (optional)
Streams can be classified by size. In any particular watereshed, the smallest streams that have year round water and no tributaries are first order or headwater streams. When two first order streams come together they form a second order stream. Further along the course, a second order stream may join another second order stream to form a third order stream, and so on. Note that when a first order stream joins a second order stream, the resutling stream remains a second order stream. A third order stream is only formed if two second order streams come together . A fourth order stream is formed when two third order streams flow together, and so on. This information is important because it lets reviewers know at a glance where you are in the watershed, whether you are on a headwater stream or on a mainstem.

County
Indicate the county where you and the stream are located.

Township/city
Indicate the township or city where the stream is located (if known).

Length of Reach Being Evaluated
Indicate the length of reach being evaluated. There are four options: 150 meters (492 feet), 200 meters (656 feet), 500 meters (1640 feet), and Other. We recommend the 150 meter option. Also, whatever length you choose, use the same length for other reaches you evaluate in the watershed, ie be consistent. This length is long enough to provide sufficient data, and having a consistent length will make it easier to measure and find your reaches. Indicate under Other the length of reach being evaluated if not one of the three options. Also indicate the measure being used, ie feet or meters.

Latitude and Longitude (optional)
Any point on earth can be identified by its north-south latitude and east-west longitude. The latitude and longitude values are known as coordinates. You can use coordinates of latitude and longitude to indicate the location on earth of the up and downstream ends of your stream reach. Use a USGS 7.5 minute quadrangle to find these coordinates.

The benefit to finding the coordinates of your reach and sites is that more and more agencies and organizations are using a computerized geographical information system (GIS) for all kinds of work that involves maps and other geographical information. GIS uses databases in which all information is stored as coordinates of latitude and longitude. Please see the worksheet in the Appendix for instructions on calculating latitude and longitude

Water level
Indicate the water level by checking "High", "Medium", "Low", or "Standing pools". This is a relative assessment, ie is the water level higher today relative to previous visits, about the same, lower, or are there only standing pools (ie, no apparent flow)? You should remember a stable point on the streambank in order to do this.

Sketch
Each form must have a sketch of the stream reach surveyed.. The sketch is a very important visual aid that allows others to not only find the reach you monitored but also to locate the important things you found, such as signs of water quality, good or poor habitat, riparian zone, pipes, bank erosion, etc. Include the flow direction and a north arrow. Please see the Appendix for an example of a good sketch.

USGS Quad
Attach a portion of a USGS 7.5 minute quad copy to the form (8 ½ x 11 inch only). Clearly mark the upstream and downstream ends of the reach being monitored. Also indicate the quadrangle name on the map.

Signs of Water Quality Page

General Instructions
You will be looking for signs of water quality-things you can see or smell that can give you an idea of water quality in the stream.

Litter
Refuse and litter in a stream can clog fish spawning areas; stress aquatic organisms; reduce water clarity; impede water treatment plant operations; and impair recreational uses of the water body, such as swimming, fishing and boating.

Do you see small litter (cans, paper, etc) or large litter (tires, appliances, etc.). Do you see the litter occasionally or is it common? Are there piles of trash like some one is dumping regularly? Do you see piles of yard waste such as grass, trees, and brush, becoming a source of organic enrichment to the stream? Check the most appropriate box(s) for the litter you see.

Algae
Algae attracts attention for many reasons, partly because of their bright colors or, more often, due to their nuisance growths in nutrient-enriched streams, ponds and lakes. While the majority of freshwater algae are microscopic, the more obvious forms are often referred to as "pond moss" or "scum". Slick rocks in streams are often due to algal growths.

There are two broad categories of algae: plankton and periphyton. **Plankton** are organisms which are suspended (i.e., free-floating) in the water. Planktonic algae are typically found in ponds, lakes, slow-moving rivers and sometimes in pool areas of streams. **Periphyton** are organisms attached to the stream bottom, rocks, submerged logs, vegetation or other surfaces. Dense growths of attached algae (e.g., *Cladophora*) often occur downstream from municipal sewage treatment plants or in agricultural areas. Attached algae are typically found in streams, rivers and around lake margins. High quality streams and lakes contain sparse to moderate amounts of algae, assuring an adequate food supply to maintain productive macroinvertebrate and fish communities. Waters with little or no algae may be affected by toxic substances or located in low-nutrient watersheds. In general, due to pH levels, waters draining limestone areas have greater algal abundance than those draining shale and sandstone regions.

Determine the presence of algae. Is it plankton or periphyton? Is there an excessive or moderate amount of algae, or no algae? An excessive amount of attached algae would cover more than 50% of the bottom. What color is the attached algae?

Water Color

To assess the color of the water:
-Collect a sample of water in a large mouthed, clear plastic container.
-Hold the container up to the sky
-Check the appropriate box or write in a description of the color of the water.

What the Colors Might Indicate

Brown (muddy/cloudy): Sediment in suspension caused by erosion.
Green, Brown, Red, or Black: If color is excessive, this is an indication of nutrients being released into the stream feeding algae and causing an algal bloom.
Grey: May indicates detergents in untreated wastewater from washing machines, dishwashing machines, bathwater, etc.
Milky: Indicates excessive bacteria and/or suspended solids in the water.
Clear: Not necessarily an indicator of clean water. Many pesticides, herbicides, chemicals, and other pollutants are colorless or produce no visible signs of contamination. Check for other signs of water quality (excessive algae, absence of algae, streambed coatings, water odor, surface coatings, etc.)
Tea Color (yellow-brown to dark brown): Shades may range to a dark wine color that is commonly called "black water". Indicates tannic acids being released from peat bogs or decaying leaves from surrounding trees such as cypress and oak. This coloration occurs naturally each fall when dead leaves collect in the stream or in streams draining marsh or swampland.

Stream Bed Coatings

What the Coatings Might Indicate

Sediment: Sediments are deposited in areas where the stream flow is reduced, such as pools and bends, or where flow is obstructed. These deposits can lead to the formation of islands, shoals, or point bars (sediments that build up in the stream, usually at the beginning of a meander) or can result in the complete filling of pools. To determine whether or not these sediment deposits are

industrial or residential waste entering the stream.

Discharge Pipes

Note discharge pipes that outlet to the reach. Indicate the total number of pipes and the number of each individual kind of pipe. Also indicate whether the pipe was discharging, the diameter of the pipe, and a brief description of the discharge from the pipe (color, odor, etc.) Kinds of pipes are described below:

Field tiles refers to pipes used to convey water from primarily agricultural fields, but also may drain parks, or other open fields.

Storm/Sanitary sewers refers to storm and sewer mains and manholes which generally follow stream valleys to treatment plants and may leak or overflow during storm events.

Industrial wastewater refers to NPDES permitted pipes that discharge wastewater to a stream.

Municipal wastewater refers to NPDES permitted pipes that discharge wastewater to a stream.

Home sewage refers to pipes most likely from aeration type home sewage systems that discharge wastewater to a stream or ditch.

Hydromodification

Channelization-Natural sinuosity of the stream has been removed and a straight trapezoidal channel excavated to replace it.

Near bank vegetation removed-Vegetation near the bank is often removed to allow equipment access to channelized streams or when the land will be used for agriculture, urban development, or some other use.

In-stream vehicle crossing-An instream vehicle crossing is indicated by the presence of a road or path leading perpendicularly to the reach. In-stream vehicle crossings can physically disturb the habitat where the crossing traverses the stream as well as downstream areas due to sedimentation.

Streambank modification-Streambank modification is present when the stream runs through a concrete channel; when artificial embankments, riprap, and other forms of artificial bank stabilization or structures are present. These modifications usually do not provide the habitat that a natural streambank would have such as underwater tree roots and rootlets, under cut banks, and overhanging shrubs and small trees, etc.

Bridges-Construction of bridge piers in the stream channel alters the flow of the stream. Bridge piers reduce and obstruct the flow of the stream causing sediment to be deposited which could fill in pools and cover over riffles. After some period of time, the stream may recover and establish pools and riffles in new locations.

Draining or Filling Wetlands-Indicate if you know that former wetland areas adjacent to the

new, look for vegetation growing on them; new sediments may not be colonized by vegetation.
Green, Yellow-Brown, Brown: Algae growing on stream bottom, particularly on rocks. If excessive it can be a concern. If no algae is present, look for possible sources of toxic pollution.
Black: Note if the undersides of rocks not deeply embedded are black which generally indicates low dissolved oxygen or anaerobic conditions. Also, oxidized manganese appears as a dark or black stain on creek rocks as with coal mine drainage.
Grey to White Cottony Masses: Could be "sewage fungus".
Black Sludge: Untreated sewage solids accumulation
Orange-Red-Yellow: Oxidized iron has an orangish, rusty color. Ferric (iron) hydroxide gives coal mine drainage-contaminated streams ans seeps their characteristic rusty, yellow-orange appearance. Nicknamed "yellow boy", the substance forms after iron is leached from iron sulfide wastes contained in rocks at mining sites. This color of deposits could also be from iron in oil well runoff.
White: High dissolved aluminum concentrations are deposited as a whitish powder as the aluminum is oxidized back into solid form. This could occur with coal mine drainage.
White Deposits along Banks: White, crusty deposits along the edge of the stream may indicate salt pollution from oil well operations.
Yellow: Indication of sulfur entering the stream. Check upstream for industrial waste operations.

Water Odors

To assess the odor of the water:
-Collect a sample of water in a large mouthed container.
-Use your hand to wave the air above the water sample toward your nose.
-Use the list of odors to describe what you smell or use your own words to describe the smell.

What the Odors Might Indicate

Rotten Egg: May indicate sewage pollution. Odor may also occur naturally in marshy or swampy land.
Chlorine: May indicate that a sewage treatment plant is over-chlorinating its effluent.
Fishy: May indicate the presence of excessive algal growth or dead fish.
Sewage: May indicate the presence of untreated domestic sewage or livestock waste.
Musky: May indicate presence of untreated sewage, livestock waste, algae, or other conditions.
Petroleum: Indicates presence of gasoline or other oil products.
Soapy: Indicates presence of detergents

Surface Coatings

What the Coatings Might Indicate

Scum: Often results from algal blooms; indicates high nutrient input from fertilizer or organic matter.
Oily Sheen (multi-color reflection): Indicates oil floating in stream. Small amounts near banks or marshes may be the result of natural decay or associated with the deposition of iron oxide as described below.
Foam: A small amount of brownish-white or flat white foam, particularly below an area of turbulence, may occur naturally. Large iridescent bubbles may be from detergents from upstream

stream have been drained or filled.

Other Signs of Water Quality
Dead Fish Observed-If you see dead fish in the water, check the line. You should also immediately contact the ODNR, Division of Wildlife at

Macroinvertebrates Absent/Uncommon -Find a riffle and turn over five to ten rocks and look at the bottoms. In a good water quality stream, you should see macroinvertebrates attached to the bottom of the rock. If you do not see any or only several, check this line.

Evidence of Extreme Flow Fluctuations-

Rooted Plants Growing in the Water (water willows)-If you see water willows growing in the water, this is a good sign of water quality.

In-stream Vehicle Crossing-

Riparian Zone
Vegetation Width-This is the width of the naturally occurring, uncultivated vegetation measured from the top of the stream bank. Evaluate the width by first estimating the average channel width perpendicularly from the top of the bank to the top of the opposite bank. Estimate the width at several locations if the channel width varies greatly within the reach. Now look at the vegetative width on the left side (looking downstream) of the reach. Is it greater than 3 times the average channel width, 2-3 times, 1-2 times, or less than one time the channel width? Enter the appropriate number of points for the left side. Now estimate the vegetation width for the right side and enter the appropriate points for the right side.

Vegetation Coverage-This is the percentage of the riparian zone covered, at the ground level, by vegetation. Look for bare areas with the soil exposed to get an idea of the coverage. Choose the appropriate percentage for each side of the reach. The choices are >90%, 70-90%, 50-70%, and less than 50%. Enter the appropriate number of points for each side.

Vegetation Variety -A good riparian zone should have trees, shrubs, and non-woody plants in a good mix, i.e. no one kind dominant. Choose the appropriate category for each side. The choices are good mix, fair mix, and poor mix. Enter the appropriate number of points for each side.

Vegetation Disruption -A riparian zone could be wide and have good vegetative coverage and variety, but could lose some of its value if maintained or disrupted on a regular basis. The maintenance or disruption could include mowing, fertilization, pesticide use, thinning, grazing, cutting, or burning. Choose the appropriate category for each side. Enter the appropriate number of points for each side.

Riparian Scoring
Add the score for each side together and transfer the value to Section IV.a. on the third page of the form (habitat evaluation form). The riparian score is then figured in with the habitat score.

The highest score one side can get is 4. The highest score that both sides together can get is 8.

Citizens Qualitative Habitat Evaluation Index Page
(Still needs done)

Land Use Page

Land Use Details

General Instructions

The default width to evaluate measured from the top of the streambank is 150 meters (about 500 feet) measured from each bank. If you want to do a different width (either more or less), indicate the approximate width in the space provided and check the units used (feet or meters).

It is not unusual for Best Management Practices (BMP's) to be associated with land uses. For instance, a farmer may have a strip of grass or trees between his crop field and the stream to protect water quality. Or a developer may install retention/detention ponds or silt fence to contro sediment runoff from his site. If you see any functioning BMP's associated with a land use, pleas note them in the Comments section.

Agriculture

Crops

Check if the adjacent land is currently growing a crop or if residue from last year's crop is present. If you know, also check what kind of crop is currently growing or that was last harvested.

Livestock

Check if there are livestock, feedlots, pastures, grazed woodlands, or manure present in or near the stream. If you know what kind of livestock is present, also check the appropriate box.

Also note if the pasture is fenced from the stream, ie are livestock given unlimited access to the stream or is the access limited by fencing?

Logging

Check whether the logging is a clearcut or selective harvest, and whether there are any logging roads present. A clearcut harvest takes most of the trees while a selective harvest takes only the desired trees.

Urban

Single residential refers to areas containing buildings, including mobile homes, with mostly one family each. Multi residential refers to areas containing buildings with mostly more than one family. Mixed residential refers to areas with a roughly balanced combination of single and multiple family buildings.

Commercial-Retail includes stores, automobile repair or fueling stations, malls, strip malls, restaurants, department stores, shops, etc. Office/warehouse includes office buildings, distribution facilities, storage facilities, etc.

Industrial includes any kind of facility where a product is manufactured or generated. A heavy industrial facility might have a smokestack and railroad spur leading to it. It might be located near a water body for a water supply intake. A light industrial facility might use trucking for distribution rather than railroads. Note in the comments if the facility is currently in operation or abandoned.

Park/Grass includes any publicly or privately managed land used for recreation or open space.

Transportation includes parking lots, roads, and railroads. When the road or railroad runs parallel to the stream reach and is located within 100 feet of it, please also note the number of lanes or sets of tracks. For example, a one lane highway has one lane running in both directions.

Construction sites

Characterize the imperviousness by making one choice between high, medium, or low. Check high if impervious areas greatly exceed pervious areas. Check low if pervious areas greatly exceed impervious areas. Check medium if pervious and impervious areas are roughly balanced.

Also characterize the area by checking urban, suburban, or rural. Urban development refers generally to smaller residential lot sizes and older buildings. Suburban development refers generally to newer buildings and relatively larger residential lot sizes at the fringes of the city. Rural refers to areas that are largely agricultural but that may have some development along the reach, ie houses, roads, stores, etc.

Mining

Coal Mining - Check whether the mining is underground or surface mining. Underground mining is indicated by the presence of entries or shafts, black mine tailings piles (gob), or mining buildings. Surface mining is indicated by the presence of highwalls and mixed sandstone/shale/limestone overburden piles (spoil).

Also indicate whether sand & gravel or oil & gas operations, or access roads are present. Also indicate in the Comments section if mining for other resources is present (sandstone, limestone, etc.).

If you see water coming from a mine tailings pile or mine that then enters the reach, check "mine

seepage entering reach".

Also check the status of the mine. Check "active" if a permit is posted on roads entering the mine, or "abandoned" if there are no permits posted. Check "reclaimed" if the mine area has been graded out to a smooth contour, there are no highwalls, and grass is growing on the area. Check "unreclaimed" if the area has not been graded out to a smooth contour and/or there are highwalls in the mined area.

Land Use Water Quality Impacts

Use the table to rank the negative impact on water quality for each land use present along the reach. Indicate "high" if the land use is a primary or major cause or source of impairment to water quality. Indicate "medium" if the land use is a secondary or moderate cause or source of impairment. Indicate "slight" if the land use is a slight or minor cause or source of impairment. Indicate none if the land use is not having any negative impact on water quality.

Estimate the closest distance from the top of the bank to each land use present along the reach. For example, if a corn field is 20 feet from the top of the left bank and a feedlot is 100 feet from the top of the right bank, indicate 20 feet for agriculture (this measurement may be in feet or meters. Check the appropriate box).

Definitions of Stream Habitat Terminology

Types of Vegetation

I. **Tree**: Woody plant having no more than 5-6 branches of the trunk region near the ground.

II. **Shrub**: Height may be between floor level and six foot tall. Usually branches several times in the trunk region close to the ground and the stems and branches lay close to the floor.

III. **Grass**: Size ranges from just covering the ground to 8 inches tall. Grasses may have characteristics such as sheathing of blades.

IV. **Aquatic**: Plants that have established roots within an area that is consistently covered by water.

V. **Non-Woody Plants**: Non-grassy plants that lack wooden stems and do not have their blades sheathed.

Amount of Litter

I. **Slight**: An area that contains ten or less pieces of litter.

II. **Moderate**: Either ten to twenty pieces of litter in a stream segment or one large piece of machinery such as a washing machine.

III. **Severe**: More than twenty pieces of litter or several large objects such as roofing shingles, etc.

Amount of Erosion

I. **Slight**: One to twenty percent of the stream bank is bare and exposed to the water.

II. **Moderate**: Twenty to forty percent of the stream bank is bare and exposed to the water. Some large tree roots are exposed at the bank line and there maybe evidence of the water undercutting the bank.

III. **Severe**: More then forty percent of the stream bank is exposed to the water. Large trees roots are exposed and trees are starting to slump or fall over because of the lack of ground support. There may also be noticeable areas where the bank has slid into the river and left behind a smooth cliff.

Types of Land Use:

I. **Agricultural**: Fields that show evidence of Agricultural land use. The survey should note if the field is no-till, conventional, or is fallow. If the field is in crop the survey should also note the type of crop that is presently growing. If the field is overgrown and no crop has been planted it should be noted as fallow.

II. **Residential**: These areas contain homes or building. The survey should note if the buildings are industrial or purely residential houses. It should also be noted is there is housing complex present in the segment. If the vegetation in the area is maintained it should be noted also.

III. **Parking Lot**: An area that is covered by cement or gravel for the purpose of placing vehicles upon it. The survey should mention the type of ground coverage such as gravel, brick, packed dirt, or cement.

IV. **Wetland**: A segment in which the ground is covered or saturated in water throughout the year. Water plants are often present in these segments.

V. **Meadow**: An area of grasses, shrubs, and non-woody plants between forested areas. Meadows either lack trees or may only have a few small trees growing within them.

Appendix C: Ohio EPA QHEI Results for the Huron River

Qualitative Habitat Evaluation Index (QHEI) table for sites in the Huron River basin, assessed in 1998.

River Mile	QHEI	Gradient (ft/mile)	WWH Attributes: No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall Embeddedness	Max Depth > 40 cm	Low-Normal Riffle Embeddedness	Total WWH Attributes	MWH Attributes — High Influence: Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth < 40 cm (WD, HW)	Total H.I. MWH Attributes	MWH Attributes — Moderate Influence: Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent and Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	Total M.I. MWH Attributes	(MWH H.I.+1)/(WWH+1) Ratio	(MWH H.I.+1)/(WWH+1) Ratio
(12-001) Huron River																																	
Year: 98																																	
14.5	72.0	8.62											6						1												2	0.29	0.57
12.3	64.5	11.80											7						1												4	0.25	0.75
11.9	74.0	11.80											6						0												5	0.14	0.86
(12-100) East Branch Huron River																																	
Year: 98																																	
24.6	70.5	15.87											9						0												3	0.10	0.40
21.0	46.5	8.47											1						4												7	2.50	6.00
13.7	80.0	11.36											9						0												0	0.10	0.10
6.8	60.0	4.67											4						0												6	0.20	1.40
(12-102) Rattlesnake Creek																																	
Year: 98																																	
2.6	84.0	19.23											9						0												0	0.10	0.10
0.2	69.5	19.23											8						0												1	0.11	0.22
(12-200) West Branch Huron River																																	
Year: 98																																	
42.2	77.0	12.82											6						1												5	0.29	1.00
38.4	75.0	9.35											7						0												5	0.13	0.75
36.3	74.0	11.76											7						0												3	0.13	0.50
29.2	86.0	7.75											9						0												0	0.10	0.10
22.7	57.5	3.44											2						2												4	1.00	2.33
16.6	76.0	4.39											9						0												0	0.10	0.10
10.5	78.5	9.62											9						0												0	0.10	0.10
7.7	62.0	13.51											5						1												2	0.33	0.67
7.0	74.5	10.42											9						0												1	0.10	0.20
3.7	59.0	9.80											6						1												3	0.29	0.71
(12-213) Walnut Creek																																	
Year: 98																																	
1.0	51.5	14.71											3						1												6	0.50	2.00

			WWH Attributes									MWH Attributes													
												High Influence					*Moderate Influence*								
Key QHEI Components			No Channelization or Recovered	Boulder/Cobble/Gravel Substrates	Silt Free Substrates	Good/Excellent Substrates	Moderate/High Sinuosity	Extensive/Moderate Cover	Fast Current/Eddies	Low-Normal Overall	Embeddedness	Max Depth > 40 cm	Low-Normal Riffle Embeddedness	**Total WWH Attributes**	Channelized or No Recovery	Silt/Muck Substrates	No Sinuosity	Sparse/No Cover	Max Depth < 40 cm (MD, HW)	**Total H.I. MWH Attributes**	Recovering Channel	Heavy/Moderate Silt Cover	Sand Substrates (Boat)	Hardpan Substrate Origin	Fair/Poor Development	Low Sinuosity	Only 1-2 Cover Types	Intermittent and Poor Pools	No Fast Current	High/Mod. Overall Embeddedness	High/Mod. Riffle Embeddedness	No Riffle	**Total M.I. MWH Attributes**	**(MWH HI+1)/(WWH+1) Ratio**	**(MWH MI+1)/(WWH+1) Ratio**
River Mile	QHEI	Gradient (ft/mile)																																		
(12-101) Cole Creek																																				
Year: 98																																				
4.9	62.0	19.23	■	■				■		■		■		5		●	●			2		◆	◆	◆	◆	◆	◆	◆					4	0.50	1.17
0.2	58.5	3.57	■	■				■		■	■	■		5		●				1		◆	◆	◆	◆	◆	◆	◆					4	0.33	1.00
(12-103) Norwalk Creek																																				
Year: 98																																				
6.7	75.0	23.81	■	■		■	■	■		■	■	■		7						0		◆	◆	◆	◆	◆	◆	◆					3	0.13	0.50
1.8	53.5	12.82	■	■				■		■		■		3	●	●	●			3		◆	◆	◆	◆	◆	◆	◆					7	1.00	2.75
0.2	66.0	5.26	■	■				■		■	■	■		5						0		◆	◆	◆	◆	◆	◆	◆					5	0.17	1.00