MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
NOVEMBER 2016

STAFF REPORT

BIOLOGICAL SURVEY OF THE LAKE MACATAWA AND PIGEON RIVER WATERSHEDS IN ALLEGAN AND OTTAWA COUNTIES, MICHIGAN, JULY-SEPTEMBER 2015

Introduction

Biological and physical habitat conditions were assessed in the Lake Macatawa and Pigeon River watersheds (Macatawa Area watersheds) by staff of the Michigan Department of Environmental Quality (MDEQ), Surface Water Assessment Section (SWAS), in 2015. The primary objectives of the assessments were to:

1. Assess the current status and condition of individual water bodies and determine if Michigan Water Quality Standards are being met.
2. Identify nonpoint sources of water quality impairment.
3. Satisfy monitoring requests submitted by internal and external customers.

Watershed Information

The Macatawa Area watersheds are located in Allegan and Ottawa Counties, between the Kalamazoo and Grand Rivers watersheds. This area includes the Macatawa River, Little Pigeon Creek (Hydrologic Unit Code [HUC] 040500020301), Pigeon River (HUCs 040500020302 and 040500020303), and Halfway Creek (HUC 040500020406) (Figure 1). The region is heavily dominated by agriculture and urbanization. The entire region drains low-gradient coastal watersheds in the Southern Michigan/Northern Indian Drift Plain ecoregion (Omernik and Gallant, 2010) and is comprised of many county drains.

The Pigeon River watershed is approximately 65 square miles. The Lake Macatawa watershed is 175 square miles. The lower half of the Pigeon River watershed (downstream of 120th Avenue) is a designated coldwater stream and has been stocked annually with brown trout since 2003 (Michigan Department of Natural Resources stocking database). The remainder of the survey area contains designated warmwater streams.

Historic Sampling Efforts and Information

The 2005 surveys in the Pigeon River watershed found acceptable coldwater fish communities at two locations and acceptable macroinvertebrate communities at all five monitoring locations (Walterhouse, 2007(a)). The 2005 survey in the Lake Macatawa watershed found marginally acceptable warmwater fish communities at three out of eight locations (with Procedure 51 [P-51] [MDEQ, 1990; Creal et al., 1996]) scores one point above the 'poor' score range); poor fish communities were found in Pine Creek, Bosch & Hulst Drain, the South Branch Macatawa River, and two locations on the Macatawa River (Walterhouse, 2007(b)). The

macroinvertebrate P-51 scores for that survey ranged from -6 to 0, with two sites scoring poor (Macatawa River at 84th Avenue and Byron Road).

The 2010 surveys in the Pigeon River watershed found an acceptable macroinvertebrate community in Ten Hagen Creek (Holden, 2012). The 2010 survey in the Lake Macatawa watershed found macroinvertebrate community scores in the 'acceptable' range, with all 11 scores between -4 and 2. Only one site on the Macatawa River received a score greater than -1. No fish surveys were conducted in 2010.

Total Maximum Daily Load (TMDL)

The Lake Macatawa Phosphorus TMDL was developed due to the presence of nuisance plant conditions in Lake Macatawa and approved in 1999. Intensive sampling in the Macatawa River watershed to develop the Lake Macatawa TMDL and continued post-TMDL monitoring have documented that water quality in the watershed is impaired due to extreme stream flow fluctuations, which are the product of years of wetland drainage, drain construction, tiling, and ongoing drain maintenance activities. Previous surveys have shown:

- All streams have been dredged to facilitate drainage of the historic abundant wetland habitat in the watershed. Drain maintenance efforts have produced flashy flow regimes in homogenous stream channels where the unstable sand and silt substrates are slowly being transported downstream.
- Buffer strips are absent along many of the agricultural drains and streams in the watershed and row crops are currently planted to the top of the stream bank. Property owners at many locations maintain nearly all of their property along the stream channel by mowing to the waters' edge.
- Adoption of best management practices in the watershed designed to reduce upland erosion and slow the rate of stream flow throughout the watershed will benefit the aquatic biota residing in the streams throughout the watershed and ultimately reduce phosphorus loading to Lake Macatawa.

Methods

The macroinvertebrate or fish community and physical habitat were qualitatively assessed at 14 stations (Table 1; Figure 1) using P-51 for wadeable streams.

The macroinvertebrate communities were assessed and scored with metrics that rate the communities on a scale from excellent to poor. Possible scores can range from 9 to -9. Stations with a score greater than or equal to +5 are considered excellent. Stations with a score less than or equal to -5 are classified as poor. Stations with a score of -4 through +4 are classified as acceptable (minimally to moderately impaired). Habitat evaluations are based on 10 metrics, with a possible maximum total score of 200. Stations are classified as excellent with a habitat score >154, good with a score between 105 and 154, marginal with a score between 56 and 104, and poor with a score <56.

Site Selection

Random and targeted site-selection methods were used in the Macatawa Area watersheds in 2015. A probabilistic monitoring approach (MDEQ, 2015), using random site selection to address statewide questions about water quality in Michigan rivers, was used to select six sites (one trend site selected in 2010 and five status sites for 2015). The Macatawa Area

Coordinating Council (MACC) requested updated fish community data at eight sites in the Lake Macatawa watershed.

2015 Sampling Results

The monitoring conducted during this 2015 survey focused on evaluating the condition of the streams that drain to either Lake Macatawa or nearby Lake Michigan drainages. Stations 1 to 6 were selected randomly to include in statewide estimates of the status and trend in macroinvertebrate community condition. Stations 7 through 14 were selected based on outside requests related to nonpoint source projects. A summary of the 2015 survey results is presented below and in Table 1.

Habitat Conditions

Habitat conditions at the 14 stations all rated either 'marginal' or 'good', with scores ranging between 70 to 135 (Table 2). The Pigeon River (Station 1) scored 'good,' but there was a noted lack of in-stream habitat, high amounts of sediment deposition, and moderately unstable banks in the sand-dominated stream. In the Lake Macatawa watershed, Stations 2, 5, 6, 8, 10, 13, and 14 also scored 'good.' Of those stations, Pine Creek (Station 2) was noted to have the least amount of in-stream epifaunal habitat. North Branch Macatawa River (Station 6), Peters Creek (Station 10), and the Macatawa River (Station 14) also had marginally rated in-stream habitat. The flow at Station 6 was noted to be very slow, water did not fill the channel, and discarded tires made up a significant proportion of the in-stream habitat.

Across the watershed, even at streams that received 'good' habitat scores, one habitat metric that more broadly received lower scores was sediment deposition, because many stream substrates were dominated by moving sand. Bank metrics also often scored poorly, with some stations with 'good' habitat scores having unstable banks or banks without much vegetative protection. This varied site by site depending on land use practices at the local scale. Broadly speaking, some rivers in the watershed have riparian zones with multiple types of vegetation extending 50-150 feet out from the edge of the river, but banks can still become unstable due to flashy/unstable river flows.

Stations 3, 4, 7, 9, 11, and 12 all received lower P-51 total habitat scores in the 'marginal' range. Habitat metrics noted to be lower at these sites include epifaunal substrate, sediment deposition, frequency of either riffles, bend, or pools, and channel alteration. Sites had varying riparian and bank structure quality. Bosch & Hulst Drain (Stations 7 and 8) scored in the 'poor' range for flashiness and had clay-dominated substrates. Throughout the region, the types of in-stream and streambank problems observed are mainly linked to historic dredging activities and ongoing highly variable stream flows.

Macroinvertebrate Communities

The macroinvertebrate communities were assessed using P-51 at Stations 1-6 (Tables 1 and 3). The Macatawa River at Quincy Road (Station 3) scored in the 'poor' range (-5). Only 13 taxa were found at Station 3 and the community was dominated by individual macroinvertebrates in the *Oligochaeta* and *Chironomidae* groups (worms and larval midges). Other commonly found taxa at Station 3 were snails, clams, and damselfly larvae. No mayfly, caddisfly, or stonefly taxa were collected at Station 3. This type of community is indicative of a stream lacking in-stream habitat. The site was noted to be a very straight channel full of duck weed and elodea (a rooted aquatic plant). There was no woody debris in the channel and the substrate was almost all clay. Flashy flow, lack of riparian woody vegetation, and clay substrates are possible causes of the 'poor' macroinvertebrate community.

The other five sites received 'acceptable' P-51 macroinvertebrate community scores (0 to -3), in the lower half of the acceptable range. The Pigeon River (Station 1) macroinvertebrate community scored -2. Fifty percent of the community was chironomidae (midge larvae), which contain many species that are tolerant to in-stream stressors. One mayfly taxa, but only three individual organisms, and three caddisfly taxa were also collected in the Pigeon River. Pine Creek at Riley Street (Station 2) scored -3. Similar to the Pigeon River, the macroinvertebrate community was dominated by midge larvae and had low numbers of mayflies and caddisflies. Only 16 macroinvertebrate taxa were collected at Pine Creek, which is less than the other stations that received 'acceptable' P-51 scores.

Stations 4-6 generally had more diverse macroinvertebrate communities that were less heavily dominated by one taxa. The South Branch of the Macatawa River (Station 4) scored -1 and was dominated by isopods and *Hydropsychidae* (a less sensitive group of caddisfly larvae). The North Branch of the Macatawa River at Ottogan Road (Station 5) had a macroinvertebrate community score of 0, which is the highest score in this survey. Twenty-nine taxa were collected at Station 5. Twelve percent of the macroinvertebrates counted were caddisflies and the dominant taxa (*Elmidae*, beetle larvae) made up the smallest proportion (21 percent) of the community of the sites in this survey. Another site on North Branch of the Macatawa River (off 59th Street, Station 6) received a lower P-51 score (-2), in part, because both fewer total taxa and caddisfly larvae were collected. Station 6 is approximately 6 miles upstream of Station 5 and was observed to have lower water flow and available habitat.

Fish Communities

The MACC requested fish community assessment at eight sites in the Macatawa River watershed. P-51 fish community surveys were conducted on Bosch & Hulst Drain (Stations 7 and 8), Macatawa River (Stations 9 and 12), Peters Creek (Station 10), South Branch Macatawa River (Station 11), and North Branch Macatawa River (Stations 13 and 14). Scores at these sites ranged from 0 to -7 (Table 4). Overall, the fish communities had 'poor' ratings for individual metrics related to numbers of intolerant taxa, numbers of sucker taxa, and percentages of tolerant fish collected. The fish communities at all of the sites had greater than 50 percent tolerant fish collected. Half of the sites had 'poor' individual metric scores for having low numbers of darter, sculpin, and madtom taxa, low percentages of piscivorous fish, and high percentages of omnivorous fish.

The fish communities at Peters Creek at 84th Street (Station 10) and North Branch Macatawa River at 56th Street (Station 14) scored in the 'poor' range. These communities were not drastically different than the other sites, but had a greater number of white suckers (which are omnivorous and considered 'tolerant'), fewer darter, sculpin, madtom taxa, and fewer piscivores. Bosch & Hulst Drain at Riley Street (Station 7) and Macatawa River at Adams Landing (Station 12) received fish community scores of 0, while the other four stations (8, 9, 11, and 13) scored in the bottom of the acceptable range with scores of -3 or -4.

Conclusions

The results of the 14 P-51 surveys conducted in 2015 will be used to assess individual water bodies in Macatawa Area watersheds for the 2018 Integrated Report. There were no specific nonpoint sources of water quality impairments identified in this survey beyond the broad scale impacts of agricultural and residential nonpoint source pollution and storm water runoff. This survey was only able to note the continued watershed-scale issues that have been noted for decades.

The MACC has developed a nonpoint source phosphorus reduction implementation plan (http://www.the-macc.org/wp-content/uploads/Macatawa-Watershed-Mgt-Plan_FINAL-NARRATIVE.pdf accessed on November 1, 2016) and is implementing many of the specific prioritized projects in the plan. This implementation plan contains a strategy to implement approximately 30 methods for reducing phosphorus, erosion, and concentrated flows in the waters of the Lake Macatawa watershed, and places priority on five to ten methods in each of three various land use classes (Residential/Commercial Nonpoint Sources, Agricultural Nonpoint Sources, and Road/Drain/Construction Nonpoint Sources) according to their measured cost effectiveness. The goal of this implementation plan is to lower the nonpoint source phosphorus loads in the watershed from approximately 126,000 pounds per year to 35,000 pounds per year. A hydrologic study of the watershed was completed in 2009 (Fongers, 2009) that provides additional information for the prioritization of nonpoint source projects.

Project Clarity (http://www.macatawaclarity.org/) is a new local initiative, working in partnership with the MACC, the Outdoor Discovery Center, Grand Valley State University, and other groups, to implement major land-based projects in the watershed to improve water quality in the Lake Macatawa watershed. The Project Clarity projects underway in the watershed are likely to result in water quality improvements in streams. P-51 assessment methods may detect changes if the scale of stream improvement is high enough, but additional assessment methods may be needed to document all in-stream improvements.

Field Work By: Sarah Holden, Aquatic Biologist
Kelly Turek, Aquatic Biologist
Dawn Roush, Aquatic Biologist
Mike Walterhouse, Aquatic Biologist
Lee Schoen, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division

Mike McCauley, Aquatic Biologist
Great Lakes Environmental Center

Report By: Sarah Holden, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division

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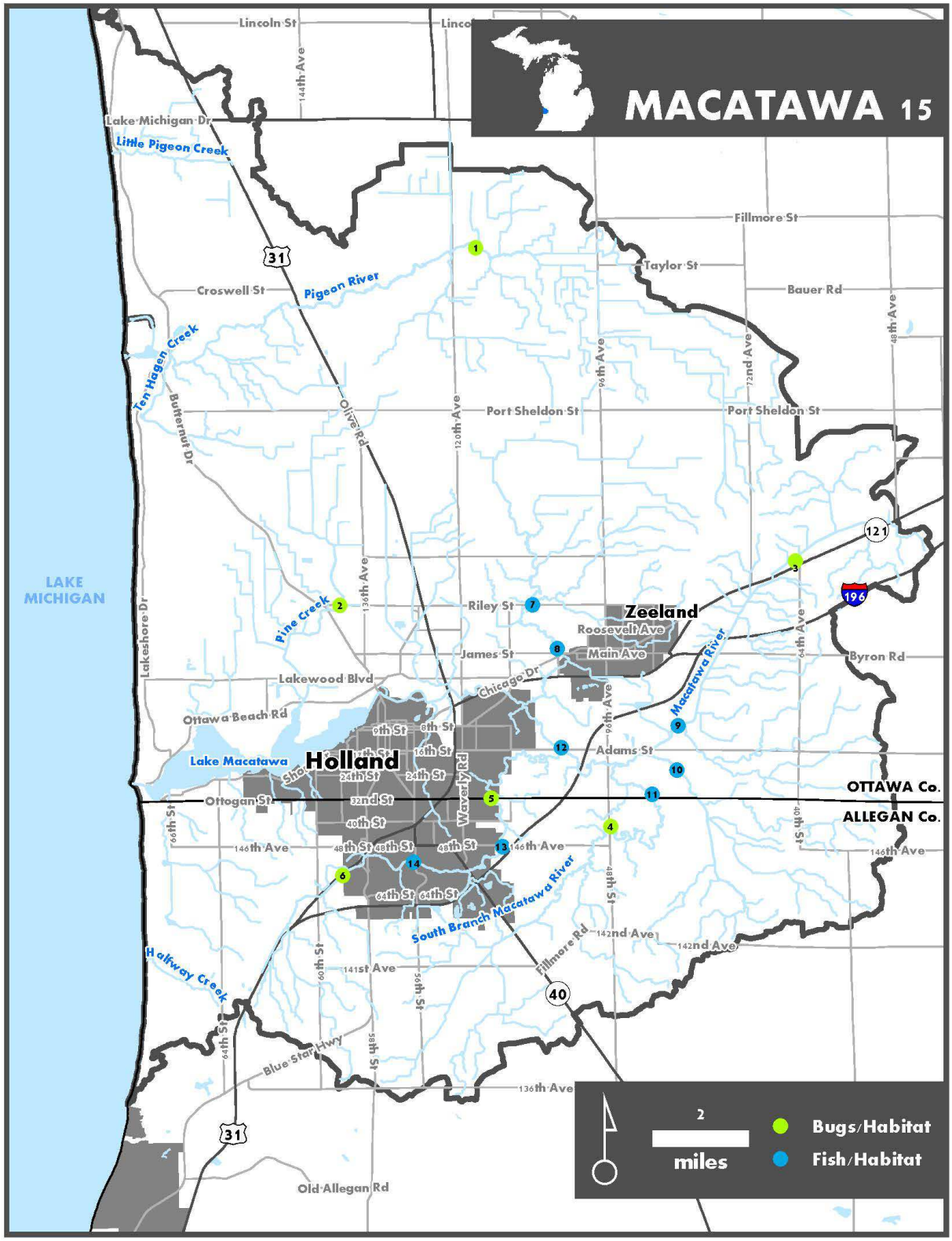

Figure 1. Macatawa Area stream monitoring locations, 2016.

Table 1. Monitoring locations and P-51 scores for sites in the Macatawa Area watersheds, 2015. "-" indicates that either the fish or macroinvertebrate community was not assessed.

Site	Water Body	Location	Lat	Long	Storet	P-51 Bug	P-51 Fish	P-51 Habitat	Reason
1	Pigeon River	116th Avenue	42.93386	-86.07219	700667	-2	-	105	Status
2	Pine Creek	Riley Street	42.82668	-86.12757	700666	-3	-	108	Status
3	Macatawa River	Quincy Road	42.84012	-85.94191	30722	-5	-	70	Status
4	South Branch Macatawa River	Downstream 48th Street	42.76040	-86.01733	30723	-1	-	100	Status
5	North Branch Macatawa River	Ottagan Road	42.76879	-86.06589	30697	0	-	135	Trend
6	North Branch Macatawa River	off end of Ottawa Ave	42.74574	-86.12636	30724	-2	-	122	Status
7	Bosch & Hulst Drain (Nooderloos Creek)	Riley Street	42.82699	-86.04904	700600	-	0	102	MACC Request
8	Bosch & Hulst Drain (Nooderloos Creek)	Downstream 104th Ave	42.81375	-86.03896	700559	-	-3	105	MACC Request
9	Macatawa River	84th Avenue	42.79077	-85.98981	700523	-	-3	77	MACC Request
10	Peters Creek	84th Avenue	42.77742	-85.99019	700638	-	-7	107	MACC Request
11	South Branch Macatawa River	Ottogan Road	42.77006	-86.00037	30651	-	-4	101	MACC Request
12	Macatawa River	Adams Landing	42.78421	-86.03747	700668	-	0	96	MACC Request
13	North Branch Macatawa River	146th Avenue	42.75430	-86.06118	30556	-	-4	123	MACC Request
14	North Branch Macatawa River	Lincoln/56th Street	42.74967	-86.09736	30568	-	-7	109	MACC Request

Table 2. Habitat evaluation for Macatawa Area rivers, 2015.

	Station 1	Station 2	Station 3	Station 4	Station 5
	Pigeon River	Pine Creek	Macatawa River	South Branch Macatawa River	North Branch Macatawa River
	116th Street	Riley Street	Quincy Avenue	D/S 48th Street	Ottogan Road
	RIFFLE/RUN	RIFFLE/RUN	GLIDE/POOL	RIFFLE/RUN	RIFFLE/RUN
HABITAT METRIC					
Substrate and In-stream Cover					
Epifaunal Substrate/ Avail Cover (20)	6	6	4	13	12
Embeddedness (20)*	3	8		4	13
Velocity/Depth Regime (20)*	13	15		13	10
Pool Substrate Characterization (20)**			6		
Pool Variability (20)**			3		
Channel Morphology					
Sediment Deposition (20)	3	6	7	10	13
Flow Status - Maint. Flow Volume (10)	7	8	9	8	8
Flow Status - Flashiness (10)	5	5	4	4	4
Channel Alteration (20)	13	10	8	11	15
Frequency of Riffles/Bends (20)*	7	10		11	16
Channel Sinuosity (20)**			3		
Riparian and Bank Structure					
Bank Stability (L) (10)	5	6	6	5	6
Bank Stability (R) (10)	5	6	6	5	6
Vegetative Protection (L) (10)	9	7	4	5	9
Vegetative Protection (R) (10)	9	7	4	5	7
Riparian Veg. Zone Width (L) (10)	10	7	3	3	8
Riparian Veg. Zone Width (R) (10)	10	7	3	3	8
TOTAL SCORE (200):	105	108	70	100	135
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
Date:	8/31/2015	8/31/2015	9/3/2015	8/31/2015	9/3/2015
Weather:	Cloudy	Cloudy	Cloudy	Sunny	Sunny
Air Temperature (°F):	63	75	72	82	79
Water Temperature (°F):	64	61	64	66	71
Ave. Stream Width (ft):	20	12	18	11	19
Ave. Stream Depth (ft):	0.4	0.5	1.5	1	0.6
Surface Velocity (ft/second):	1.16	0.65	0.28	0.4	0.67
Estimated Flow (ft^3/second):	9.28	3.9	7.56	4.4	7.638
Stream Modifications:	Dredged	Bank Stabilization	Dredged	None	Bank Stabilization
Nuisance Plants (Y/N):	N	N	N	N	N
STORET No.:	700667	700666	30722	30723	30697
Stream Name:	Pigeon River	Pine Creek	Macatawa River	South Branch Macatawa River	North Branch Macatawa River
Road Crossing/Location:	116th Street	Riley Street	Quincy Avenue	D/S 48th Street	Ottogan Road
County Code:	70	70	03	03	03
TRS:	06N15W3	05N15W7	05N14W3	04N14W06	04N15W3
Latitude (dd):	42.93386	42.8267	42.841005	42.7604	42.76879
Longitude (dd):	-86.07219	-86.128	-85.941913	-86.017	-86.06589
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
USGS Basin Code:	4050002	4050002	4050002	4050002	4050002

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s). * Applies only to Riffle/Run stream Surveys ** Applies only to Glide/Pool stream Surveys

Table 2 (cont.). Habitat evaluation for Macatawa Area rivers, 2015.

	Station 6	Station 7	Station 8	Station 9	Station 10
	North Branch Macatawa River	Bosch&Hulst Drain/Nooderloos Creek	Bosch&Hulst Drain/Nooderloos Creek	Macatawa River	Peters Creek
	end of 59th Street	Riley Street	104th	84th Avenue	84th Avenue
	GLIDE/POOL	RIFFLE/RUN	RIFFLE/RUN	RIFFLE/RUN	RIFFLE/RUN
HABITAT METRIC					
Substrate and In-stream Cover					
Epifaunal Substrate/ Avail Cover (20)	8	10	12	3	10
Embeddedness (20)*		11	12	7	9
Velocity/Depth Regime (20)*		11	11	7	11
Pool Substrate Characterization (20)**	15				
Pool Variability (20)**	13				
Channel Morphology					
Sediment Deposition (20)	13	6	8	3	5
Flow Status - Maint. Flow Volume (10)	8	8	8	4	7
Flow Status - Flashiness (10)	5	2	2	1	5
Channel Alteration (20)	11	11	10	10	12
Frequency of Riffles/Bends (20)*		11	8	4	12
Channel Sinuosity (20)**	5				
Riparian and Bank Structure					
Bank Stability (L) (10)	7	4	4	3	6
Bank Stability (R) (10)	7	4	4	5	6
Vegetative Protection (L) (10)	7	7	6	7	7
Vegetative Protection (R) (10)	7	7	6	7	7
Riparian Veg. Zone Width (L) (10)	8	5	7	8	7
Riparian Veg. Zone Width (R) (10)	8	5	7	8	3
HABITAT METRIC	122	102	105	77	107
Substrate and In-stream Cover	GOOD (SLIGHTLY IMPAIRED)	POOR (SEVERELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	POOR (SEVERELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
Date:	8/31/2015	9/17/2015	9/17/2015	9/17/2015	9/3/2015
Weather:	Sunny	Sunny	Sunny	Sunny	Sunny
Air Temperature (°F):	80	70	72	80	82
Water Temperature (°F):	70	65	65	68	72
Ave. Stream Width (ft):	9	20	20	12	14
Ave. Stream Depth (ft):	1	1.5	1	0.3	0.6
Surface Velocity (ft/second):	0.01				0.1
Estimated Flow (ft^3/second):	0.09				0.84
Stream Modifications:	None	Dredged	Dredged	Dredged	Dredged
Nuisance Plants (Y/N):	N	N	N	N	N
STORET No.:	30724	700600	700559	700523	700638
Stream Name:	North Branch Macatawa River	Bosch&Hulst Drain/Nooderloos Creek	Bosch&Hulst Drain/Nooderloos Creek	Macatawa River	Peters Creek
Road Crossing/Location:	end of 59th Street	Riley Street	104th	84th Avenue	84th Avenue
County Code:	03	70	70	70	70
TRS:	04N15W7	05N15W14	05N15W12	05N14W29	05N14W32
Latitude (dd):	42.74574	42.82684	42.8283	42.790787	42.77746
Longitude (dd):	-86.12636	-86.04906	-86.0394	-85.98991	-85.99019
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
USGS Basin Code:	4050002	4050002	4050002	4050002	4050002

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s). * Applies only to Riffle/Run stream Surveys ** Applies only to Glide/Pool stream Surveys

Table 2 (cont.). Habitat evaluation for Macatawa Area rivers, 2015.

	Station 11	Station 12	Station 13	Station 14
	South Branch Macatawa River	Macatawa River	North Branch Macatawa	North Branch Macatawa River
	108th Avenue	Adams Landing	146th	56th Avenue
	GLIDE/POOL	RIFFLE/RUN	RIFFLE/RUN	GLIDE/POOL
HABITAT METRIC				
Substrate and In-stream Cover				
Epifaunal Substrate/ Avail Cover (20)	9	7	13	8
Embeddedness (20)*		10	11	
Velocity/Depth Regime (20)*		8	8	
Pool Substrate Characterization (20)**	6			11
Pool Variability (20)**	11			8
Channel Morphology				
Sediment Deposition (20)	9	10	11	9
Flow Status - Maint. Flow Volume (10)	5	8	8	8
Flow Status - Flashiness (10)	3	2	4	4
Channel Alteration (20)	10	11	13	11
Frequency of Riffles/Bends (20)*		8	15	
Channel Sinuosity (20)**	14			4
Riparian and Bank Structure				
Bank Stability (L) (10)	3	4	6	6
Bank Stability (R) (10)	3	4	6	6
Vegetative Protection (L) (10)	6	6	7	8
Vegetative Protection (R) (10)	6	6	7	8
Riparian Veg. Zone Width (L) (10)	8	6	7	9
Riparian Veg. Zone Width (R) (10)	8	6	7	9
TOTAL SCORE (200):	101	96	123	109
HABITAT RATING:	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)
Date:	7/22/2015	9/17/2015	9/3/2015	9/3/2015
Weather:	Sunny	Sunny	Sunny	Partly Cloudy
Air Temperature (°F):	70	75	82	82
Water Temperature (°F):	72	66	72	72
Ave. Stream Width (ft):	22	35	18	22
Ave. Stream Depth (ft):	1	1	0.5	1.3
Surface Velocity (ft/second):	0.62			
Estimated Flow (ft^3/second):	13.64			
Stream Modifications:	Dredged	Dredged	Bank Stabilization	Dredged
Nuisance Plants (Y/N):	N	N	N	N
STORET No.:	30651	700668	30556	30568
Stream Name:	South Branch Macatawa River	Macatawa River	North Branch Macatawa	North Branch Macatawa River
Road Crossing/Location:	108th Avenue	Adams Landing	146th	56th Avenue
County Code:	03	70	03	03
TRS:	04N14W05	05N15W25	04N15W10	04N15W09
Latitude (dd):	42.76871	42.784213	42.7544	42.7489
Longitude (dd):	-85.999371	-86.037472	-86.0608	-86.0961
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP
USGS Basin Code:	4050002	4050002	4050002	4050002

Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s). * Applies only to Riffle/Run stream Surveys ** Applies only to Glide/Pool stream Surveys

Table 3A. Qualitative macroinvertebrate sampling results for Macatawa Area rivers, 2015.

	Pigeon River		Pine Creek		Macatawa River		South Branch Macatawa River	
	116th Street		Riley Street		Quincy Avenue		48th Street	
	8/31/2015		8/31/2015		9/3/2015		8/31/2015	
TAXA	STATION 1		STATION 2		STATION 3		STATION 4	
PLATYHELMINTHES (flatworms)								
Turbellaria					12		26	
ANNELIDA (segmented worms)								
Hirudinea (leeches)	1		2		2		1	
Oligochaeta (worms)	4		14		64		4	
ARTHROPODA								
Crustacea								
Amphipoda (scuds)	56		55				4	
Decapoda (crayfish)	1						1	
Isopoda (sowbugs)	9		5		1		79	
Arachnoidea								
Hydracarina	1		10				11	
Insecta								
Ephemeroptera (mayflies)								
Baetidae	3		6				5	
Heptageniidae							22	
Odonata								
Anisoptera (dragonflies)								
Aeshnidae	1							
Zygoptera (damselflies)								
Calopterygidae	10		7				7	
Coenagrionidae					20			
Hemiptera (true bugs)								
Belostomatidae					1			
Corixidae	1				1			
Gerridae	1		2					
Notonectidae	1		1					
Trichoptera (caddisflies)								
Hydropsychidae	31		6				65	
Hydroptilidae			12				1	
Phryganeidae	1							
Uenoidae	1							
Coleoptera (beetles)								
Haliplidae (adults)	3		2					
Hydrophilidae (total)	1							
Elmidae	7		1				34	
Diptera (flies)								
Chironomidae	150		171		100		40	
Dixidae	1						1	
Simuliidae	4						3	
Tabanidae	5							
Tipulidae							3	
MOLLUSCA								
Gastropoda (snails)								
Ancylidae (limpets)	1							
Hydrobiidae					23			
Lymnaeidae					1			
Physidae	7		5		21			
Planorbidae					1			
Pelecypoda (bivalves)								
Sphaeriidae (clams)	1		1		53		8	
TOTAL INDIVIDUALS	302		300		300		315	

Table 3B. Macroinvertebrate metric evaluation of Macatawa Area rivers, 2015.

	Pigeon River		Pine Creek		Macatawa River		South Branch Macatawa River	
	116th Street		Riley Street		Quincy Avenue		48th Street	
	8/31/2015		8/31/2015		9/3/2015		8/31/2015	
	STATION 1		STATION 2		STATION 3		STATION 4	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	25	1	16	0	13	0	18	0
NUMBER OF MAYFLY TAXA	1	-1	1	-1	0	-1	2	0
NUMBER OF CADDISFLY TAXA	3	0	2	0	0	-1	2	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	0.99	-1	2.00	-1	0.00	-1	8.57	0
PERCENT CADDISFLY COMP.	10.93	0	6.00	0	0.00	-1	20.95	0
PERCENT DOMINANT TAXON	49.67	-1	57.00	-1	33.33	0	25.08	0
PERCENT ISOPOD, SNAIL, LEECH	5.96	0	4.00	0	16.33	-1	25.40	-1
PERCENT SURF. AIR BREATHERS	2.32	1	1.67	1	0.67	1	0.00	1
TOTAL SCORE	-2		-3		-5		-1	
MACROINV. COMMUNITY RATING	ACCEPT.		ACCEPT.		POOR		ACCEPT.	

Table 3A. Qualitative macroinvertebrate sampling results for Macatawa Area rivers, 2015.

	North Branch Macatawa River		North Branch Macatawa River	
	Ottogan Road		end of 59th Street	
	9/3/2015		8/31/2015	
TAXA	STATION 5		STATION 6	
PLATYHELMINTHES (flatworms)				
Turbellaria	26		8	
ANNELIDA (segmented worms)				
Hirudinea (leeches)	3		2	
Oligochaeta (worms)	2		2	
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	16		28	
Decapoda (crayfish)	1		2	
Isopoda (sowbugs)	44		34	
Arachnoidea				
Hydracarina			4	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	4		4	
Heptageniidae	6		14	
Odonata				
Anisoptera (dragonflies)				
Libellulidae			1	
Zygoptera (damselflies)				
Calopterygidae	1			
Coenagrionidae	5		80	
Hemiptera (true bugs)				
Belostomatidae	1			
Corixidae	1			
Gerridae	1		1	
Mesoveliidae	2		2	
Nepidae	1			
Notonectidae	1			
Pleidae	1			
Trichoptera (caddisflies)				
Hydropsychidae	9		2	
Hydroptilidae			1	
Leptoceridae	17		4	
Philopotamidae	8			
Coleoptera (beetles)				
Haliplidae (adults)	1		2	
Elmidae	60		39	
Diptera (flies)				
Chironomidae	28		38	
Culicidae	1			
Dixidae			1	
Simuliidae			1	
Tabanidae	1			
Tipulidae	3			
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			3	
Hydrobiidae	1			
Lymnaeidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)	36		12	
TOTAL INDIVIDUALS	282		285	

Table 3B. Macroinvertebrate metric evaluation of Macatawa Area rivers, 2015.

	North Branch Macatawa River		North Branch Macatawa River	
	Ottogan Road		end of 59th Street	
	9/3/2015		8/31/2015	
	STATION 5		STATION 6	
METRIC	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	29	1	23	0
NUMBER OF MAYFLY TAXA	2	0	2	0
NUMBER OF CADDISFLY TAXA	3	0	3	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMP.	3.55	0	6.32	0
PERCENT CADDISFLY COMP.	12.06	0	2.46	-1
PERCENT DOMINANT TAXON	21.28	0	28.07	0
PERCENT ISOPOD, SNAIL, LEECH	17.38	-1	13.68	-1
PERCENT SURF. AIR BREATHERS	3.55	1	1.75	1
TOTAL SCORE	0		-2	
MACROINV. COMMUNITY RATING	ACCEPT.		ACCEPT.	

Table 4A. Qualitative fish sampling results for Macatawa Area rivers, 2015.

	Bosch & Hulst Drain (Nooderloos Creek)	Bosch & Hulst Drain (Nooderloos Creek)	Macatawa River	Peters Creek
	Riley Street	104th	84th Avenue	84th Avenue
	9/17/2015	9/17/2015	9/17/2015	9/3/2015
TAXA	STATION 7	STATION 8	STATION 9	STATION 10
Umbridae (mudminnows)				
Umbra limi (Central mudminnow)		3	1	11
Esocidae (pikes)				
Esox lucius (Northern Pike)	1			
Cyprinidae (minnows and carps)				
Campostoma anomalum (Central stoneroller)		3		
Cyprinus carpio (Carp)	1		1	
Semotilus atromaculatus (Creek chub)	35	34	72	36
Luxilus cornutus (Common shiner)	11	5		
Notropis volucellus (Mimic shiner)		1	1	
Pimephales promelas (Fathead minnow)				1
Pimephales notatus (Bluntnose minnow)	36	22	10	5
Rhinichthys atratulus (Blacknose dace)		24		6
Catostomidae (suckers)				
Catostomus commersoni (White sucker)	2	38	31	124
Ictaluridae (Bullhead, Catfish)				
Ameiurus nebulosus (Brown bullhead)		1		1
Ictalurus punctatus (Channel cat)			12	
Aphredoderidae (pirate perch)				
Aphredoderus sayanus (Pirate perch)	1			
Labidesthes sicculus (Brook silverside)				
Fundulus diaphanus (Banded killifish)	4		1	
Gasterosteidae (sticklebacks)				
Culaea inconstans (Brook stickleback)				2
Centrarchidae (sunfish)				
Ambloplites rupestris (Rock bass)	4	2		
Lepomis cyanellus (Green sunfish)	16	13	2	3
Lepomis gibbosus (Pumpkinseed sf)	10			
Lepomis macrochirus (Bluegill sf)	55	3	1	
Micropterus salmoides (Largemouth bass)		10	2	1
Percidae (perch)				
Etheostoma nigrum (Johnny darter)	7	31	111	71
Percina maculata (Blackside darter)	1	1		
Gobiidae (gobies)				
Neogobius melanostomus (Round goby)		17		
TOTAL INDIVIDUALS	184	208	245	261
Number of hybrid sunfish	0	0	0	0
Number of anomalies	0	0	0	0
Percent anomalies	0.000	0.000	0.000	0.000
Percent salmonids	0.000	0.000	0.000	0.000
Reach sampled (ft)	240	340	250	250
Area sampled (sq ft)	4,800	6,800	3,000	3,500
Density (# fish/sq ft)	0.038	0.031	0.082	0.075
Gear	ss	ss	ss	bps

Table 4B. Fish metric evaluation of Macatawa Area rivers, 2015.

	Bosch & Hulst Drain (Nooderloos Creek)		Bosch & Hulst Drain (Nooderloos Creek)		Macatawa River		Peters Creek	
	Riley Street		104th		84th Avenue		84th Avenue	
	9/17/2015		9/17/2015		9/17/2015		9/3/2015	
	STATION 7		STATION 8		STATION 9		STATION 10	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	14	1	16	1	12	1	11	0
NO. OF DARTER, SCULPIN, MADTOM TAXA	2	0	2	0	1	-1	1	-1
NUMBER OF SUNFISH TAXA	4	1	3	0	2	0	1	-1
NUMBER OF SUCKER TAXA	1	-1	1	-1	1	0	1	-1
NUMBER OF INTOLERANT TAXA	2	-1	1	-1	1	-1	0	-1
PERCENT TOLERANT	52.72	0	79.33	-1	93.06	-1	98.47	-1
PERCENT OMNIVOROUS TAXA	40.22	0	58.65	-1	46.94	-1	70.50	-1
PERCENT INSECTIVOROUS TAXA	57.07	0	34.13	0	47.35	0	29.12	-1
PERCENT PISCIVOROUS TAXA	2.72	0	5.77	0	5.71	0	0.38	-1
% SIMPLE LITHOPHILIC SPAWNER TAXA	7.61	0	32.69	0	12.65	0	49.81	1
TOTAL SCORE	0		-3		-3		-7	
FISH COMMUNITY RATING	ACCEPT.		ACCEPT.		ACCEPT.		POOR	

Table 4A. Qualitative fish sampling results for Macatawa Area rivers, 2015.

	South Branch Macatawa River	Macatawa River	North Branch Macatawa	North Branch Macatawa River
	108th Avenue	Adams Landing	146th	56th Avenue
	7/22/2015	9/17/2015	9/3/2015	9/3/2015
TAXA	STATION 11	STATION 12	STATION 13	STATION 14
Umbridae (mudminnows)				
Umbra limi (Central mudminnow)	9	13	9	11
Cyprinidae (minnows and carps)				
Campostoma anomalum (Central stoneroller)		1	5	16
Semotilus atromaculatus (Creek chub)	23		7	25
Notemigonus crysoleucas (Golden shiner)				5
Luxilus cornutus (Common shiner)	23			
Pimephales notatus (Bluntnose minnow)	2		14	4
Catostomidae (suckers)				
Catostomus commersoni (White sucker)	12	5	20	83
Ictaluridae (Bullhead, Catfish)				
Ameiurus melas (Black bullhead)		1		
Ameiurus nebulosus (Brown bullhead)	2		1	1
Ameiurus natalis (Yellow bullhead)		2		
Labidesthes sicculus (Brook silverside)				
Fundulus diaphanus (Banded killifish)			2	
Centrarchidae (sunfish)				
Ambloplites rupestris (Rock bass)		2		
Lepomis cyanellus (Green sunfish)	5	56	2	10
Lepomis gibbosus (Pumpkinseed sf)		3	10	26
Lepomis macrochirus (Bluegill sf)	4	8	9	12
Micropterus salmoides (Largemouth bass)		2		1
Micropterus dolomieu (Smallmouth bass)			2	
Percidae (perch)				
Etheostoma nigrum (Johnny darter)	20	33	192	10
Percina maculata (Blackside darter)	11	3		
Perca flavescens (Yellow perch)	1			
Gobiidae (gobies)				
Neogobius melanostomus (Round goby)		15		
TOTAL INDIVIDUALS	112	144	273	204
Number of hybrid sunfish	0	0	0	0
Number of anomalies	0	0	0	0
Percent anomalies	0.000	0.000	0.000	0.000
Percent salmonids	0.000	0.000	0.000	0.000
Reach sampled (ft)	600	500	400	300
Area sampled (sq ft)	13,200	17,500	8,000	6,600
Density (# fish/sq ft)	0.008	0.008	0.034	0.031
Gear	ss	ss	bps	bps

Table 4B. Fish metric evaluation of Macatawa Area rivers, 2015.

	South Branch Macatawa River		Macatawa River		North Branch Macatawa River		North Branch Macatawa River	
	108th Avenue		Adams Landing		146th		56th Avenue	
	7/22/2015		9/17/2015		9/3/2015		9/3/2015	
	STATION 11		STATION 12		STATION 13		STATION 14	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	11	0	13	0	12	0	12	0
NO. OF DARTER, SCULPIN, MADTOM TAXA	2	0	2	0	1	-1	1	-1
NUMBER OF SUNFISH TAXA	2	0	4	1	3	0	3	0
NUMBER OF SUCKER TAXA	1	-1	1	-1	1	-1	1	-1
NUMBER OF INTOLERANT TAXA	0	-1	1	-1	2	-1	0	-1
PERCENT TOLERANT	63.39	-1	75.69	-1	89.38	-1	72.55	-1
PERCENT OMNIVOROUS TAXA	42.86	0	14.58	1	18.68	0	63.24	-1
PERCENT INSECTIVOROUS TAXA	56.25	0	81.94	1	78.75	1	28.43	-1
PERCENT PISCIVOROUS TAXA	0.00	-1	2.78	0	0.73	-1	0.49	-1
% SIMPLE LITHOPHILIC SPAWNER TAXA	41.07	0	5.56	0	7.33	0	40.69	0
TOTAL SCORE	-4		0		-4		-7	
FISH COMMUNITY RATING	ACCEPT.		ACCEPT.		ACCEPT.		POOR	
Comments:	Equipment not working well.		hybrid sunfish 1					