

# Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan

June-August 2018

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## INTRODUCTION

Michigan has over 76,000 miles of rivers and streams. Understanding the quality of those waters is an important part of the Michigan Department of Environment, Great Lakes, and Energy’s (EGLE) mission to protect Michigan’s environment and public health by managing air, water, land, and energy resources. All of Michigan’s watersheds are surveyed once every five years. As part of that effort, the Pigeon River and Cherry Creek watersheds were sampled in 2018; this report includes the information collected as part of that survey.

Water quality can be measured in different ways, such as sampling macroinvertebrate and fish communities and collecting water or sediment samples. EGLE biologists sample macroinvertebrates and fish living in our rivers and streams because some are more sensitive to pollution than others. In general, macroinvertebrate and fish communities in healthy streams include those sensitive to pollution.

Looking at the quality of the physical habitat helps reveal what may be limiting the kinds of life in a stream. Habitat includes the wood, rocks, gravel, silt, and sand in the stream or river and the vegetation in the water and along the shore. Typically, a range of habitats provides for diverse types of macroinvertebrates and fish. Diverse biological communities are more resilient to change and provide greater ecological benefits.

### Sampling Goals:

1. Assess the current condition of individual rivers and streams in the Pigeon River and Cherry Creek watersheds and determine whether Michigan Water Quality Standards (WQS) are being met.
2. Evaluate water quality trends across the state and over time.
3. Satisfy [targeted monitoring requests](#) (TMR) submitted by EGLE staff and external stakeholders.
4. Identify [nonpoint sources](#) of water quality pollution.

### WATERSHED INFORMATION

The Pigeon River and Cherry Creek watersheds are coastal watersheds. They are primarily located in Huron and Sanilac Counties, with small portions extending into Tuscola and St. Clair Counties (Figure 1). The Pigeon and Pinnebog Rivers are the largest systems, with both streams having main channel lengths of approximately 40 miles (Alwin, 2015). In addition to the Pigeon and Pinnebog Rivers, there are numerous small, perennial, intermittent, and/or ephemeral streams that drain directly to Lake Huron or Saginaw Bay. The entire watershed group is within the Huron/Erie Lake Plains (HELP) Ecoregion (Omernik and Gallant, 1988).

Soil composition within the watersheds consists of soil types that are nearly level and poorly drained (United States Department of Agriculture [USDA], 1980). The combination of these attributes yields systems that are minimally influenced by groundwater and primarily influenced by precipitation (Alwin, 2015). Moreover, the generally flat topography of the region produces systems characterized by low gradient and sluggish flow. Many of these streams have no name, exist without delineated tributaries, and/or only flow a few miles before reaching their confluence with Lake Huron.

### LAND USE

Land use in a watershed can influence water quality. Land use in the sampled watersheds is predominantly agricultural and many of the smaller streams have been straightened and/or routinely dredged to accelerate surface drainage (Alwin, 2015). Widespread utilization of fertile soils for growing crops in this region has left few areas within these watersheds in a natural state. Natural areas, especially wetlands, act as sponges, allowing rainwater to soak into the ground, reducing the amount of water that runs off the land, filtering pollutants, and recharging groundwater. These characteristics protect water quality, minimize flooding, and stabilize shorelines and stream banks. The amount of total [wetlands](#) lost since pre-settlement times in the Pigeon River and Cherry Creek watersheds is upwards of 80 percent (Michigan Department of Environmental Quality [MDEQ], 2014). Most of these wetlands were

intentionally drained to support agriculture or development. Land use data for Pigeon River, Cherry Creek, and other nearby watersheds are presented in Table 1.

Table 1. Land use summary for Pigeon River, Cherry Creek, and other nearby watersheds.

<u>Watershed</u>	<u>Natural Terrestrial</u>	<u>Wetland</u>	<u>Developed</u>	<u>Cultivated Agriculture</u>	<u>Hay/Pasture</u>	<u>Water</u>	<u>Barren</u>
Au Gres & Tawas	46.0%	24.2%	7.9%	11.1%	8.5%	2.0%	0.4%
Kawkawlin-Wiscoggin	28.9%	12.9%	8.2%	42.9%	5.1%	1.8%	0.3%
Clinton	14.9%	7.8%	55.6%	11.3%	7.1%	2.7%	0.6%
Pigeon River	6.0%	7.6%	7.2%	68.5%	10.2%	0.1%	0.3%
Cherry Creek	13.8%	5.5%	7.9%	57.8%	14.8%	0.1%	0.1%

## HISTORIC SAMPLING EFFORTS

Table 2 is a summary of the reports available from the last two monitoring cycles for this watershed. For more information about older reports, monitoring results, or for any other questions about this watershed, please contact the watershed biologist by finding their contact information on the [Watershed Monitoring Story Map](#).

Table 2. Historical EGLE biosurvey reports available for the Pigeon River and Cherry Creek watersheds.

<b>Survey Year</b>	<b>Report Citation Report Number</b>	<b>Finding/Comments</b>
2013	Alwin T., 2015 #MI/DEQ/WRD-15/010	<ul style="list-style-type: none"> <li>• Macroinvertebrate community samples collected at 31 wadeable stations with ratings of poor to low acceptable.</li> <li>• Habitat ratings ranged from poor or excellent. All but two sites had clear evidence of habitat alteration or degradation.</li> <li>• Nuisance aquatic plants and algae prevalent in some agricultural drains.</li> </ul>
2008	Cooper, J., 2009 #MI/DEQ/WB-09/011	<ul style="list-style-type: none"> <li>• Macroinvertebrate community samples collected at 31 wadeable stations with ratings of poor to excellent.</li> <li>• Habitat ratings ranged from good to marginal.</li> <li>• Extensive nonpoint source issues related to excess nutrients and sedimentation were identified.</li> </ul>

Older reports dating back to 1992 are available upon request.

## SITE-SELECTION/METHODS

In July and August 2018, 11 sites were sampled in the Pigeon River and Cherry Creek watersheds. EGLE's status and trend sampling strategy for rivers and streams was modified in 2016 to allow staff more time to expand efforts into other water quality monitoring projects. As such, the 2018 sampling plan for the Pigeon River and Cherry Creek watersheds contains fewer sites than in previous monitoring cycles. [Procedure 51: Qualitative Biological and Habitat Survey Protocols for Wadeable Streams and Rivers](#) was used to collect habitat and macroinvertebrate community information. Fish were not sampled as part of this survey.

Three types of site-selection methods were used in the Pigeon River and Cherry Creek watersheds in 2018. These include:

- (1) Status sites: Randomly selected across Michigan so statewide water quality summaries can be made. The random selection resulted in three sites from the Pigeon River and Cherry Creek watersheds to support the statewide condition portion of the SWAS Status and Trend Program (MDEQ, 2015).
- (2) Trend sites: Four sites, originally selected from a random group, became trend sites that are sampled every five years. These sites will be used for a separate statewide trend report following analysis of 2006-2020 data.
- (3) Targeted sites: Four targeted sites were selected through our [TMR process](#). Sites discussed in this report were selected from TMRs related to National Pollutant Discharge Elimination System, Water Quality-Based Effluent Limits, near wastewater treatment plant (WWTP) and wastewater storage lagoon (WWSL) outfalls near Caseville and Bad Axe, Michigan. This work was carried out by the WRD, Permits Section, and is included in this staff report.

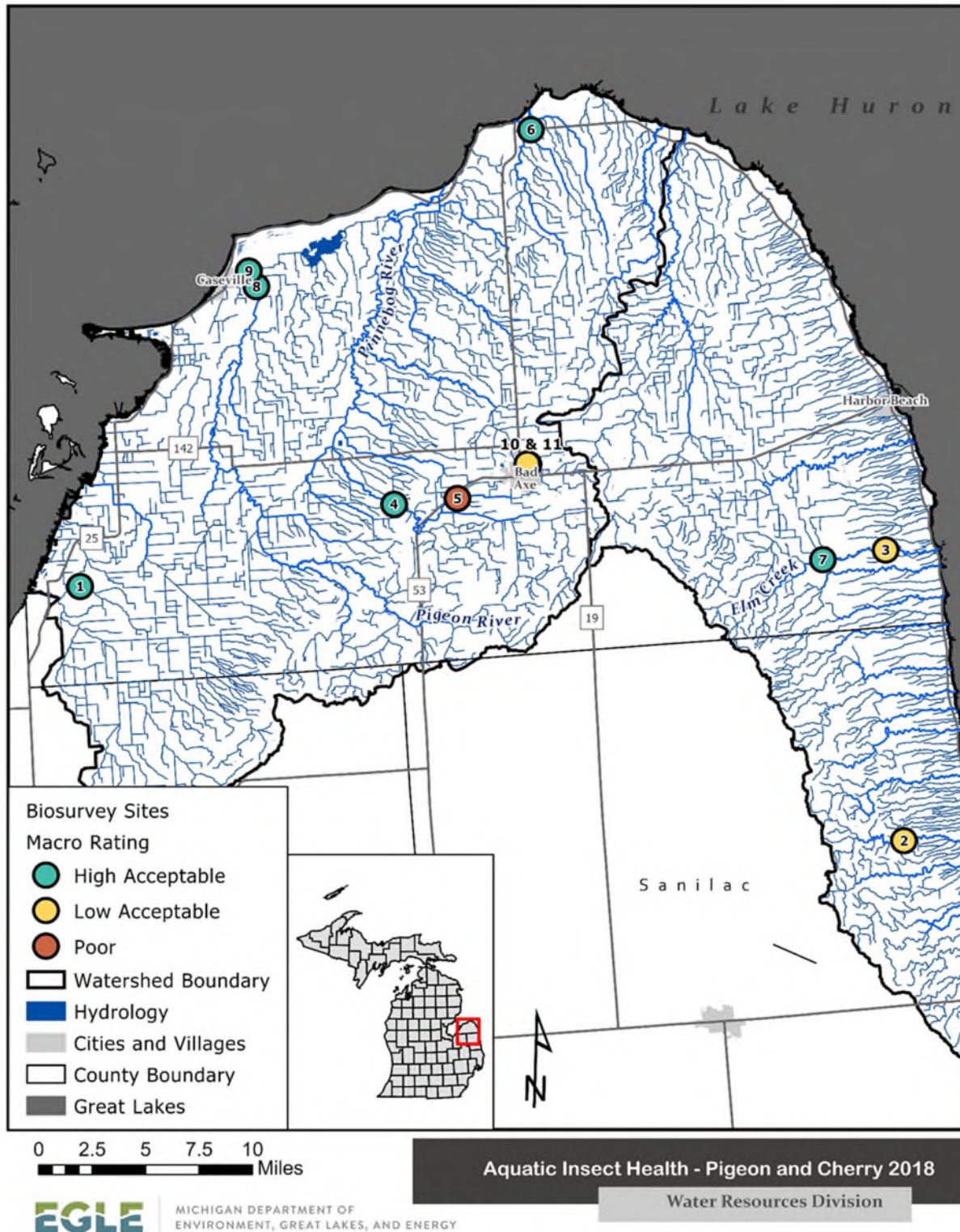


Figure 1. Pigeon River and Cherry Creek sites, 2018. Colored dots represent 2018 aquatic macroinvertebrate community station ratings of high acceptable (green), low acceptable (orange), and poor (red). Scores can also be found in Table 3.

Table 3. Summary of sampling locations in the Pigeon River and Cherry Creek watersheds, June-August 2018.  
(AUID = Assessment Unit Identifier)

Station #	Stream Name	Road Crossing	STORET #	County	Latitude	Longitude	Habitat Rating	Habitat Score	Macro Rating	Macro Score	Site Type	AUID
1	Columbia Drain	Lange Road	320319	Huron	43.736	-83.416	Good	128	High Acceptable	0	Trend	040801030110-01
2	Big Creek	Loree Road	760242	Sanilac	43.541	-82.656	Good	117	Low Acceptable	-1	Trend	040801040202-05
3	Elm Creek	Schock Road	320302	Huron	43.742	-82.662	Good	121	Low Acceptable	-2	Trend	040801040108-01
4	Pinnebog River	Downstream Grassmere Road	320306	Huron	43.786	-83.120	Good	144	High Acceptable	2	Trend	040801030301-01
5	Pinnebog River	McMillan Road	320366	Huron	43.7885	-83.060	Poor	48	Poor	-5	Status	040801030301-01
6	Grant Creek	Grindstone Road	320365	Huron	44.0411	-82.978	Marginal	97	High Acceptable	0	Status	040801030406-01
7	Elm Creek	Eppenbrock Road	320367	Huron	43.737	-82.720	Good	134	High Acceptable	0	Status	040801040108-01
8	Pigeon River	Upstream WWSL (Kinde Road)	320245	Huron	43.939	-83.241	Good	134	High Acceptable	1	Targeted	040801030204-01
9	Pigeon River	Downstream WWSL (at facility)	320363	Huron	43.950	-83.248	Good	140	High Acceptable	1	Targeted	040801030204-01
10	Bad Axe Creek	Upstream WWTP (Wilcox Park)	320356	Huron	43.810	-82.992	Good	107	Low Acceptable	-1	Targeted	040801030302-02
11	Bad Axe Creek	Downstream WWTP (Wilcox Park)	320369	Huron	43.810	-82.993	Good	105	Low Acceptable	-2	Targeted	040801030302-02

Procedure 51 is used in streams and rivers that can be safely waded. This procedure evaluates macroinvertebrate communities based on several characteristics and combines all results into a one-number score that ranges from +9 to -9. Habitat is scored using 11 metrics that allow for a score up to 200 (Table 4).

Table 4. EGLE Procedure 51 macroinvertebrate and habitat scoring and rating system.

<b>Macroinvertebrate Score</b>	<b>Macroinvertebrate Rating</b>	<b>Habitat Score</b>	<b>Habitat Rating</b>
5 to 9	Excellent	> 154	Excellent
-4 to 4	Acceptable	105 to 154	Good
-5 to -9	Poor	56 to 104	Marginal
		<56	Poor

Macroinvertebrate community scores are one of two biological components used to evaluate the other indigenous aquatic life and wildlife designated use. Procedure 51 can be used to rate the fish community in a similar way. Fish community scores are used to evaluate the warmwater and coldwater fish designated uses. Habitat scores are used to help better understand what might influence the fish and macroinvertebrate scores. More information on the metrics and scoring can be found in the [Procedure-51 Scoring Document](#).

## **MONITORING FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS**

### **Goal 1: Determine the condition of individual waters of the state and whether Michigan WQS are being met.**

Three randomly selected status sites were sampled within the Pigeon River and Cherry Creek watersheds in 2018 (Figure 1; Stations 5-7). Habitat scores ranged from poor to good. Macroinvertebrate community scores ranged from poor to high acceptable. Habitat evaluations can be found in Tables 3 and 5; macroinvertebrate evaluations can be found in Tables 3, 6a, and 6b).

Station 5 (Pinnebog River at McMillan Road) was channelized historically, producing a linear reach with steep banks surrounded by agricultural fields. The riparian zone was limited to grasses, and the stream substrate was comprised of fine silt, sand, and senescing algae, providing limited habitat for macroinvertebrate colonization (Figure 2). Procedure 51 results reflected these observations, scoring “poor” for both the habitat (receiving only 48 out of a potential 200 points) and the macroinvertebrate community (receiving a -5). The “poor” macroinvertebrate score was driven by the community being dominated by pollution tolerant taxa. For example, stoneflies and most families of caddisflies and mayflies are among the most sensitive taxa found in streams and are therefore considered indicators of disturbance if

absent. There were no stoneflies or caddisflies present at this site, and the single mayfly found was in a family that is often found in disturbed streams. Isopoda (aquatic pillbugs), Gastropoda (snails), and Hirudinea (leeches) are tolerant taxa and are considered indicators of disturbance when found in high numbers. These three taxa made up 37 percent of the sample, with isopods being the dominant taxa in the sample at 31 percent.



Figure 2. Pinnebog River at McMillan Road.

Station 6 (Grant Creek at Grindstone Road) was located near its confluence with Lake Huron. The stream was channelized historically, producing a linear canal. A narrow strip of riparian zone was present along the reach, which improved epifaunal habitat scores. The stream substrate was primarily sand and silt, with sparse gravel. Habitat scored as marginal. Similar to Station 5, no stoneflies were present and there was a low abundance of mayflies. There were five families of caddisflies found, with Helicopsychidae, which makes a case from sand grains, being the dominant taxon at 23 percent. Isopods, snails, and leeches collectively made up a high proportion of the macroinvertebrate community at 38 percent. The macroinvertebrate community at this location scored as acceptable.

Station 7 (Elm Creek at Eppenbrock Road) was also surrounded by agricultural land. However, habitat in the immediate vicinity of the sample reach demonstrated good overall conditions. There was no evidence of channelization and substrates were comprised of a mix of sand, gravel, cobble, and boulders. Stream banks had visible scarring demonstrating precipitation-driven, flashy hydrology resulting from poorly draining soils and upstream agricultural land cover. However, tree roots from the riparian zone were stabilizing banks and

woody debris was present throughout the sample reach (Figure 3). Similar to Stations 5 and 6, stoneflies were absent and there was a low abundance of mayflies. There were five families of caddisflies found, with Helicopsychidae being the dominant family within the order Trichoptera at 91 percent. However, physid snails made up 27 percent of the sample overall, suggesting nutrient enrichment in this reach. Isopods, snails, and leeches again made up a high proportion of the macroinvertebrate community at 36 percent. One unidentified juvenile unionid mussel was present, suggesting local reproduction in this reach. The macroinvertebrate community at this location reflected improved habitat, relative to other stations, and scored as acceptable.



Figure 3. Elm Creek at Eppenbrock Road.

**Goal 2: Evaluate biological integrity temporal trends.**

Four trend sites were located within the Pigeon River and Cherry Creek watersheds (Figure 1; Stations 1-4). Trend information cannot be summarized until a third cycle is complete and sufficient data have been collected. However, results from 2018 are summarized below, with general comparisons to 2013.

All four trend sites had habitat that scored good. Macroinvertebrate scores at the trend sites ranged from low acceptable (two locations) to high acceptable (two locations). In previous sampling years habitat and macroinvertebrate communities exhibited similar scores, trending

toward the low range of acceptable. Of particular note amongst the trend sites was Station 4, Pinnebog River downstream of Grassmere Road. This location achieved the highest habitat score of any site visited during this survey. Substrate was dominated by gravel and cobble in a shallow riffle conducive to epifaunal colonization (Figure 4). A modest riparian buffer comprised of trees and woody shrubs was also present, providing canopy cover and shade to the river. Moreover, several sensitive taxa (e.g., caddisflies, stoneflies) were detected at this location, indicating that the diversity of the aquatic macroinvertebrate community benefited from the favorable habitat conditions. Habitat and macroinvertebrate community scores for all trend sites can be found in Tables 3, 6a, and 6b.



Figure 4. Pinnebog River at Grassmere Road.

**Goal 3: Satisfy monitoring requests submitted by EGLE staff and external stakeholders.**

Four sites were targeted by WRD, Permits Section, biologists for Procedure 51 biological surveys within the Pigeon River and Cherry Creek watersheds. Sites were located upstream and downstream of WWTP/WWSL outfalls located in Bad Axe and Caseville (Figure 1; Stations 8-11).

There were no remarkable differences between scores upstream and downstream of the outfalls. Habitat scored as good at the upstream and downstream locations in Caseville and

in Bad Axe. Macroinvertebrate communities scored as high acceptable at the upstream and downstream locations in Caseville and low acceptable at the upstream and downstream locations in Bad Axe. Habitat and macroinvertebrate community scores can be found in Tables 3, 5, 6a, and 6b.

**Goal 4: Identify potential nonpoint and other sources of water quality impairment.**

There were no nonpoint source issues investigated in 2018.

**CONCLUSIONS AND RECOMMENDATIONS**

In general, the Pigeon River and Cherry Creek watersheds exhibited macroinvertebrate communities with tolerant taxa. As described in past surveys, poorly draining soils and agricultural practices continue to influence water quality. Channelization, flashy hydrology, and siltation negatively impact macroinvertebrate communities where epifaunal substrates are otherwise favorable (Figure 4). Sites that scored as high acceptable were limited to reaches with relatively intact riparian zones. Macroinvertebrate surveys from 2013 and 2018 (48 sites total) did not identify any reaches with excellent macroinvertebrate community scores.

Several randomly selected status sites exhibited stagnant pools or reverse flows driven by a seiche from Lake Huron. Alternate sites were used in these instances. Future surveys should visit streams during low water and carefully observe flow orientation to avoid using Procedure 51 within seasonally intermittent streams and/or streams impacted by seiche.

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## BIOSURVEY TABLES

Table 5. Habitat evaluation for selected stations in the Pigeon River and Cherry Creek watersheds in Huron, Sanilac, Tuscola and St. Clair Counties, Michigan, June-August 2018. HELP ecoregion = Huron/Erie Lake Plains.

	<b>Station 1</b> Columbia Drain Lange Road 6/13/2018	<b>Station 2</b> Big Creek Loree Road 6/14/2018	<b>Station 3</b> Elm Creek Schock Road 6/14/2018	<b>Station 4</b> Pinnebog River d/s Grassmere Road 6/23/2018
<b>HABITAT METRIC</b>	<b>RIFFLE/RUN</b>	<b>RIFFLE/RUN</b>	<b>RIFFLE/RUN</b>	<b>RIFFLE/RUN</b>
<b>Substrate and Instream Cover</b>				
Epifaunal Substrate/ Available Cover (20)	11	10	8	16
Embeddedness (20)*	16	14	10	16
Velocity/Depth Regime (20)*	14	13	10	14
Pool Substrate Characterization (20)**	11	10	8	16
Pool Variability (20)**				
<b>Channel Morphology</b>				
Sediment Deposition (20)	13	9	15	17
Flow Status – Maintained Flow Volume (10)	9	4	8	8
Flow Status - Flashiness (10)	7	2	5	3
Channel Alteration (20)	6	18	14	18
Frequency of Riffles/Bends (20)*	15	12	7	10
Channel Sinuosity (20)**				
<b>Riparian and Bank Structure</b>				
Bank Stability (L) (10)	7	3	4	3
Bank Stability (R) (10)	8	3	4	7
Vegetative Protection (L) (10)	6	7	8	6
Vegetative Protection (R) (10)	6	8	8	7
Riparian Vegetative Zone Width (L) (10)	6	6	10	9
Riparian Vegetative Zone Width (R) (10)	4	8	10	10
<b>TOTAL SCORE (200):</b>	128	117	121	144
<b>HABITAT RATING:</b>	<b>GOOD</b>	<b>GOOD</b>	<b>GOOD</b>	<b>GOOD</b>
<b>Weather:</b>	cloudy	sunny	sunny	Not Available
<b>Air Temperature: °F</b>	70	75	79	72
<b>Water Temperature: °F</b>	Not Available	Not Available	70	68
<b>Average Stream Width: Feet</b>	6.4	3.3	30.0	31.0
<b>Average Stream Depth: Feet</b>	0.627	0.153	0.840	0.460
<b>Surface Velocity: Feet/Second</b>	0.879	0.349	0.126	0.573
<b>Estimated Flow: Cubic Feet/Second</b>	3.524	0.177	3.183	8.165
<b>Stream Modifications:</b>	dredged	none	dredged	none
<b>Nuisance Plants (Y/N):</b>	No	No	No	No
<b>STORET No.:</b>	320319	760242	320302	320306
<b>County Code:</b>	32	76	32	32
<b>TRS:</b>	15N09E10	13N15E26	15N15E14	16N11E25
<b>Latitude (dd):</b>	43.7364	43.541	43.742	43.786
<b>Longitude (dd):</b>	-83.41616	-82.656	-82.662	-83.12
<b>Ecoregion:</b>	HELP	HELP	HELP	HELP
<b>Stream Type:</b>	Warmwater	Warmwater	Warmwater	Warmwater
<b>USGS Basin Code:</b>	4080103	4080104	4080104	4080103

\*Applies only to Riffle/Run stream Surveys \*\*Applies only to Glide/Pool stream Surveys

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). Surveys are done upstream of road crossings unless noted otherwise.

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Table 5. Habitat evaluation for selected stations in the Pigeon River and Cherry Creek watersheds in Huron, Sanilac, Tuscola and St. Clair Counties, Michigan, June-August 2018. HELP ecoregion = Huron/Erie Lake Plains.

	<b>Station 5</b> Pinnebog River McMillan Road 9/26/2018	<b>Station 6</b> Grant Creek Grindstone Road 9/26/2018	<b>Station 7</b> Elm Creek Eppenbrock Road 9/26/2018
<b>HABITAT METRIC</b>	<b>GLIDE/POOL</b>	<b>RIFFLE/RUN</b>	<b>RIFFLE/RUN</b>
<b>Substrate and Instream Cover</b>			
Epifaunal Substrate/ Available Cover (20)	3	11	15
Embeddedness (20)*		13	19
Velocity/Depth Regime (20)*		8	14
Pool Substrate Characterization (20)**	11		
Pool Variability (20)**	0		
<b>Channel Morphology</b>			
Sediment Deposition (20)	4	15	18
Flow Status – Maintained Flow Volume (10)	9	7	8
Flow Status - Flashiness (10)	3	7	8
Channel Alteration (20)	3	7	14
Frequency of Riffles/Bends (20)*		4	8
Channel Sinuosity (20)**	1		
<b>Riparian and Bank Structure</b>			
Bank Stability (L) (10)	3	4	5
Bank Stability (R) (10)	3	4	3
Vegetative Protection (L) (10)	3	5	7
Vegetative Protection (R) (10)	3	5	7
Riparian Vegetative Zone Width (L) (10)	1	3	4
Riparian Vegetative Zone Width (R) (10)	1	4	4
<b>TOTAL SCORE (200):</b>	48	97	134
<b>HABITAT RATING:</b>	POOR	MARGINAL	GOOD
<b>Weather:</b>	sunny	sunny	partly cloudy
<b>Air Temperature: °F</b>	68	70	70
<b>Water Temperature: °F</b>	67	68	64
<b>Average Stream Width: Feet</b>	9.3	7.2	12.8
<b>Average Stream Depth: Feet</b>	0.440	0.287	0.440
<b>Surface Velocity: Feet/Second</b>	0.392	0.205	0.000
<b>Estimated Flow: Cubic Feet/Second</b>	1.609	0.424	0.000
<b>Stream Modifications:</b>	dredged	dredged	bank stabilization
<b>Nuisance Plants (Y/N):</b>	No	No	No
<b>STORET No.:</b>	320366	320365	320367
<b>County Code:</b>	32	32	32
<b>TRS:</b>	16N12E27	19N13E29	15N15E16
<b>Latitude (dd):</b>	43.78853	44.04118	43.73705
<b>Longitude (dd):</b>	-83.06052	-82.97886	-82.72094
<b>Ecoregion:</b>	HELP	HELP	HELP
<b>Stream Type:</b>	Warmwater	Warmwater	Warmwater
<b>USGS Basin Code:</b>	4080103	4080103	4080104

\*Applies only to Riffle/Run stream Surveys \*\*Applies only to Glide/Pool stream Surveys

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). Surveys are done upstream of road crossings unless noted otherwise.

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan  
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Table 5. Habitat evaluation for selected stations in the Pigeon River and Cherry Creek watersheds in Huron, Sanilac, Tuscola and St. Clair Counties, Michigan, June-August 2018. HELP ecoregion = Huron/Erie Lake Plains.

	<b>Station 8</b> Pigeon River Kinde Rd u/s WWSL 9/27/2018	<b>Station 9</b> Pigeon River at Caseville WWSL 9/27/2018	<b>Station 10</b> Bad Axe Creek u/s Bad Axe WWTP 9/27/2018	<b>Station 11</b> Bad Axe Creek d/s Bad Axe WWTP 9/27/2018
<b>HABITAT METRIC</b>	<b>RIFFLE/RUN</b>	<b>GLIDE/POOL</b>	<b>GLIDE/POOL</b>	<b>GLIDE/POOL</b>
<b>Substrate and Instream Cover</b>				
Epifaunal Substrate/ Available Cover (20)	15	12	11	13
Embeddedness (20)*	11			
Velocity/Depth Regime (20)*	14			
Pool Substrate Characterization (20)**		13	11	10
Pool Variability (20)**		13	13	13
<b>Channel Morphology</b>				
Sediment Deposition (20)	14	12	10	17
Flow Status – Maintained Flow Volume (10)	8	9	10	9
Flow Status - Flashiness (10)	4	9	7	4
Channel Alteration (20)	16	18	9	7
Frequency of Riffles/Bends (20)*	12			
Channel Sinuosity (20)**		8	0	0
<b>Riparian and Bank Structure</b>				
Bank Stability (L) (10)	8	8	7	5
Bank Stability (R) (10)	6	8	7	5
Vegetative Protection (L) (10)	7	9	6	6
Vegetative Protection (R) (10)	8	6	6	6
Riparian Vegetative Zone Width (L) (10)	5	8	2	2
Riparian Vegetative Zone Width (R) (10)	6	7	8	8
<b>TOTAL SCORE (200):</b>	134	140	107	105
<b>HABITAT RATING:</b>	<b>GOOD</b>	<b>GOOD</b>	<b>GOOD</b>	<b>GOOD</b>
<b>Weather:</b>	sunny	sunny	sunny	sunny
<b>Air Temperature: °F</b>	65	60	55	50
<b>Water Temperature: °F</b>	60	59	52	55
<b>Average Stream Width: Feet</b>	34	58	13	14
<b>Average Stream Depth: Feet</b>	1	2	1	2
<b>Surface Velocity: Feet/Second</b>	0.565	Not Available	0.333	0.270
<b>Estimated Flow: Cubic Feet/Second</b>	14.046	Not Available	4.227	5.592
<b>Stream Modifications:</b>	Dredged	None	None	None
<b>Nuisance Plants (Y/N):</b>	No	No	No	No
<b>STORET No.:</b>	320245	320363	320356	320369
<b>County Code:</b>	32	32	32	32
<b>TRS:</b>	17N10E03	18N10E25	16N13E18	16N13E18
<b>Latitude (dd):</b>	43.9394	43.950277	43.81045	43.810555
<b>Longitude (dd):</b>	-83.2417	-83.248333	-82.992777	-82.993888
<b>Ecoregion:</b>	HELP	HELP	HELP	HELP
<b>Stream Type:</b>	Warmwater	Warmwater	Warmwater	Warmwater
<b>USGS Basin Code:</b>	4080103	4080102	4080103	4080103

\*Applies only to Riffle/Run stream Surveys \*\*Applies only to Glide/Pool stream Surveys

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). Surveys are done upstream of road crossings unless noted otherwise.

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan  
June-August 2018**

Table 6a. Qualitative macroinvertebrate community sampling results at selected stations in the Pigeon River and Cherry Creek watershed, 2018.

	<b>Columbia Drain Lange Road</b>	<b>Big Creek Loree Road</b>	<b>Elm Creek Schock Road</b>	<b>Pinnebog River Downstream of Grassmere Road</b>
	<b>Station 1</b>	<b>Station 2</b>	<b>Station 3</b>	<b>Station 4</b>
<b>TAXA</b>				
PLATYHELMINTHES (flatworms)				
Turbellaria	7			
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1	2	1	
Oligochaeta (worms)	4	1	14	
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	16		1	17
Decapoda (crayfish)		1	2	7
Isopoda (sowbugs)		22	4	7
Arachnoidea				
Hydracarina	20	2		4
Insecta				
Ephemeroptera (mayflies)				
Baetidae		3		5
Caenidae	7		9	4
Heptageniidae		3	1	10
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	4	4		2
Zygoptera (damselflies)				
Calopterygidae	1		3	5
Coenagrionidae	32	1	22	
Plecoptera (stoneflies)				
Perlidae				10
Hemiptera (true bugs)				
Corixidae		2	10	
Gerridae		4	4	1
Notonectidae	1			
Pleidae		35		
Veliidae		1	1	1
Megaloptera				
Corydalidae (dobsonflies)				2
Trichoptera (caddisflies)				
Helicopsychidae				1
Hydropsychidae				16
Hydroptilidae	7			1
Leptoceridae		1	1	1
Limnephilidae		1	1	2
Philopotamidae	2	1	6	
Coleoptera (beetles)				
Dytiscidae (total)	2	9	2	

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan  
June-August 2018**

	<b>Columbia Drain Lange Road</b>	<b>Big Creek Loree Road</b>	<b>Elm Creek Schock Road</b>	<b>Pinnebog River Downstream of Grassmere Road</b>
	<b>Station 1</b>	<b>Station 2</b>	<b>Station 3</b>	<b>Station 4</b>
<b>TAXA</b>				
Gyrinidae (adults)	2		3	
Haliplidae (adults)	2	3	2	
Hydrophilidae (total)		2	3	
Elmidae	11	3	45	16
Gyrinidae (larvae)	1		4	
Haliplidae (larvae)	4		6	
<b>Diptera (flies)</b>				
Ceratopogonidae	8	1		1
Chaoboridae	1			
Chironomidae	33	56	94	76
Culicidae	3	1		
Dixidae		1	3	1
Simuliidae	18	124	2	
Stratiomyidae	1	1		1
Tabanidae		1		
Tipulidae				3
<b>MOLLUSCA</b>				
<b>Gastropoda (snails)</b>				
Ancylidae (limpets)			1	
Hydrobiidae	2			
Physidae	69		14	3
Planorbidae	17		2	
<b>Pelecypoda (bivalves)</b>				
Unionidae (mussels)				4
<b>TOTAL INDIVIDUALS</b>	<b>276</b>	<b>286</b>	<b>261</b>	<b>201</b>

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan  
June-August 2018**

Table 6b. Qualitative macroinvertebrate community sampling results at selected stations in the Pigeon River and Cherry Creek watershed, 2018.

	<b>Columbia Drain</b> Lange Road		<b>Big Creek</b> Loree Road		<b>Elm Creek</b> Schock Road		<b>Pinnebog River</b> Grassmere Road	
	<b>Station 1</b>		<b>Station 2</b>		<b>Station 3</b>		<b>Station 4</b>	
<b>METRIC</b>	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	25	1	27	1	26	0	26	0
NUMBER OF MAYFLY TAXA	1	1	2	1	2	0	3	0
NUMBER OF CADDISFLY TAXA	2	1	3	1	3	0	5	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	1	1
PERCENT MAYFLY COMPOSITION	2.54	-1	2.10	-1	3.83	-1	9.45	-1
PERCENT CADDISFLY COMPOSITION	3.26	0	1.05	-1	3.07	0	10.45	0
PERCENT DOMINANT TAXON	25.00	-1	43.36	-1	36.02	-1	37.81	-1
PERCENT ISOPOD, SNAIL, LEECH	32.25	-1	8.39	0	8.43	0	4.98	1
PERCENT SURFACE AIR BREATHERS	4.35	1	20.28	0	9.58	1	1.49	1
<b>TOTAL SCORE</b>		0		-1		-2		2
<b>MACROINVERTEBRATE COMMUNITY RATING</b>	Acceptable		Acceptable		Acceptable		Acceptable	

Table 6a. Qualitative macroinvertebrate community sampling results at selected stations in the Pigeon River and Cherry Creek watershed, 2018.

	<b>Pinnebog River</b> McMillan Rd	<b>Grant Creek</b> Grindstone Road	<b>Elm Creek</b> Eppenbrock Road
	<b>Station 5</b>	<b>Station 6</b>	<b>Station 7</b>
<b>TAXA</b>			
PLATYHELMINTHES (flatworms)			
Turbellaria	13		
ANNELIDA (segmented worms)			
Hirudinea (leeches)	3	2	
Oligochaeta (worms)	3	1	
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	18		
Decapoda (crayfish)			1
Isopoda (sowbugs)	87		
Arachnoidea			
Hydracarina	2	1	1
Insecta			
Ephemeroptera (mayflies)			
Baetidae	1		
Caenidae		8	8
Ephemerellidae			1

Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan  
June-August 2018

	Pinnebog River McMillan Rd	Grant Creek Grindstone Road	Elm Creek Eppenbrock Road
	Station 5	Station 6	Station 7
<b>TAXA</b>			
Heptageniidae		5	2
Siphonuridae			1
Odonata			
Anisoptera (dragonflies)			
Aeshnidae		1	2
Gomphidae		1	
Libellulidae	1		1
Zygoptera (damselflies)			
Calopterygidae		1	
Coenagrionidae	48	8	14
Hemiptera (true bugs)			
Belostomatidae	1		
Corixidae	1	38	11
Gerridae			1
Mesoveliidae	4	1	3
Pleidae	13	1	4
Trichoptera (caddisflies)			
Helicopsychidae		65	60
Hydropsychidae		2	2
Hydroptilidae			1
Leptoceridae		7	3
Limnephilidae		5	
Phryganeidae		2	4
Coleoptera (beetles)			
Dytiscidae (total)	3	2	
Gyrinidae (adults)			2
Haliplidae (adults)	21		3
Hydrophilidae (total)	2		
Dryopidae		2	
Elmidae	7	1	6
Gyrinidae (larvae)		1	2
Haliplidae (larvae)	1	1	8
Diptera (flies)			
Ceratopogonidae	23	2	7
Chironomidae	13	19	69
Culicidae			1
Dixidae		1	
Tipulidae			1
<b>MOLLUSCA</b>			
Gastropoda (snails)			
Hydrobiidae	1		2
Lymnaeidae	10	48	4
Physidae		30	93
Planorbidae	3	29	24

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan  
June-August 2018**

	<b>Pinnebog River</b> McMillan Rd	<b>Grant Creek</b> Grindstone Road	<b>Elm Creek</b> Eppenbrock Road
	<b>Station 5</b>	<b>Station 6</b>	<b>Station 7</b>
<b>TAXA</b>			
Pelecypoda (bivalves)			
Pisidiidae	3	1	
Unionidae (mussels)			1
<b>TOTAL INDIVIDUALS</b>	<b>282</b>	<b>286</b>	<b>343</b>

Table 6b. Qualitative macroinvertebrate community sampling results at selected stations in the Pigeon River and Cherry Creek watershed, 2018.

	<b>Pinnebog River</b> McMillan Rd		<b>Grant Creek</b> Grindstone Road		<b>Elm Creek</b> Eppenbrock Road	
	<b>Station 5</b>		<b>Station 6</b>		<b>Station 7</b>	
<b>METRIC</b>	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	23	1	29	1	30	1
NUMBER OF MAYFLY TAXA	1	0	2	1	4	1
NUMBER OF CADDISFLY TAXA	0	-1	5	1	5	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	0.35	-1	4.55	-1	3.50	-1
PERCENT CADDISFLY COMPOSITION	0.00	-1	28.32	1	20.41	0
PERCENT DOMINANT TAXON	30.85	-1	22.73	-1	27.11	-1
PERCENT ISOPOD, SNAIL, LEECH	36.88	-1	38.11	-1	35.86	-1
PERCENT SURFACE AIR BREATHERS	15.96	0	14.69	0	7.29	1
<b>TOTAL SCORE</b>		-5		0		0
<b>MACROINVERTEBRATE COMMUNITY RATING</b>	<b>Poor</b>		<b>Acceptable</b>		<b>Acceptable</b>	

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan**  
**June-August 2018**

Table 6a. Qualitative macroinvertebrate community sampling results at selected stations in the Pigeon River and Cherry Creek watershed, 2018.

	<b>Pigeon River Kinde Rd Upstream WWSL</b>	<b>Pigeon River Caseville WWSL, at facility</b>	<b>Bad Axe Creek Upstream of Bad Axe WWTP</b>	<b>Bad Axe Creek Downstream Bad Axe WWTP</b>
	<b>Station 8</b>	<b>Station 9</b>	<b>Station 10</b>	<b>Station 11</b>
<b>TAXA</b>				
PLATYHELMINTHES (flatworms)				
Turbellaria	4	2	2	5
ANNELIDA (segmented worms)				
Hirudinea (leeches)	2	1	6	
Oligochaeta (worms)	1	1	12	12
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	35	26	2	1
Decapoda (crayfish)	1	1		1
Isopoda (sowbugs)	8	1	1	1
Arachnoidea				
Hydracarina	5	6	35	16
Insecta				
Ephemeroptera (mayflies)				
Baetidae	3		1	1
Caenidae	24	82	4	3
Heptageniidae	4			
Tricorythidae	31	1		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1		3
Macromiidae		1		
Zygoptera (damselflies)				
Calopterygidae		2	10	4
Coenagrionidae	15	53	49	103
Hemiptera (true bugs)				
Belostomatidae	4	1		
Corixidae	2	1	2	
Gerridae	1		1	1
Nepidae	1	1	1	
Notonectidae	1			
Pleidae	3	13		
Veliidae				2
Trichoptera (caddisflies)				
Hydropsychidae	26	1	2	4
Hydroptilidae		2		
Leptoceridae	5	17		
Phryganeidae			1	

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan**  
**June-August 2018**

	<b>Pigeon River Kinde Rd Upstream WWSL</b>	<b>Pigeon River Caseville WWSL, at facility</b>	<b>Bad Axe Creek Upstream of Bad Axe WWTP</b>	<b>Bad Axe Creek Downstream Bad Axe WWTP</b>
	<b>Station 8</b>	<b>Station 9</b>	<b>Station 10</b>	<b>Station 11</b>
<b>TAXA</b>				
Polycentropodidae		1		
Coleoptera (beetles)				
Dytiscidae (total)		1	2	
Haliplidae (adults)	8	26	3	10
Hydrophilidae (total)	5		3	
Elmidae	2	4	8	19
Diptera (flies)				
Ceratopogonidae		4		
Chironomidae	110	41	107	62
Culicidae			2	
Dixidae			2	1
Simuliidae	1			
Stratiomyidae			2	
Tabanidae			1	
<b>MOLLUSCA</b>				
Gastropoda (snails)				
Ancylidae (limpets)			1	
Physidae	1	3	2	2
Planorbidae		2		
Pelecypoda (bivalves)				
Pisidiidae	1		1	
<b>TOTAL INDIVIDUALS</b>	<b>305</b>	<b>296</b>	<b>263</b>	<b>251</b>

**Biosurvey of the Pigeon River and Cherry Creek Watersheds, Michigan  
June-August 2018**

Table 6b. Qualitative macroinvertebrate community sampling results at selected stations in the Pigeon River and Cherry Creek watershed, 2018.

	<b>Pigeon River Kinde Rd Upstream Caseville WWSL</b>		<b>Pigeon River Downstream Caseville WWSL</b>		<b>Bad Axe Creek Upstream Bad Axe WWTP</b>		<b>Bad Axe Creek Downstream Bad Axe WWTP</b>	
	<b>Station 8</b>		<b>Station 9</b>		<b>Station 10</b>		<b>Station 11</b>	
<b>METRIC</b>	<b>Value</b>	<b>Score</b>	<b>Value</b>	<b>Score</b>	<b>Value</b>	<b>Score</b>	<b>Value</b>	<b>Score</b>
TOTAL NUMBER OF TAXA	28	0	28	0	27	0	19	0
NUMBER OF MAYFLY TAXA	4	1	2	0	2	1	2	1
NUMBER OF CADDISFLY TAXA	2	0	4	1	2	0	1	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	20.33	0	28.04	1	1.90	-1	1.59	-1
PERCENT CADDISFLY COMPOSTITION	10.16	0	7.09	0	1.14	-1	1.59	-1
PERCENT DOMINANT TAXON	36.07	-1	27.70	-1	40.68	-1	41.04	-1
PERCENT ISOPOD, SNAIL, LEECH	3.61	1	2.36	1	3.80	1	1.20	1
PERCENT SURFACE AIR BREATHERS	8.20	1	14.53	0	6.08	1	5.18	1
<b>TOTAL SCORE</b>		1		1		-1		-2
<b>MACROINVERTEBRATE COMMUNITY RATING</b>	<b>Acceptable</b>		<b>Acceptable</b>		<b>Acceptable</b>		<b>Acceptable</b>	