MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
AUGUST 2017

STAFF REPORT

Biological surveys from the Cheboygan, Black, Thunder Bay, Swan, Ocqueoc, and Little Black Rivers watersheds within Michigan's Northeastern Lower Peninsula, located in Alpena, Alcona, Cheboygan, Emmet, Montmorency, Oscoda, Otsego, and Presque Isle Counties, August and September 2015.

Introduction

Biological and physical habitat conditions from various watersheds within Michigan's Northeastern Lower Peninsula located in Alpena, Alcona, Cheboygan, Emmet, Montmorency, Oscoda, Otsego, and Presque Isle Counties were assessed by staff of the Michigan Department of Environmental Quality (MDEQ), Surface Water Assessment Section (SWAS), in August and September 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 (WQS) are being met.
2) Evaluate biological community temporal trends.
3) Address monitoring requests submitted by internal and external customers.
4) Collect water quality data needed for Total Maximum Daily Load development and address nonattainment listings described in the 2014 Integrated Report (Goodwin, 2014).
5) Monitor invasive species.

Watershed Information

The Black, Cheboygan, Long Lake-Ocqueoc, and Thunder Bay Rivers watersheds sample locations were all located in the United States Environmental Protection Agency (USEPA) Level III Northern Lakes and Forest ecoregion (Omernik & Gallant, 1988) except for Site 5, Sturgeon River at Whitmarsh Road. This sampling location was located in the USEPA Level III North Central Hardwood Forests (NCHF) ecoregion (Omernik & Gallant, 1988) (Figure 1). In general, the soils in the NCHF ecoregion are generally sandy soils with some rocky areas near the Lake Huron lakeshore. Agriculture and pasture land can be intensive in the loamier portions of the ecoregion; however, along the lakeshore thinner glacial drift exposes limestone, dolomite, and gypsum, which are mined and used locally. The underlying bedrock is a source for salt, brine, and petroleum reservoirs. The topography is rolling to moderately sloping, the drumlin areas are separated by poorly drained outwashes, and karst topography is also present near the lakeshore. The predominant land use for each watershed can be found below in Table 1.

The Cheboygan River watershed is composed of several larger coldwater rivers systems including the Crooked, Sturgeon, and Pigeon Rivers (Appendix A). These watersheds cover approximately 1,493 square miles within Emmet, Cheboygan, Charlevoix, and Otsego Counties (Godby, 2015) and cover an area from Gaylord to Cheboygan before emptying into Lake Huron.

Silver Creek Pond is the only listed warmwater body located within this watershed (Michigan Department of Natural Resources [MDNR], 1997).

The Black River watershed has an area of 600 square miles within the counties of Cheboygan, Montmorency, Otsego, and Presque Isle in northeastern Lower Michigan. The river originates approximately 40 miles upstream from its confluence with the Cheboygan River, which empties into Lake Huron approximately 3.5 miles downstream of the convergence, in the town of Cheboygan. Using the Designated Trout Streams for the State of Michigan list (MDNR, 1997; DFI-101-97), the Black River was generally listed as a warmwater system with a seven mile stretch, from the Kleber Dam to Red Bridge Road, the only section designated as coldwater. However, the updated version of the list (MDNR, 2013; FO-210.13) recognizes the Black River and all connecting tributaries upstream of the Tower Pond Dam as designated coldwater systems (Appendix A).

The Thunder Bay River is generally a warmwater system. The headwater tributaries, along with a small section below the Ninth Street Dam (in the town of Alpena) are designated as coldwater trout streams (MDNR, 1997; Appendix A). The Thunder Bay River covers an area of approximately 1,250 square miles and drains portions of Alpena, Alcona, Oscoda, Montmorency, and Presque Isle Counties. The Thunder Bay River originates from the outlet of McCormick Lake, seven miles northeast of Lewiston and travels more than 40 miles east until empting into Thunder Bay, which is part of Lake Huron (Cwalinski et al., 2006).

The Long Lake-Ocqueoc River watershed extends from the city of Alpena and follows the Lake Huron coast up to Mackinaw City. This watershed is composed of the Ocqueoc River, which originates approximately 20 miles upstream from its confluence with Lake Huron, in Horseshoe Lake, southwest of the town of Hawks and is generally a coldwater designated stream up to Lower Barnhart Lake (MDNR, 1997). Several warmwater coastal systems also drain directly to Lake Huron along this shoreline. A list of the coldwater systems can be found in the Designated Trout Streams for the State of Michigan list (MDNR, 1997; Appendix A). This watershed is approximately 1,034 square miles and is located in Alpena, Cheboygan, and Presque Isle Counties.

Historical Sampling Efforts and Information

Black River Watershed

Biological, chemical, and physical habitat surveys were performed during the 2000 field season in which macroinvertebrate communities rated acceptable to excellent, habitat quality rated good to excellent, and no chemicals measured above WQS (Lipsey, 2004). In October 2004, biological and water chemistry surveys were conducted using the Surface Water Assessment Section Procedure 51 (MDEQ, 1990) to assess the impacts associated with the proposed Onaway Wastewater Treatment Plant (WWTP) discharge to Bowen Creek, assess the current status and condition of individual water bodies, and determine whether Michigan WQS were being met. The macroinvertebrate community rated acceptable with good habitat quality. No chemicals were measured at levels above WQS (Schmitt, 2005). During the summer of 2005, Procedure 51 biological and water chemistry assessments were performed in the Black River watershed. The macroinvertebrate community rated acceptable to excellent with habitat quality rating marginal to good. No chemicals were measured at levels above WQS. The fish community was found to be meeting its coldwater fishery designated use on the Upper Black River (Walker, 2008d).

Cheboygan River Watershed

This watershed has a long history of Procedure 51 surveys. During the summer of 1994, a biological survey was performed on the Pigeon River and Mullett Creek to assess impacts from land use practices and to collect data prior to best management practices implementation. The fish community rated good at all stations, the macroinvertebrate community rated fair to good, and the habitat quality rated poor to excellent (Morse, 1996a). In August 2000, the upper Sturgeon River watershed was surveyed to document water quality conditions, identify nonpoint source impairments, and determine attainment status of WQS. The macroinvertebrate community rated acceptable to excellent with habitat quality rating good to excellent. No chemicals were measured at levels above WQS (Taft, 2002). In August 2001, the West Branch Sturgeon River was surveyed to collect baseline data prior to road/stream crossing improvements. The macroinvertebrate community was rated acceptable with habitat quality rating excellent. It was found that the impacts from the road/stream crossings may be localized and do not extend long distances (Kohlhepp, 2001). During the summer of 2005, several biological surveys and water chemistry assessments were performed within this watershed (Sturgeon, Pigeon, and Maple River watersheds). Macroinvertebrate community surveys within these waterseds rated acceptable to excellent, habitat quality rated good to excellent, and water chemistry data indicated no chemicals measured above WQS (Walker, 2007; 2008a; 200b; and 2008c). In 2008, SWAS staff surveyed the impoundment on the Pigeon River owned and operated by the Song of the Morning Ranch to calculate a preliminary estimate of sediment volume held behind the dam and to determine how much sediment could be lost if the dam was removed (Sunday, 2008).

Thunder Bay River Watershed

In May and August 1995, biological surveys were conducted in the Thunder Bay River watershed. The surveys found that the fish community rated excellent at three sites, the macroinvertebrate community was rated acceptable to excellent at all stations surveyed, and the habitat quality rated poor to excellent. Water chemistry results found no exceedances of WQS with the exception of one site with elevated zinc concentrations (Morse, 1997). During the summer of 2000, biological surveys were performed in the Thunder Bay River watershed. The macroinvertebrate community rated acceptable to excellent. Water chemistry monitoring found that no chemicals were measured at levels above WQS (Taft, 2003.).

Long Lake – Ocqueoc River Watershed

In July 1995, biological surveys were conducted on the Little Ocqueoc River, Silver Creek, and an Unnamed Creek as part of point and nonpoint source monitoring activities. Fish communities rated good to excellent, macroinvertebrate communities rated fair to good, and the habitat quality rated good to excellent. No chemicals were measured at levels above WQS (Morse, 1996b). In 2000, biological, chemical, and physical habitat surveys were again performed at nine sites in the Ocqueoc River watershed. The macroinvertebrate community rated acceptable to excellent, the habitat quality rated good to excellent, and no chemicals were measured above WQS (Lipsey, 2004). During the summer of 2006, biological, chemical, and physical habitat surveys were performed in the Ocqueoc, Trout, Little Trout, and Swan Rivers watersheds. The macroinvertebrate community rated acceptable to excellent and the habitat quality rated marginal to excellent. No chemicals were measured at levels above WQS (Schmitt, 2006). Also during the summer of 2006, SWAS staff investigated water quality conditions in Newton Creek near the vicinity of the cement kiln dust pile owned by the National Gypsum Company near Alpena, Michigan. Water chemistry and aquatic toxicity monitoring

indicate WQS exceedances for pH, cadmium, mercury, molybdenum, selenium, thallium, vanadium, and total dissolved solids. Water from Newton Creek was also found to be acutely toxic to *Daphnia magna* and *Pimephales promelas* (Dimond and Schmitt, 2007). This investigation was followed-up in 2007, when SWAS staff revisited Newton Creek near the vicinity of the cement kiln dust pile owned by the National Gypsum Company. Water chemistry monitoring indicated exceedances of pH, total dissolved solids, and mercury (Schmitt, 2008).

Northeast Michigan Watersheds

During the summer of 2010, the Black, Cheboygan, Ocqueoc, Swan, Little Black, and Thunder Bay Rivers watersheds were combined into one survey period. Assessments were completed at 33 stations and the macroinvertebrate community rated from poor to excellent with habitat quality rating marginal to excellent. The poor rating was from the Thunder Bay River at Bagley Road where it was determined that SWAS Procedure 22 was not appropriate since this location was downstream of the Ninth Street Dam and was observed as a lentic system. No water chemistries were collected during this monitoring cycle (Noffke, 2011).

Methods

The macroinvertebrate community and physical habitat were qualitatively assessed at 30 stations (Table 2) using Procedure 51 for wadeable streams. If a station is at a road crossing, it is sampled upstream unless otherwise noted. The macroinvertebrate and fish communities were assessed and scored with metrics that rate water bodies from excellent (+5 to +9 [macroinvertebrates]; +5 to +10 [fish]) to poor (-5 to -9 [macroinvertebrates]; -5 to -10 [fish]). Scores from +4 to -4 are rated acceptable. Negative scores in the acceptable range are considered tending towards a poor rating, while positive scores in the acceptable range are tending towards an excellent rating. Habitat evaluations are based on 10 metrics, with a maximum total score of 200. A station habitat score of >154 is characterized as having excellent habitat, 105-154 is good, 56-104 is marginal, and <56 is poor. Where available, macroinvertebrate community scores are used to determine attainment of the Other Indigenous Aquatic Life and Wildlife (OIALW) designated use and fish community scores are used to assess attainment of the relevant fish designated use. Habitat scores and individual metrics are used to help better understand the biological community scores.

The macroinvertebrate community and physical habitat was qualitatively assessed at one station (Table 2) using the SWAS Procedure 22 (MDEQ, 2013), Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers. Using Procedure 22, the range of scores possible for macroinvertebrate community metrics is 0-100 with scores from 26-100 typically representing communities meeting WQS. Only the macroinvertebrate community scores are used to determine attainability of the OIALW designated use.

All macroinvertebrate and habitat stream evaluations can be found in their entirety in Appendix B (Procedure 51 Wadeable Macroinvertebrate Community calculations), Appendix C (Procedure 51 Habitat Evaluation calculations), and Appendix D (Procedure 22 Nonwadeable Macroinvertebrate Community calculations).

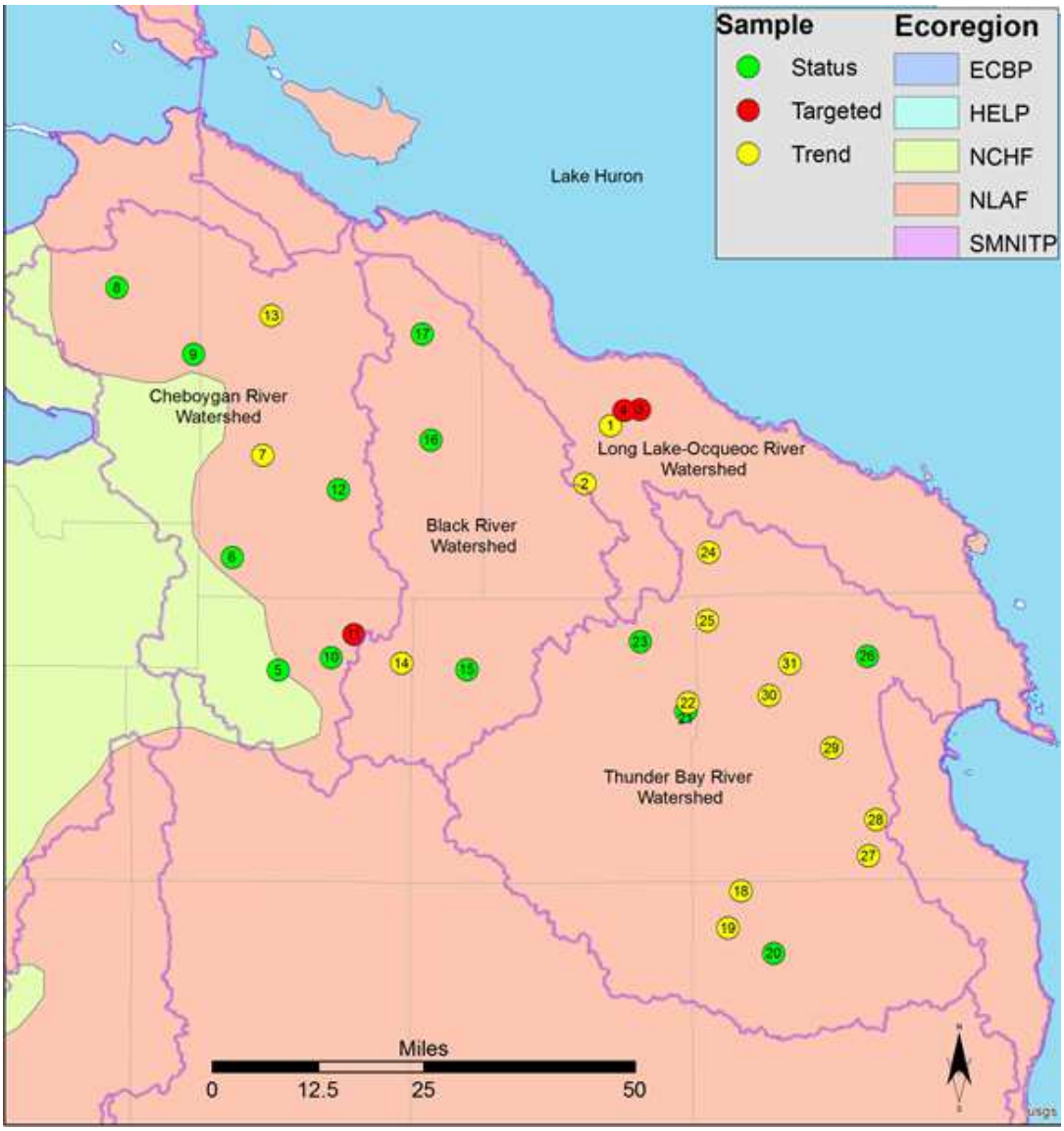

Figure 1. 2015 sampling locations within the USEPA Level III ecoregions.

Table 1. Land use summary for the Northeast Michigan watersheds.

Watershed	Natural	Developed	Cultivated Agriculture	Hay or Pasture	Water	Wetlands
Thunder Bay River	52%	6%	5%	5%	3%	29%
Cheboygan River	60%	7%	7%	1%	8%	17%
Black River	59%	5%	3%	2%	4%	27%
Long Lake-Ocqueoc River	42%	5%	4%	5%	4%	40%

Site Selection

Two site-selection methods were used to assess the Northeastern Michigan River watersheds in 2015: (1) stratified random; and (2) targeted. Twenty-eight randomly selected sites were assigned to support the SWAS Status (13 sites; including the nonwadeable site) and Trend (15 sites) Program with two trend sites doubling as status sites due to the random selection of status sites. These sites will be used to estimate the watershed attainment status for the OIALW designated use component of Rule 100 (R 323.1100(e)) of the Part 4 Rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, and will be used as baseline data to facilitate a measurement of biological community temporal trends (MDEQ, 2015).

Three stations within the Cheboygan, Black, Thunder Bay, Swan, Ocqueoc, and Little Black Rivers watersheds were selected for ***targeted*** monitoring to support and answer concerns of stakeholders or staff, bringing the total field sampling to 31 sites (Table 2).

Summary of Findings by Monitoring Objective

Objective 1: Assess the current status and condition of individual waters of the state and determine whether Michigan WQS are being met.

During the 2015 field season, 31 stations were evaluated for the OIALW designated use within the Northeast Michigan watershed group (which includes the Cheboygan, Black, Thunder Bay, Swan, and Ocqueoc Rivers watersheds). All individual stations met the OIALW designated use with macroinvertebrate community ratings of >-4 and habitat assessment ratings of >56. Of the 31 total stations sampled, the 14 probabilistic sample locations were evaluated to support the watershed attainment status calculation. Based on this probabilistic monitoring, 100 percent of the randomly selected sites supported the OIALW designated use component of the Michigan WQS using Procedure 51. Percent attainment was calculated by dividing the number of random sites that met WQS by the total number of random locations ((13/13)*100 = 100 percent) (MDEQ, 2015).

Table 2. Summary of the aquatic habitat and macroinvertebrate community evaluations for selected stations in the Northeastern Michigan watersheds and adjacent Lake Michigan coastal watersheds located in Alpena, Alcona, Cheboygan, Emmet, Montmorency, Oscoda, Otsego, and Presque Isle Counties, August and September 2015. Site ID 5 is located in the North Central Hardwood Forest Ecoregion; the remaining sites are located within the Northern Lakes and Forest Ecoregion.

SITE ID	STREAM NAME	LOCATION	STORET	COUNTY	TRS	TOWNSHIP	LATITUDE	LONGITUDE	Habitat Evaluation		Macroinvertebrate Community		S/T/Tr	AUID
									Rating	Score	Rating	Score		
1	Little Ocqueoc River	Silver Creek Road	710081	Presque Isle	35N03E23	Ocqueoc	45.40731	-84.02871	Excellent	173	Acceptable	4	S, Tr	040700030203-01
2	Ocqueoc River	Walker Highway	710083	Presque Isle	34N03E16	Case	45.33767	-84.07298	Good	150	Excellent	5	Tr	040700030204-01
3	Silver Creek	Upstream of Beech Grove/Silver Creek crossing (eastern most)	710163	Presque Isle	35N04E17	Moltke	45.42676	-83.97912	Excellent	178	Acceptable	4	T	040700030205-01
4	Silver Creek	Downstream of last driveway on Beech Grove Highway over Silver Creek	710164	Presque Isle	35N04E18	Moltke	45.42545	-84.00592	Excellent	175	Excellent	6	T	040700030205-01
5	Sturgeon River	Whitmarsh Road	690139	Otsego	32N02W31	Corwith	45.11269	-84.59734	Excellent	165	Acceptable	0	S	040700040104-01
6	West Branch Sturgeon River	McEachron Road	160265	Cheboygan	33N03W16	Wilmot	45.24887	-84.67665	Excellent	179	Excellent	5	S	040700040105-01
7	Sturgeon River	White Road	160183	Cheboygan	34N03W01	Mentor	45.37203	-84.62426	Excellent	174	Excellent	6	Tr	040700040107-01
8	West Branch Maple River	Pleasantville Road	240204	Emmet	37N05W25	Center	45.57310	-84.87334	Excellent	159	Acceptable	2	S	040700040206-01
9	Maple River	Brutus Road	240203	Emmet	36N04W24	Maple River	45.49324	-84.74230	Good	154	Acceptable	3	S	040700040207-01
10	Pigeon River	Old Vanderbilt Road	690145	Otsego	32N02W25	Corwith	45.12815	-84.50679	Excellent	188	Excellent	6	S	040700040302-01
11	Pigeon River	Sturgeon Valley Road (Below Song of the Morning Ranch)	690142	Otsego	32N01W20	Corwith	45.15578	-84.46818	Good	151	Excellent	6	T	040700040303-01
12	Pigeon River	Pigeon River Road	160024	Cheboygan	34N02W24	Ellis	45.33044	-84.49493	Excellent	176	Excellent	6	S	040700040307-01
13	Mullett Creek	South Extension Road	160180	Cheboygan	36N03W01	Mullett	45.53964	-84.60955	Good	138	Acceptable	1	Tr	040700040402-01
14	Black River	off Chandler Dam Road	690161	Otsego	32N01W36	Corwith	45.12100	-84.38663	Excellent	157	Excellent	6	Tr	040700050202-01

Table 2. cont.

									Habitat Evaluation		Macroinvertebrate Community			
SITE ID	STREAM NAME	LOCATION	STORET	COUNTY	TRS	TOWNSHIP	LATITUDE	LONGITUDE	Rating	Score	Rating	Score	S/T/Tr	AUID
15	East Branch Black River	2-trk off Shingle Mill Road	600083	Montmorency	32N01E35	Montmorency	45.11371	-84.27458	Good	145	Excellent	7	S	040700050203-01
16	Milligan Creek	Two-track off Klieber Road	160257	Cheboygan	35N01E29	Waverly	45.39024	-84.33640	Excellent	196	Excellent	6	S	040700050212-01
17	Black River	Black River Road		Cheboygan	36N01E07	Grant	45.51725	-84.35095	NA	NA	Good	55	S-NW	040700050303-02
18	Indian Creek	VanWagoner Road	10129	Alcona	28N05E02	Mitchell	44.84553	-83.80598	Excellent	167	Acceptable	2	Tr	040700060101-01
19	McGinn Creek	M-65	10128	Alcona	28N05E21	Mitchell	44.80058	-83.82836	Excellent	164	Excellent	6	Tr	040700060102-01
20	Wildcat Creek	Hubbard Lake Trail	010136	Alcona	27N06E06	Mitchell	44.77003	-83.75041	Good	153	Excellent	6	S	040700060103-01
21	Thunder Bay River	State Street	600085	Montmorency	31N04E23	Hillman	45.06378	-83.89989	Good	154	Excellent	5	S	040700060310-01
22	Anchor Creek	Carrier Road	600077	Montmorency	31N04E24	Hillman	45.07346	-83.89644	Good	142	Acceptable	3	S, Tr	040700060310-01
23	Long Lake Creek	County Road 628	600084	Montmorency	32N04E20	Montmorency	45.14719	-83.97809	Good	152	Acceptable	1	S	040700060401-01
24	Quinn Creek	Finley Road	710159	Presque Isle	33N05E18	Metz	45.25475	-83.86155	Good	150	Acceptable	-3	Tr	040700060402-01
25	N B Thunder Bay River	Truax Road	040183	Alpena	32N05E18	Wellington	45.17237	-83.86364	Good	136	Acceptable	2	Tr	040700060403-01
26	North Branch Thunder Bay River	Long Rapids Road	040196	Alpena	32N07E33	Maple Ridge	45.12969	-83.59016	Excellent	164	Acceptable	2	S	040700060405-01
27	Lower S B Thunder Bay River	Hubbard Lake Road	040186	Alpena	29N07E28	Ossineke	44.88824	-83.58732	Excellent	157	Acceptable	1	Tr	040700060505-01
28	Lower S B Thunder Bay River	Beaver Lake Road	040185	Alpena	29N07E10	Ossineke	44.93182	-83.57477	Good	145	Excellent	5	Tr	040700060505-01
29	King Creek	Bussie Road	040187	Alpena	30N06E12	Wilson	45.01878	-83.65073	Good	153	Acceptable	-1	Tr	040700060507-01
30	Thunder Bay River	Salina Road	040042	Alpena	31N05E13	Wellington	45.08249	-83.75754	Good	139	Excellent	6	Tr	040700060603-01
31	Thunder Bay River	M-65	040184	Alpena	32N06E32	Long Rapids	45.12056	-83.72233	Good	153	Acceptable	1	Tr	040700060603-01

S/T/Tr = status, targeted, trend station
NW = Nonwadeable
NA = Not Applicable

Habitat Scoring Wadeable Stations
Poor < 56 Marginal 56-104 Good 105-154 Excellent >154

Macroinvertebrate Scoring Wadeable Stations
Poor < -4 Acceptable -4 to +4 Excellent > +4

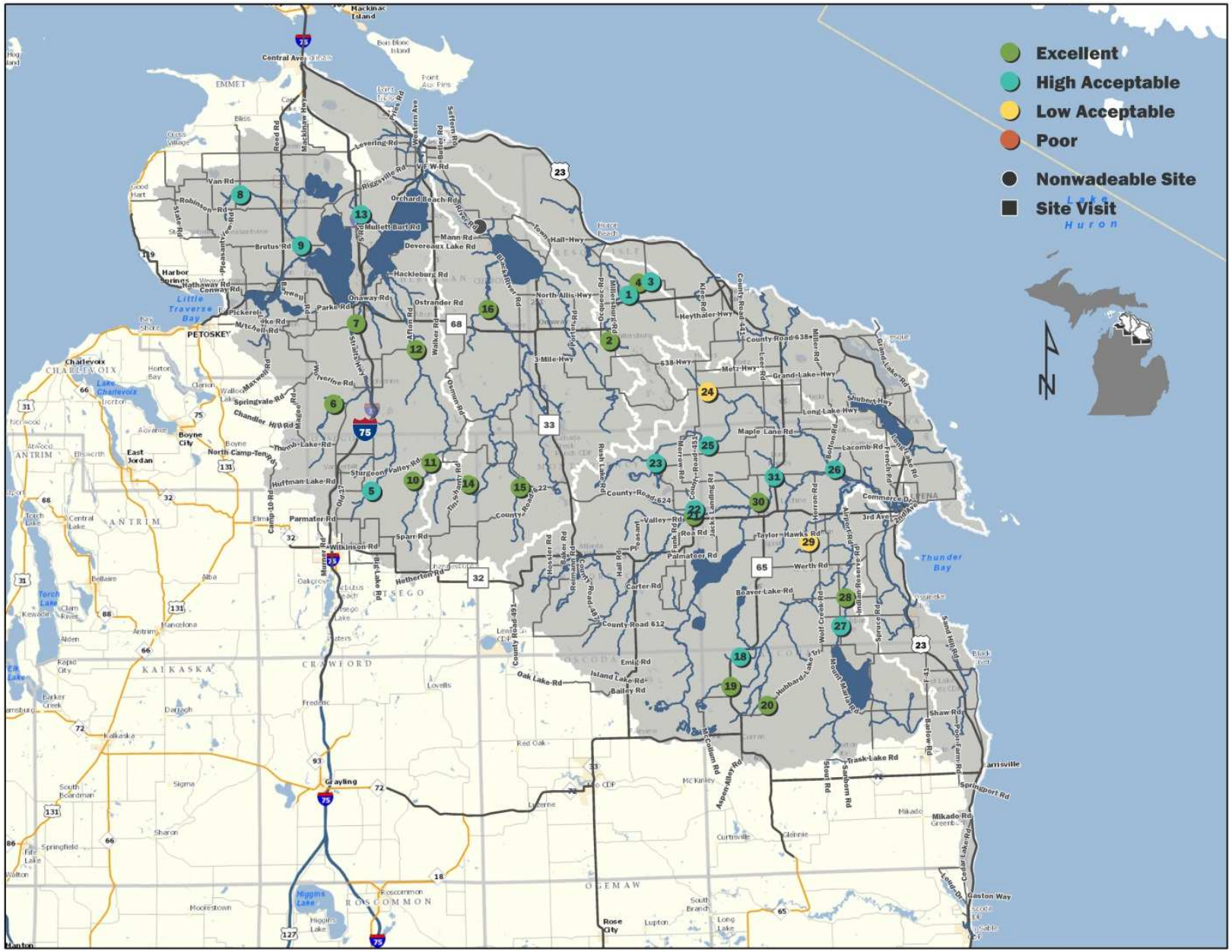

Figure 2. Sample locations within the Northeastern Michigan watersheds, dots represent 2015 aquatic macroinvertebrate community ratings.

Randomly Selected Wadable Locations

CHEBOYGAN WATERSHED

STURGEON RIVER

Figure 3. Sturgeon River at Whitmarsh Road

The Sturgeon River at Whitmarsh Road (Station 5; Figure 3) is located approximately four miles southeast of the village of Vanderbilt near the Treetops Resort. The Sturgeon River is surrounded by forest at this location and was found to have an average width of 27 feet and a depth of 1.4 feet. The flow at this location was estimated at 65.7 cubic feet per second (cfs). Both aquatic macrophytes and overhanging vegetation were absent throughout this riffle/run section of river. However, habitat quality rated excellent (165) along with very heavy amounts of large woody debris present and moderate amounts of undercut banks for macroinvertebrate colonization. Substrates were dominated by sand and silt with patches of gravel and cobble present, which are approximately 25 percent embedded. The macroinvertebrate communities rated acceptable (0) with a total of 25 different taxa identified within this reach. Twenty-six percent of the total individuals identified at this location were composed of Ephemeroptera, Plecoptera, and Trichoptera (EPT), and dominated by Amphipods and Chironomids.

WEST BRANCH STURGEON RIVER

The West Branch Sturgeon River at McEachron Road (Station 6) is located approximately one mile upstream of the Marl Creek confluence and four miles southwest of the village of Wolverine. This location is also a popular canoe landing with several canoers observed during the survey. The West Branch Sturgeon River was found to have an average width of 27 feet with an average flow of 23.4 cfs. Sediments throughout this reach were an even mix of gravel and sand with small portions of cobble and silt mixed in. Within this glide/pool section, habitat was found to be excellent (179) with large woody debris and aquatic macrophytes found to be moderately available with undercut banks, overhanging vegetation, and rootwads sparsely available for macroinvertebrate colonization. Stream banks at this location were found to have excellent vegetative protection and zone width, with most vegetation allowed to grow naturally with no human influences within 150 feet. Macroinvertebrate communities rate excellent as well with 84 percent of the total individuals composed of the EPT taxa. The dominant taxa within this reach were Brachycentrids and Limnephilids.

WEST BRANCH MAPLE RIVER

Figure 4. West Branch Maple River at Pleasantview Road.

The West Branch Maple River was surveyed at Pleasantview Road (Station 8; Figure 4), approximately four miles upstream of the Emmet County Airport and village of Pellston. The river originates just upstream of the sample location in the Pleasant View Swamp and has an average width of 28 feet and depth of 3 feet, with an estimated flow of 41.7 cfs. Habitat quality rated excellent (159) with heavy to very heavy availability of large woody debris, aquatic macrophytes, and overhanging vegetation, respectively. Cladophora was very heavy at this location covering approximately 75 percent of the stream width but was not considered a nuisance. Pools were large and deep with the substrates dominated by sand and silt. All in-stream vegetation was observed to have a thin layer of silt covering the available habitat. Along the riparian zone, shrubby vegetation was heavy but missing large trees, with the road and a residential house within 100 feet of river. The macroinvertebrate community rated acceptable (2) with 34 taxa identified within this reach. Twenty-three percent of the total individuals identified at this location were either Ephemeroptera or Trichoptera. No Plecoptera were found at this location. The dominant taxa within this reach were Amphipods and Isopods.

MAPLE RIVER

The Maple River at the Brutus Road (Station 9) sampling location is approximately four miles southeast of the village of Pellston and about 1.5 miles upstream of the mouth, where the river empties into Maple Bay on the west side of Burt Lake. The Maple River had a width of 44 feet and flow of approximately 134 cfs. Sediments were dominated by sand and gravel with moderate amounts of macrophytes present throughout this site. In-stream habitat within the active channel was moderate for large woody debris but sparse for undercut banks, overhanging vegetation, and rootwads. The riparian vegetative zone width was excellent on the right bank but poor on the left bank due to a private residence along the edge of the river. Riffles were present only occasionally in this stretch with embeddedness ranging from 25-50 percent of the gravelly substrate surrounded by fine sediments. Habitat rated good (154) with the macroinvertebrate community rating acceptable (3). Forty-one taxa were identified in which 37 percent of the individuals were from the EPT taxa. The dominant taxa were comprised of Physids and Isopods.

PIGEON RIVER

The Pigeon River was sampled at two stations (10 and 12). The most upstream station was at Old Vanderbilt Road (Station 10), upstream of the Song of the Moring Ranch. Station 12 was located at Pigeon River Road approximately 14 miles downstream of Station 10.

The riffle run habitat at Old Vanderbilt Road (Station 10; Figure 5) rated excellent (188) with substrates composed mainly of gravel, cobble, and sand that was less than 25 percent embedded due to swift currents. Watercress was observed sparsely as in-stream vegetation with undercut banks, overhanging vegetation, and rootwads occurring moderately. Large woody debris was very heavy throughout this section providing ample structure for macroinvertebrate colonization. Width was found to be approximately 29 feet with average depth of 1.5 feet and flow of 132 cfs. Macroinvertebrate communities rated excellent (6), dominated by Hydropsychids, with 86 percent identified as EPT taxa.

Figure 5. Pigeon River at Old Vanderbilt Road.

The Pigeon River at Pigeon River Road (Station 12) was also found to have excellent habitat (176). Substrates were composed mainly of sand, gravel, and cobble with embeddedness less than 25 percent. Some new increase in bar formation was also observed throughout this reach. Macrophytes, undercut banks, and rootwads were all found to be sparse throughout this reach. However, overhanging vegetation and large woody debris was found moderately available for macroinvertebrate colonization. The riparian vegetative zone width was excellent on both banks with a good mix of trees, understory, and non-woody vegetation. Macroinvertebrate communities were rated excellent (6) with 48 percent of the total individuals composed of EPT taxa. The dominant taxa within this reach were Chironomids and Elmids.

BLACK RIVER WATERSHED

EAST BRANCH BLACK RIVER

Figure 6. East Branch Black River off Shingle Mill Road.

The East Branch Black River off Shingle Mill Road (Station 15; Figure 6) is located approximately 10 miles northwest of the village of Atlanta. The river originates about four miles upstream of the sample location in the Green Swamp. The East Branch Black River has an average width of 23 feet and average depth of 1.8 feet. Flow at this location was estimated at 49.3 cfs. Substrates were composed mainly of sand and silt with small areas of cobble and gravel. Habitat quality rated good (145) with overhanging vegetation very heavy throughout this site. Large woody debris was moderately available and rootwads were sparse at this site. The riparian vegetative zone width was found to be marginal on the right bank due to the road running alongside the river. The right bank vegetative zone was excellent with the margins dominated by native vegetation. The right bank was found to me moderately stable with small areas of erosion present during periods of high water. Thirty-four total macroinvertebrate taxa were identified, resulting an a rating of excellent (7). Fifty-three percent of the individuals were composed of the EPT taxa and the dominant taxa within this reach were Bracycentrids and Chironomids.

MILLIGAN CREEK

Figure 7. Milliken Creek at two-track (North Eastern State Trail) off Kleber Road.

Milligan Creek at North Eastern State Trail (Station 6; Figure 7), immediately west of Kleber Dam, six miles northwest of the town of Onaway, is 0.25 miles upstream of the confluence with the Upper Black River. The North Eastern State Trail is a 71-mile bicycle trail which connects the cities of Alpena and Cheboygan on the former Detroit and Mackinaw Railway. Milligan Creek at this location is approximately 23-feet wide with a depth of approximately 5 inches and estimated flow of 19 cfs. Substrates were composed mainly of bedrock and cobble with very little fine sediment or organics throughout the reach due to high velocities. Habitat rated excellent (196) with undercut banks, overhanging vegetation, large woody debris, and rootwads all sparsely available. Stream bank vegetation and vegetative width was found to be excellent with very little human impacts along the riparian zones. The macroinvertebrate community rated excellent (6) with 34

total taxa, dominated by Hydropsychids and Perlids. EPT taxa composed 74 percent of the total individuals identified in the sample.

THUNDER BAY RIVER WATERSHED

WILDCAT CREEK

Wildcat Creek at Hubbard Lake Trail (Station 20; Figure 8) is located approximately five miles northeast of the town of Curran in Alcona County. The estimated flow within the creek at this location was approximately 12.5 cfs and was measured at 15-feet wide and 8-inches deep. Substrates were found to be dominated by sand and silt with some new formation of in-stream bars. Aquatic vegetation was found to be sparse and stream bank vegetation good with the absence of large trees along the margin. Overhanging vegetation, undercut banks, and large woody debris were moderately present for macroinvertebrate colonization, resulting in a good habitat rating (153). The macroinvertebrate communities were found to be dominated by Chironomids and Simulids with the EPT taxa composing 49 percent of the total individuals identified, resulting in an excellent rating (6).

Figure 8. Wildcat Creek at Hubbard Lake Trail.

THUNDER BAY RIVER

The Thunder Bay River downstream of State Street (Station 21) is located approximately 0.3 miles downstream of the Hillman Dam in the village of Hillman. The survey location was moved below the State Road Bridge (400 feet) since water depth above the road was nonwadeable. At this location the Thunder Bay River has a narrow vegetative margin, which gives away to commercial and residential areas along the north bank. The south bank has a greater vegetative width than the north bank due to a forested area within the city limits. The width at this location was found to be 68 feet and had an average depth of 2.1 feet. The flow at this location was estimated at 376 cfs and is regulated by the Hillman Dam. Substrates were dominated by sand and gravel, with gravel sections less than 25 percent embedded, within this predominantly run section of river. Available colonizable structures for macroinvertebrate communities were sparse except for large woody debris, which was found to be moderately available. Habitat quality rated good (154) and macroinvertebrate communities rated excellent (5). A total of 38 different taxa were identified within this reach. Forty percent of the total individuals were composed of EPT and dominated by Hydropsychids and Oligochaetes.

LONG LAKE CREEK

Figure 9. Long Lake Creek at County Road 628.

Long Lake Creek at County Road 628 (Station 23; Figure 9) is located approximately 7.5 miles northwest of the town of Hillman and 0.5 miles downstream of Long Lake Pond. Long Lake Creek had an approximate width of 16 feet and depth of around 1 foot. Flow was estimated at 16 cfs. Substrates were composed mainly of silt and sand with a heavy load of organics throughout the reach and could be the result of an undersized culvert at this location. Habitat rated good (152) with overhanging vegetation very heavy throughout this reach. Large woody debris and aquatic macrophyte availability was moderate for macroinvertebrate colonization with rootwads and undercut banks absent. Stream bank vegetation was good and allowed to grow naturally but had an absence of trees in the flat floodplain which borders the creek. The vegetative width was found to be excellent with very little human impacts along the riparian zones and immediate floodplain. The macroinvertebrate community rated acceptable (1) with the presence of 23 total taxa, dominated by Ephemerellids and Caenids. EPT composed 68 percent of the total individuals identified in the sample.

NORTH BRANCH THUNDER BAY RIVER

The North Branch Thunder Bay River was surveyed approximately 0.6 miles upstream of Long Rapids Road (Station 26), off Bolton Road, near the powerline crossing. The river has an average width of 65 feet, depth of 2 feet, with an estimated flow of 35.1 cfs. Habitat quality rated excellent (164) with moderate availability of undercut banks, overhanging vegetation, and rootwads. Large woody debris and aquatic macrophytes were only sparsely present within this reach. This section was characterized mainly as a slow run with very few riffles or pools. Substrates were dominated by cobble and gravel and embeddedness was less than 25 percent. However, all in-stream structures were observed to have a thin layer of silt covering the available habitat. Along the riparian zone and banks to the east, vegetation was present but a private residence and yard is within 100 feet of the river. The zone to the west also had a private residence but it was located more than 150 feet from the river. The macroinvertebrate community rated acceptable (2) with 34 taxa identified within this reach. Forty-three percent of the total individuals identified were either Ephemeroptera or Trichoptera. No Plecoptera were found at this location. The dominant taxa were Baetids and Tabanids.

RANDOMLY SELECTED NONWADEABLE LOCATION

BLACK RIVER

One location was found to exceed the channel limitations for use of Procedure 51. Therefore, Station 17, Black River at Black River Road, was assessed using SWAS Procedure 22. The reach surveyed is approximately two miles downstream of Black Lake near the village of Manning. The Black River is an impounded river with the Alverno Dam located approximately three miles downstream of the sampling location. Substrates in the upper portion of this section were predominately cobble and gravel with an average depth of 3 feet. Composition of the

substrates changed approximately half way through the reach to fine material. Depths within this section were also a lot deeper with the maximum depth recorded at 14.5 feet. The river banks were found to be stable to moderately stable with moderate riparian vegetation, due to areas of heavy human influence adjacent to the river. In-stream macrophytes were found to be moderate to heavy along the depositional margin areas. Twenty-eight taxa were identified with the macroinvertebrate community rating good (55). Macroinvertebrates were dominated by Amphipods and Isopods, composing 64 percent of the total sample. EPT taxa only composed 15 percent of the sample with no Plecoptera identified.

Objective 2: Evaluate biological community temporal trends.

Fifteen Trend sites (Table 2) were resampled within the Northeastern Michigan watersheds. These sites were randomly selected as Status stations in 2010 and will continue to be sampled every five years. Trend information cannot be summarized until 2020, when a sufficient amount of data has been collected.

Wadeable Trend Locations

LONG LAKE-OCQUEOC WATERSHED

LITTLE OCQUEOC RIVER

The Little Ocqueoc River was sampled at Silver Creek Road (Station 1; Figure 10) approximately one mile east of the confluence with the Ocqueoc River. This station was surveyed both as a Status and a Trend site. The river is 17-feet wide, with an average depth of 5 inches and an estimated flow of 7.4 cfs. Habitat rated excellent (173) with substrates dominated by cobble and gravel throughout this riffle/run section of stream. Aquatic as well as overhanging vegetation was absent with undercut banks, large woody debris, and rootwads sparse throughout this section of river. The vegetative protection along the banks was excellent with all plants allowed to grow naturally. The vegetative zone width was impacted slightly on the left bank with human activity impacting the zone minimally. There was some evidence of bank scour; however, the stream was mostly stable throughout this section. The macroinvertebrate communities were found to be dominated by Elmids and Oligochaetes with EPT taxa composing 27 percent of the total individuals identified, resulting in a final rating of acceptable (4). Since the 2010 survey, the habitat score has improved from 151 to 173, improving the habitat rating from good to excellent. However, the macroinvertebrate community scoring has remained stable (both years at 4) resulting in a rating of acceptable (Noffke, 2011).

Figure 10. Little Ocqueoc River at Silver Creek Road.

OCQUEOC RIVER

Ocqueoc River at Walker Highway (Station 2) is approximately three miles downstream of Upper Barnhart Lake, 0.5 miles west of the town of Millersburg. The Ocqueoc River was found to be approximately 18-feet wide with a depth of around 2 feet; flow was calculated at 55.9 cfs. Substrates were composed mainly of sand and cobble with an even mix of gravel and silt. Organic material was also found to be heavy within the margins and low velocity areas within this glide/pool area. Habitat rated good (150) with overhanging vegetation, large woody debris, and aquatic macrophytes moderately available with sparse undercut banks. Stream bank vegetation was found to be good but missing riparian trees. Vegetative width was excellent on the left bank and good on the right bank due to a private residence located within 150 feet. The macroinvertebrate community rated excellent (5) with the presence of 29 total taxa, dominated by Amphipods and Heptagenids. EPT taxa composed 44 percent of the total individuals identified in the sample. Since the 2010 survey, the habitat score has improved from 120 to 150; however, the rating has remained good. The macroinvertebrate community scoring has remained stable (both years at 5) resulting in a rating of excellent (Noffke, 2011).

CHEBOYGAN WATERSHED

STURGEON RIVER

The Sturgeon River at White Road (Station 7) is located approximately 2.5 miles south of the mouth of the river where it empties into Burt Lake and two miles south of the town of Indian River. This location is also a popular canoe landing with access stairs built into the bank to the river. The Sturgeon River has an average width of 52 feet and average depth of 1.8 feet. Flow at this location was estimated at 338.4 cfs. Substrates were composed mainly of gravel with very little sand present, which might embed the gravel. Habitat quality rated excellent (174) with large woody debris heavily available throughout this site. Undercut banks, overhanging vegetation, and rootwads were present but sparse. The riparian vegetative zone width and vegetative protection on the right banks were both found to be marginal due to a private residence along this side of the river with a manicured yard. The left bank vegetative zone was excellent with the margins dominated by native vegetation but the width was less than 150 feet due to the road. Thirty total macroinvertebrate taxa were identified in which 56 percent of the individuals were composed of the EPT taxa. The dominant taxa within this reach were Hydropsychids and Bracycentrids, the macroinvertebrate community rated excellent (6). Since the 2010 survey, the habitat score has declined slightly from 177 to 174; however, the rating has remained excellent. The macroinvertebrate community scoring has improved slightly (5 to 6) and also remained excellent (Noffke, 2011).

MULLETT CREEK

Mullett Creek was surveyed at South Extension Road (Station 13; Figure 11), approximately 2.5 miles south of the town of Riggsville, where Mullett Creek originates. Mullett Creek empties into Mullett Lake 3.2 miles southeast of the sample location, south of Veery Point. This glide/pool section of wetland stream has an average width of 10 feet, depth of 1 foot, with an estimated flow of 10 cfs. Habitat quality rated good (138) with heavy to very heavy availability of undercut banks and overhanging vegetation. Pools, when available, were small and deep with the substrates dominated by sand and silt. There was moderate rootwad and no submerged vegetation or large woody debris present. However, the free-floating *Lemna sp*. was observed at this location. Long grasses covered the banks and the immediate riparian zone so densely that the bank margins were not visible (Figure 11). No shrubby vegetation or large trees were present along this section of wetland stream. The macroinvertebrate community rated acceptable (1) with 27 taxa identified within this reach. Forty-seven percent of the total individuals identified at this location were composed of EPT taxa. The dominant taxa within this reach were Limnephilids, Baetids, and Chironomids. Since the 2010 survey, the habitat score has improved from 121 to 138; however, the rating has remained good. The macroinvertebrate community rating has declined from excellent (5) to acceptable (1) (Noffke, 2011).

Figure 11. Mullett Creek at South Extension Road.

BLACK RIVER WATERSHED

BLACK RIVER

Figure 12. Black River off Chandler Dam Road.

The Black River off Chandler Dam Road (Station 14; Figure 12) is located approximately 10 miles northeast of the village of Johannesburg. The river originates about five miles upstream of the sample location in the western portion of the Green Swamp in Otsego County. The Black River has an average width of 26 feet and average depth of 1.1 feet. Flow at this location was estimated at 57.8 cfs. Substrates were composed mainly of cobble and sand within this glide/pool section of river. Pools were composed of a mixture of soft sand and silt with moderate detrital material and no submerged aquatic vegetation present. Habitat quality rated excellent (157) with overhanging vegetation availability heavy throughout this site for macroinvertebrate colonization. Large woody debris was moderately available along with sparsely available undercut banks and rootwads. The riparian vegetative zone width was found to be marginal on the left bank due to the grassy upland near the road running alongside the river. The right bank vegetative zone was excellent with the margins dominated by native vegetation allowed to grow naturally. The macroinvertebrate community rated excellent (6) with 32 total macroinvertebrate taxa identified in which 54 percent of the individuals were composed of the EPT taxa. The dominant taxa within this reach were Simulids and Ephemerelids. Since the 2010 survey, the habitat score declined from 173 to 157; however, the rating remained excellent. The macroinvertebrate community scoring increased slightly (5 to 6) but remained excellent (Noffke, 2011).

THUNDER BAY RIVER WATERSHED

INDIAN CREEK

Indian Creek at VanWagoner Road (Station 18) is located approximately ten miles west of the Town of Hubbard Lake. Indian Creek originates about two miles upstream of the sample location in the Oscoda State Forest. The estimated flow within the creek at this location was approximately 4 cfs and was measured at 7-feet wide and 8-inches deep. Substrates were found to be dominated by sand a slight mix of gravel, cobble, and silt in this glide/pool section. Pools were shallow when present with some submerged aquatic vegetation sparsely present. Undercut banks, large woody debris, and rootwads were found to be sparse. Overhanging vegetation was moderately present for macroinvertebrate colonization, resulting in an excellent habitat rating (167). The vegetative riparian zones on both banks were rated excellent with minimal human disturbance and vegetation allowed to grow naturally. The macroinvertebrate communities were found to be dominated by Chironomids and Baetids with the EPT taxa composing 27 percent of the total individuals and 26 taxa identified, resulting in an acceptable rating (2). Since the 2010 survey, the habitat rating has improved from good (153) to excellent

(167) while the macroinvertebrate community rating has declined from excellent (5) to acceptable (2) (Noffke, 2011).

McGinn Creek

McGinn Creek at M-65 (Station 19), is located approximately 6 miles north of the town of Curran and 4 miles downstream of the creek's origin near McCollum Lake. McGinn Creek had an approximate width of 16 feet and depth of around 4 inches. Flow was estimated at 7 cfs. Substrates were composed mainly of sand and silt with a moderate load of organics throughout the reach. Habitat rated excellent (164) with moderate availability of undercut banks for macroinvertebrate colonization. Overhanging vegetation, large woody debris, aquatic macrophytes, and rootwads were all sparse throughout this reach. Stream bank vegetation was excellent and allowed to grow naturally. The vegetative width was found to be excellent with very little human impacts along the riparian zones. The macroinvertebrate community rated excellent (6) with the presence of 37 total taxa, dominated by Chironomids and Simulids. EPT taxa composed 31 percent of the total individuals identified in the sample. Since the 2010 survey, the habitat score has declined slightly from 173 to 164; however, the rating remained excellent. The macroinvertebrate community scoring declined slightly (8 to 6) and also remained excellent (Noffke, 2011).

Anchor Creek

Anchor Creek was sampled at Carrier Road (Station 22), on the north side of the town of Hillman, approximately one mile west of the confluence with the Thunder Bay River. This station was also surveyed as both a Status and Trend site, since the randomly selected Status site was less than 0.1 miles downstream. The river was 10-feet wide with an average depth of 6 inches and estimated flow of 8.9 cfs. Habitat rated good (142) with substrates dominated by sand and cobble throughout this shallow, low flow, riffle/run section. The cobble present at this location was embedded with fine sediment at nearly 50 percent. Aquatic macrophytes were absent with sparsely available undercut banks, overhanging vegetation, large woody debris, and rootwads for macroinvertebrate colonization. The vegetative protection zone and width along the right bank was excellent with all plants allowed to grow naturally with the left bank showing slight disruption by human activities but not effecting full growth. The macroinvertebrate communities were found to be dominated by Amphipods and Hydropsychids with a total of 30 taxa present. The EPT taxa composed 37 percent of the total individuals identified, resulting in a final rating of acceptable (3). Since the 2010 survey, the habitat rating has improved from marginal (94) to good (142) while the macroinvertebrate community rating has declined from excellent (5) to acceptable (3) (Noffke, 2011).

Quinn Creek

Quinn Creek was surveyed at Finley Road (Station 24) approximately 3.5 miles south of the town of Hawks. This glide/pool section had an average width of 15 feet, depth of 1.5 feet, with an estimated flow of 4.2 cfs. Pools were shallow and dominated by firm sediments with no submerged vegetation present. Habitat quality rated good (150); however, a thin layer of silt blanketed all available habitat throughout this reach, limiting the availability of the in-stream habitats. Structure for macroinvertebrate use included undercut banks, large woody debris, aquatic macrophytes, and rootwads, but all were available sparsely. Overhanging vegetation was moderately available. Substrates were dominated by sand and silt with moderate amounts of detrital material present. Stream bank vegetation was good and allowed to grow naturally but absent of large trees. The vegetative width was found to be excellent with very little human

impacts along the riparian zones. The macroinvertebrate community rated acceptable (-3) with 34 taxa identified within this reach. Seven percent of the total individuals identified at this location were either Ephemeroptera or Trichoptera. No Plecoptera were found at this location. The dominant taxa within this reach were Physids and Elmids. Since the 2010 survey, the habitat rating has remained good (137), while the macroinvertebrate community scoring has declined slightly (1 to -3) but remained acceptable (Noffke, 2011).

North Branch Thunder Bay River

The North Branch Thunder Bay River was surveyed at Truax Road (Station 25) approximately eight miles north of the town of Hillman. The river has an average width of 35 feet, depth of 1 foot, with an estimated flow of 18 cfs. Vegetation along the margins are dominated by shrubs and grasses. In-stream habitat quality rated good (136) with moderate overhanging vegetation and sparsely available large woody debris, aquatic macrophytes, and rootwads present within this reach. Substrates were dominated by sand and silt within this glide/pool section of stream. All pools were shallow with soft bottoms with no root mats or submerged vegetation present. In-stream structures were also observed to have a thin layer of silt covering all available habitat, which was less than desirable. Vegetative protection was good along both banks but was missing a majority of the canopy. The canopy along the left bank appears to have been removed about five to ten years ago and of the few trees that remain, most appear to be dead. The riparian zone width was excellent for both banks allowing vegetation to grow naturally and at a distance greater than 150 feet. The macroinvertebrate community rated acceptable (2) with 37 taxa identified within this reach. Sixteen percent of the total individuals identified at this location were EPT taxa. The dominant taxa within this reach were Elmids and Chironomids. Since the 2010 survey, the habitat rating has remained good (110), while the macroinvertebrate community scoring has declined from excellent (5) to acceptable (2) (Noffke, 2011).

Lower South Branch Thunder Bay River

Two locations were sampled on the Lower South Branch Thunder Bay River. The first location was at Hubbard Lake Road (Station 27), one mile north of the Town of Hubbard Lake. The riffle section at this location had an average width of 71 feet, depth of 1 foot, and estimated flow of 69 cfs. Habitat quality rated excellent (157) with moderate availability of overhanging vegetation. Large woody debris and aquatic macrophytes were only sparsely present within this reach. Substrates were dominated by cobble and gravel and embeddedness was less than 25 percent. Vegetative protection was excellent allowing all vegetation to grow naturally. The riparian zone width was excellent on the right bank and good on the left bank due to presence of Hubbard Lake Road within the vegetative zone. The macroinvertebrate community rated acceptable (1) with 31 taxa identified within this reach. Nineteen percent of the total individuals identified at this location were either Ephemeroptera or Trichoptera. No Plecoptera were found at this location. The dominant taxa within this reach were Chironomids and Elmids. Since the 2010 survey, the habitat rating has improved from good (141) to excellent (157) while the macroinvertebrate community scoring has declined slightly (4 to 1) but the macroinvertebrate community rating remained acceptable (Noffke, 2011).

The second location was at Beaver Lake Road (Station 28), three miles downstream of Station 27 at Hubbard Lake Road. This section, composed entirely of run, had an average width of 62 feet, depth of 1 foot, and an estimated flow of 49 cfs. Habitat quality rated good (145) with moderate availability of overhanging vegetation; all remaining structure was sparse in this section. Substrates were dominated by gravel and cobble with no presence of submerged vegetation. Vegetative protection was excellent along the left bank allowing all vegetation to

grow naturally. The right bank was dominated by grass but allowed to naturally grow with no evidence of disruption. The riparian zone width on both banks was excellent. The macroinvertebrate community rated excellent (5) with 40 taxa identified within this reach. Twenty-six percent of the total individuals identified at this location were composed of EPT taxa. The dominant taxa within this reach were Chironomids and Amphipods. Since the 2010 survey, the habitat rating has remained good (146) and the macroinvertebrate community rating has remained excellent (5) (Noffke, 2011).

KINGS CREEK

Kings Creek at Bussie Road (Station 29) is approximately ten miles east of the town of Alpena, in a predominately agricultural portion of the watershed. Kings Creek is small and measured 3 inches deep, 1.5 feet wide, and had an estimated flow of 1.4 cfs. Substrates were dominated by sand and silt with small, infrequent patches of cobble and gravel within this section. There was some new increase in bar formation from sand in the low velocity areas but embeddedness of the coarse substrates was minimal at the riffles. All macroinvertebrate community structures used for colonization were found to be sparse or absent, but resulted in a good habitat rating (153). The macroinvertebrate communities were found to be acceptable (-1) with 22 taxa identified. This section was dominated by Amphipods, which composed 79% of all individuals sampled in this collection. Only five percent of the total individuals were identified as either Ephemeroptera or Trichoptera. No Plecoptera were found at this location. Since the 2010 survey, the habitat score has improved from 131 to 153; however, the rating has remained good. The macroinvertebrate community score has declined slightly (0 to -1) but remained acceptable (Noffke, 2011).

THUNDER BAY RIVER

Two locations were sampled on the Thunder Bay River. The first location was at Salina Road (Station 30), two miles west of the town of Lachine, within the Mackinaw State Forest. The Thunder Bay River at this location is a deep, slow moving system with an average width of 102 feet, depth of 2 feet, with an estimated flow of 250 cfs. Large woody debris availability is heavy along the margins creating debris jams but generally absent from the active channel, suggesting a flashy system. Banks were found to be moderately stable with some eroded areas that look to be mostly healed. The substrates within the active channel are composed of sand and silt with no aquatic vegetation present. Overall, habitat quality rated good (139) with moderate availability of undercut banks and overhanging vegetation and rootwads sparsely available. Vegetative protection along the banks was good allowing most vegetation to grow naturally. The riparian zone width along the right bank was very narrow and rated marginal due to the proximity to Salina Road to the east. The left bank was rated excellent, with no human activities observed within that zone. The macroinvertebrate community rated excellent (6) with 37 taxa identified within this reach. Forty-four percent of the total individuals identified at this location were composed of EPT taxa. The dominant taxa within this reach were Elmids and Hydropsychids. Since the 2010 survey, the habitat score has improved from 113 to 139; however, the rating has remained good. The macroinvertebrate community scoring has improved slightly (5 to 6) and the rating remained excellent (Noffke, 2011).

The second location surveyed on the Thunder Bay River was at M-65 (Station 31), three miles downstream of Station 30. This location is three miles north of the town of Lachine but in a more agriculturally-impacted area. Again, the river is deep and slow moving, with an average width of 94 feet, depth of 2.5 feet, and estimated flow of 270 cfs. Habitat quality rated good (153) with large woody debris, undercut banks, and rootwads sparsely available with no

overhanging vegetation or aquatic macrophytes present within this section of river. Bank stability at this site was excellent with no erosional areas observed. Substrates were quite different from the upstream location with this glide/pool section dominated by cobble and gravel. Vegetative protection and riparian zone width were excellent along both banks; however, M-65 was just over 150 feet from the river on the right bank. The macroinvertebrate community rated acceptable (1) with 34 taxa identified within this reach. Twenty-nine percent of the total individuals identified at this location were composed of EPT taxa. The dominant taxa within this reach were Heptageniids and Corixids. Since the 2010 survey, the habitat score has improved from 142 to 153; however, the rating has remained good. The macroinvertebrate community scoring has improved slightly (-2 to 1) and remained acceptable (Noffke, 2011).

Objective 3: Satisfy monitoring requests submitted by internal and external customers.

Several targeted monitoring requests were carried out during this sampling period on Newton Creek, Silver Creek, and the Pigeon River. However, only the Silver Creek and Pigeon River requests will be discussed in this report. The Newton Creek sampling will be discussed separately, in a future report.

SILVER CREEK AT CHURCH HIGHWAY

Silver Creek at Church Highway was one of three locations that the Huron Pines Watershed Council (HPWC) requested for targeted monitoring. The HPWC replaced or improved ten crossings within a three-mile area within the Silver Creek watershed. This project was completed in 2012 and monitoring was requested at this location to help evaluate long-term impacts of the construction on water quality. However, this location was impacted by beaver and was found not to be suitable for evaluation with Procedure 51.

SILVER CREEK UPSTREAM OF BEECH GROVE HIGHWAY (EAST CROSSING)

Silver Creek upstream of Beech Grove Highway (Station 3; Figure 13) is the second of three locations that the HPWC requested for targeted monitoring. Station 3 is located nine miles west of the town of Rogers City, within the Mackinaw State Forest. Silver Creek was found to be 12-feet wide and 9-inches deep with an estimated flow of 9 cfs. Substrates were composed mainly of sand and cobble with a heavy load of coarse detrital material throughout this riffle/run section. Rip rap has recently been placed immediately upstream of the new culvert/stream crossing to help control erosion of these banks. Habitat rated excellent (178) with heavy availability of large woody debris for macroinvertebrate colonization. Undercut banks and rootwads were sparse with overhanging vegetation and aquatic macrophytes absent from this reach. Stream bank vegetation was excellent and allowed to grow naturally on both banks. The vegetative width was also found to be excellent with very little human impacts along the riparian zones. The macroinvertebrate

Figure 13. Silver Creek upstream of Beech Grove Highway, east crossing.

community rated acceptable (4) with the presence of 35 total taxa, dominated by Chironomids and Heptageniids. EPT taxa composed 46 percent of the total individuals identified in the sample. Water chemistry data was collected at this location and can be found in Table 3.

SILVER CREEK AT BEECH GROVE HIGHWAY (WEST CROSSING)

Silver Creek at Beech Grove Highway (Station 4) was the third and final location that the HPWC requested for targeted monitoring pertaining to improved or replaced river crossings. Silver Creek at Beech Grove Highway is one mile west (downstream) of Station 3. Silver Creek's in-stream features and flow were similar to Station 3. Substrates were composed mainly of sand and gravel with coarse organic matter still prevalent in at the moderate level. Habitat rated excellent (175) with moderate availability of large woody debris for macroinvertebrate colonization. Undercut banks and rootwads were sparsely available throughout this reach with absence of overhanging vegetation and aquatic macrophytes. Stream bank vegetation was good but lacked shrubby vegetation. The vegetative width was found to be excellent with very little human impacts along the riparian zones. The macroinvertebrate community rated excellent (6) with the presence of 33 total taxa and was dominated by Chironomids and Elmids. EPT taxa composed 51 percent of the total individuals identified in the sample. Water chemistry data was collected at this location and can be found in Table 3.

Figure 14. Pigeon River at Sturgeon Valley Road, sediments.

PIGEON RIVER AT STURGEON VALLEY ROAD

Monitoring at Pigeon River at Sturgeon Valley Road (Station 11; Figures 14 and 15) was requested by the MDNR to evaluate the release and potential deposition of silt downstream from the Song of the Morning Ranch/Lansing Club dam during the dam's drawdown and eventual removal during the summer 2015. The Pigeon River at Sturgeon Valley Road is located approximately one mile below the old Song of the Morning/Lansing Club dam, 10 miles east of the town of Vanderbilt. The river has an average width of 45 feet, depth of 9 inches, with an estimated flow of 87 cfs. In-stream habitat quality rated good (151) with moderate availability of undercut banks, large woody debris, and overhanging vegetation. Aquatic macrophytes and rootwads were sparsely available within this reach. Substrates were composed of sand, cobble, and gravel within this riffle/run section of stream. Sand was observed to be actively moving along the bottom as well

Figure 15. Pigeon River at Sturgeon Valley Road.

as depositing fine sediment at obstructions and bends. In areas of coarse substrates, cobble was embedded at approximately 50 percent. Vegetative protection was good along the left bank, but was missing large trees. The right bank was excellent with all plants allowed to grow naturally. The riparian zone width was excellent on the right bank and good on the left bank due to the road being within the riparian zone. The macroinvertebrate community rated excellent (6) with 40 taxa identified within this reach. Seventy percent of the total individuals identified at this location were EPT taxa. The dominant taxa within this reach were Baetids and Ephemerellids.

Objective 4: Collect water quality data needed for Total Maximum Daily Load development and address nonattainment listings described in the Integrated Report.

SILVER CREEK

The results of the water chemistry analysis are presented in Table 3. Water samples were collected at two locations (Stations 3 and 4) and analyzed for general nutrients. Both stations met all WQS.

Table 3. Water chemistry analysis for Silver Creek, August 19, 2015.

		Silver Creek u/s Beech Grove Hwy (East Crossing)	Silver Creek at Beech Grove Hwy (West Crossing)
	Date	8/19/2015	8/19/2015
	Latitude	45.42676	45.42545
	Longitude	-83.97912	-84.00592
Parameters	Label	Station 3	Station 4
YSI - Field			
Time	24h	1030	0900
Water Temp	^{o}F	66.7	63.7
Conductivity	µS/cm	448	449
Dissolved Oxygen	mg/l	9.16	8.73
Dissolved Oxygen	%	100.4	91.3
pH	pH	7.88	7.83
Water Samples - Lab			
Kjeldahl Nitrogen	mg/l	0.95	0.54
Nitrate/Nitrite	mg/l	1.3	0.82
Total Phosphorus	mg/l	0.066	0.029

Objective 5: Monitor Invasive Species

As part of the instream habitat and macroinvertebrate community monitoring at each location, invasive species were surveyed by SWAS staff. Invasive species were observed at 6 of the 31 locations and the observations are summarized in Table 4. All observations of invasive species were reported to the Aquatic Invasive Species Program for further evaluation.

Table 4. Invasive Species found during the 2015 biological and physical habitat conditions, from various watersheds within Michigan's Northeastern Lower Peninsula located in Alpena, Alcona, Cheboygan, Emmet, Montmorency, Oscoda, Otsego, and Presque Isle Counties, Michigan.

Station Number	Location Description	Type	Observation
8	West Branch Maple River at Pleasantville Road	Japanese Knotweed	Extensive
21	Thunder Bay River at State Street	Rusty Crayfish	Sparse
27	Lower South Branch Thunder Bay River at Hubbard Lake Road	Rusty Crayfish	Moderate
		Zebra Mussel	Moderate
28	Lower South Branch Thunder Bay River at Beaver Lake Road	Rusty Crayfish	Sparse
		Zebra Mussel	Sparse
		Purple Loosestrife	Sparse
30	Thunder Bay River at Salina Road	Zebra Mussel	Sparse
31	Thunder Bay River at M-65	Rusty Crayfish	Sparse
		Zebra Mussel	Sparse

Future Monitoring Recommendations

Pigeon River at Sturgeon Valley Road (Station 11)

- Due to the recent drawdown and removal of the Song of the Morning/Lansing Club dam, this headwater location should be further monitored to evaluate the potential of further deposition of fine sediments, which may be inhibiting aquatic communities.

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Citations

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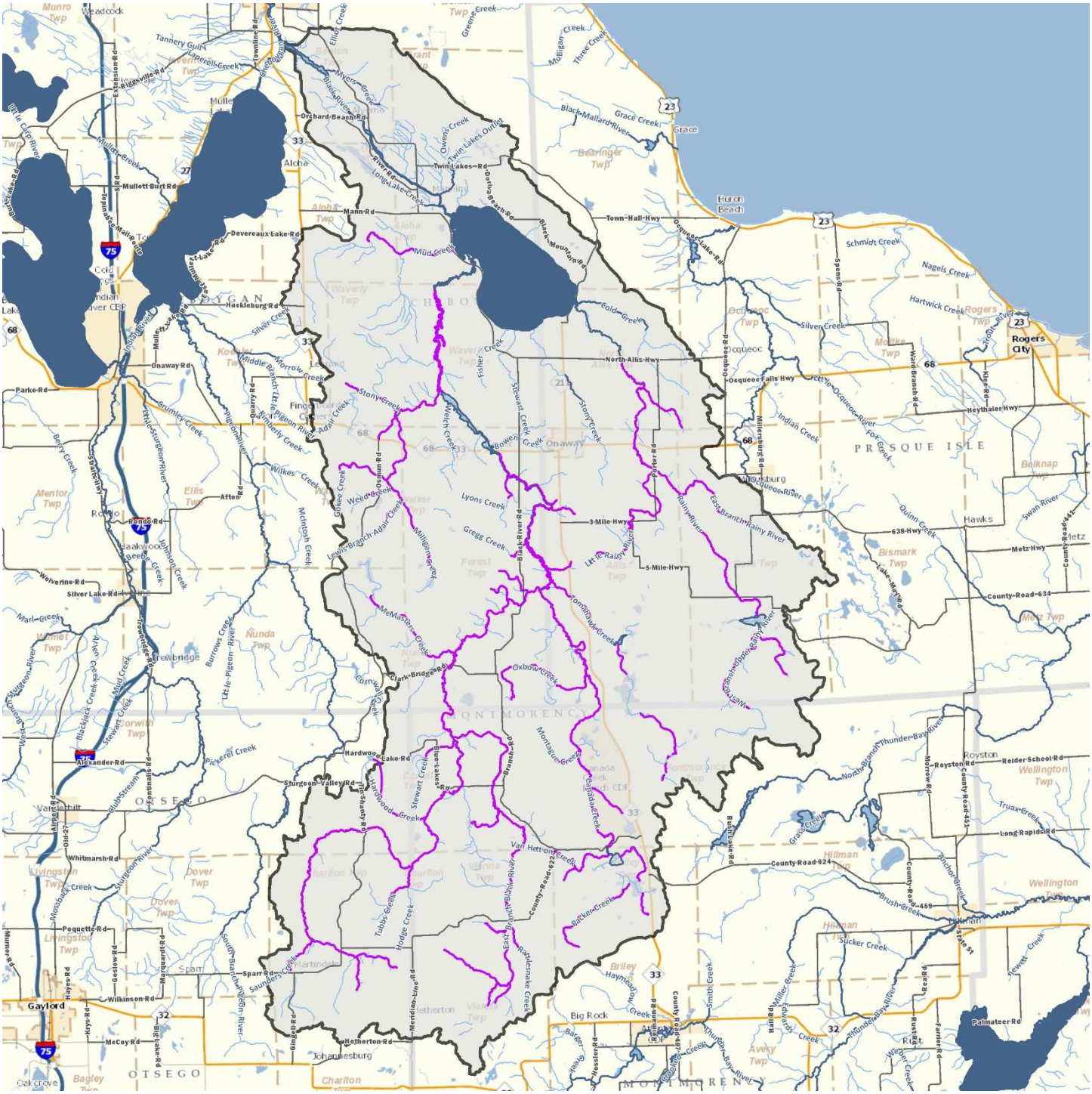
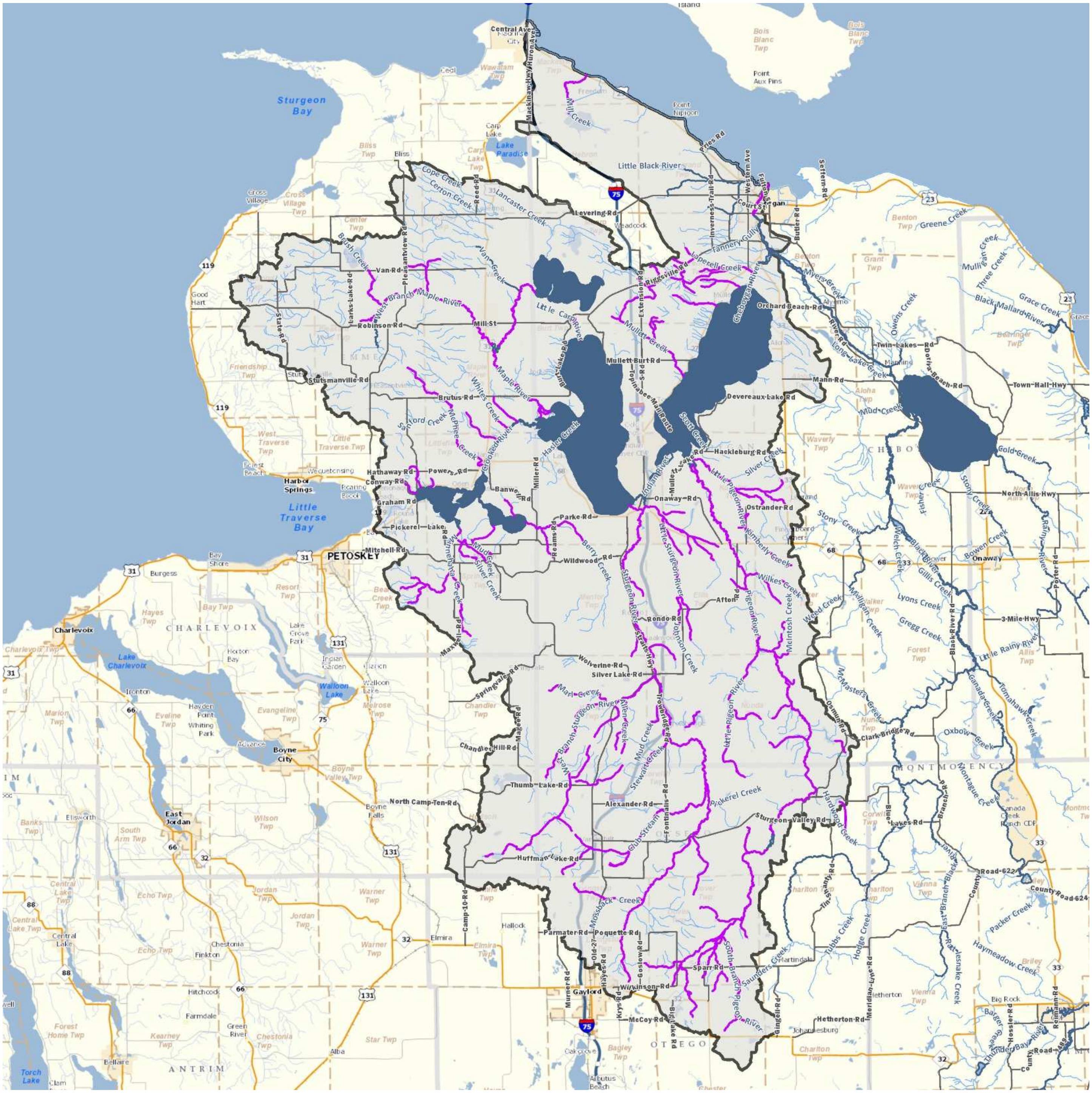
Appendix A.

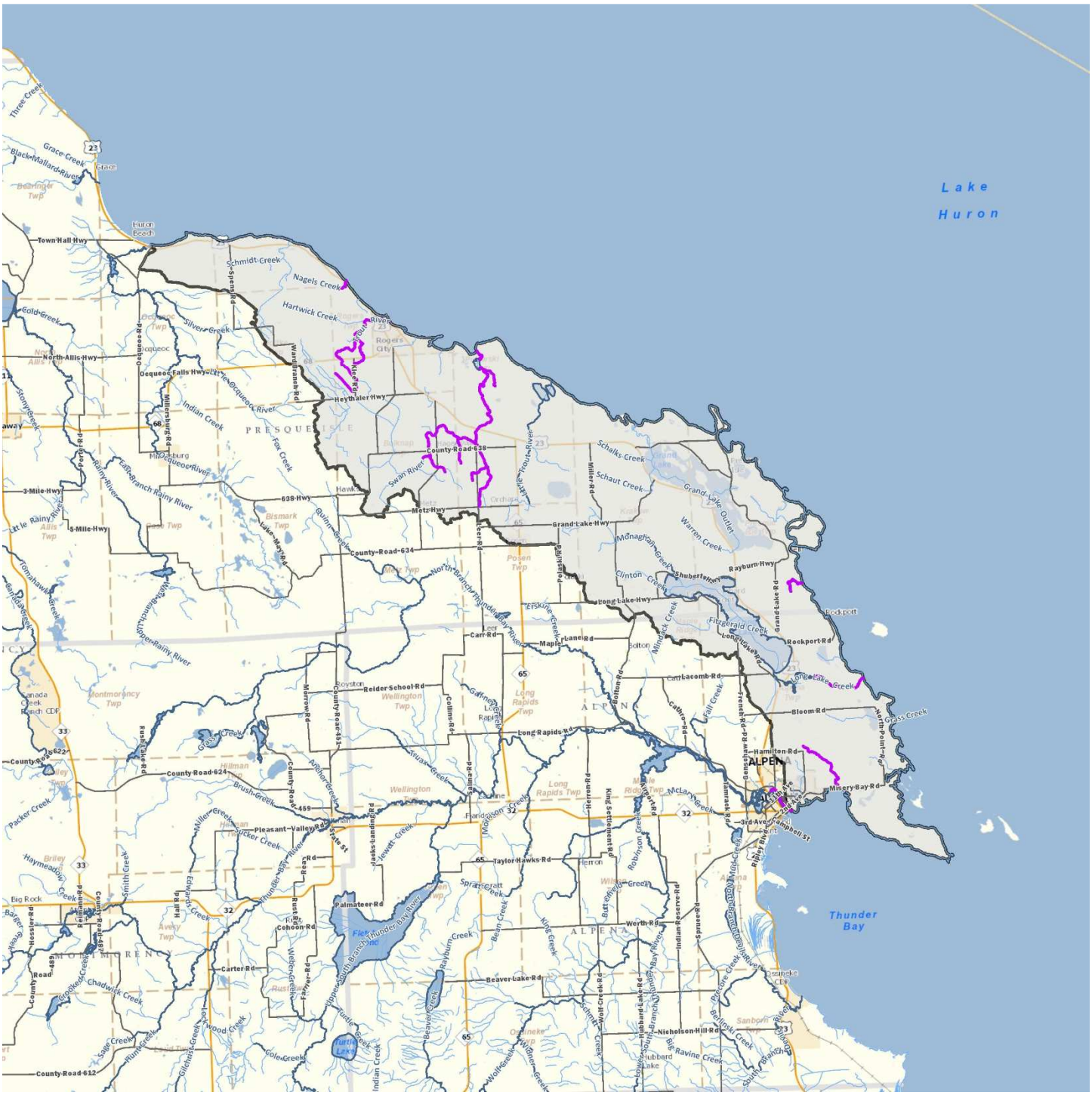
Coldwater Streams

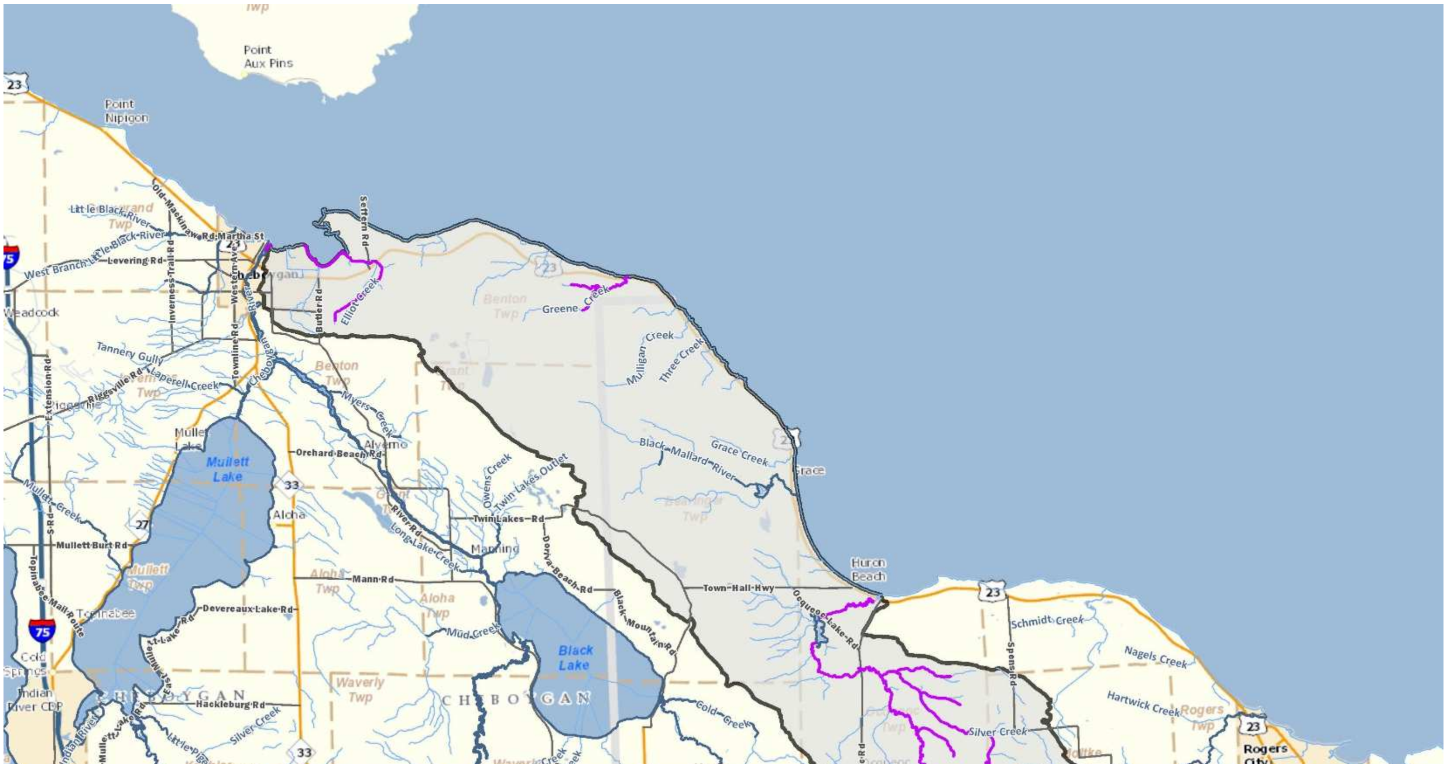


Black River Watershed – Coldwater Streams

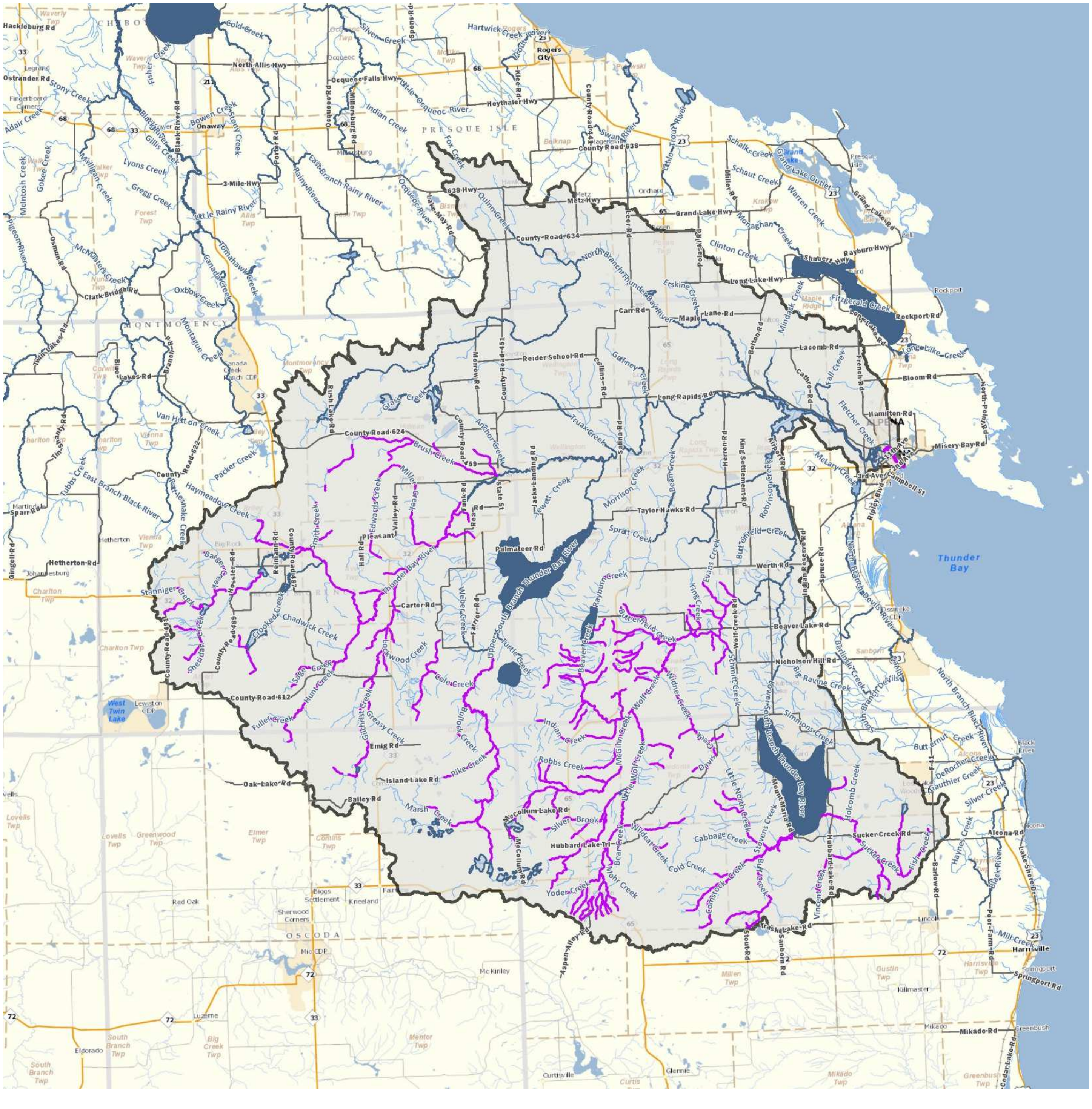


Cheboygan River Watershed – Coldwater Streams


Lake
Huron
Thunder
Bay
PRESQUE ISLE
MONTMORENCY
ALPENA
Town Hall Hwy
Huron Beach
Schmidt Creek
Nagels Creek
Hartwick Creek
Gold Creek
Silver Creek
North Allis Hwy
Oqueoc Falls Hwy
Oqueoc River
Indian Creek
Fox Creek
Rainy River
East Branch Rainy River
3-Mile-Hwy
5-Mile-Hwy
Lake Mary Rd
Quinn Creek
638 Hwy
Hawks
Metz Hwy
County Road 638
Swan River
Thousand River
Schaut Creek
Miller Rd
Schalks Creek
Grand Lake Outlet
Warren Creek
Grand Lake Hwy
County Road 634
North Branch Thunder Bay River
Erskine Creek
Long Lake Hwy
Clinton Creek
Shubert Hwy
Rayburn Hwy
Fitzgerald Creek
Rockport
Rockport Rd
Maple Lane Rd
Carl Rd
Reider School Rd
Monroe Rd
County Road 451
Collins Rd
Long Rapids Twp
Long Rapids Rd
Bolton Rd
Carl Lacomb Rd
Fall Creek
Bloom Rd
Grass Lake Creek
North Point Rd
Misery Bay Rd
Hamilton Rd
ALPENA
3rd Ave
Campbell St
Ninth St
Tamarack Rd
McLain Creek
Wellington
Long Rapids Twp
King Settlement Rd
Robinson Creek
Herron
Taylor Hawks Rd
Sprat Creek
Beam Creek
Werth Rd
Indian Reserve Rd
Spruce Rd
Palmateer Rd
Thunder Bay River
Fletcher Pond
Rayburn Creek
Beaver Lake Rd
Wolf Creek Rd
Nicholson Hill Rd
Big Ravine Creek
Hubbard Lake
Sanborn
Ossineke
Ossineke CDP
Besser Creek
Besser Rd
Nessler Rd
Big Rock
Haymeadow Creek
Briley
Avery Twp
Smith Creek
Packer Creek
Brush Creek
Pleasant Valley Rd
Tucker Creek
Miller Creek
Hillman
Canada Creek Ranch CDP
Montmorency Twp
Gilchrist Creek
Chadwick Creek
Crooked Creek
Sage Creek
Hunt Creek
Cole Creek
Wolf Creek
Wilson Creek
Hubbard Lake
County Road 612
Long Lake/Swan River Watershed – Coldwater Streams



Ocqueoc River Watershed – Coldwater Streams



Thunder Bay River Watershed – Coldwater Streams

Appendix B.

Procedure 51 - Wadeable Streams Macroinvertebrate Community Results

TAXA	Little Ocqueoc River Silver Ck Rd d-s bridge 8/16/2015 **STATION 1**	Ocqueoc River Walker Hwy 8/19/2015 **STATION 2**	Silver Creek u-s Beech Grove Hwy 8/19/2015 **STATION 3**	Silver Creek d-s last driveway on Beech Grove Hwy 8/19/2015 **STATION 4**
ANNELIDA (segmented worms)				
Oligochaeta (worms)	39	2	10	3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)		59		
Decapoda (crayfish)	1			
Isopoda (sowbugs)			1	
Arachnoidea				
Hydracarina	3	5	2	3
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae		2		
Baetidae	3	8	7	9
Caenidae		9		
Ephemerellidae	1		1	
Ephemeridae				1
Heptageniidae	7	47	42	26
Isonychiidae	3	4		1
Leptophlebiidae		5		
Tricorythidae		2		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	9	6
Cordulegastridae	4		3	6
Gomphidae		6		
Macromiidae		1		
Zygoptera (damselflies)				
Calopterygidae		17	13	1
Coenagrionidae		9		
Plecoptera (stoneflies)				
Nemouridae	6			3
Perlidae	9	7	5	6
Pteronarcyidae	2			24
Hemiptera (true bugs)				
Gerridae	2		2	1
Mesoveliidae	2			
Megaloptera				
Corydalidae (dobson flies)	2	1	2	13
Sialidae (alder flies)	1		2	4
Trichoptera (caddisflies)				
Brachycentridae	2		3	24
Glossosomatidae	1		5	
Helicopsychidae		5		
Hydropsychidae	22	5	3	24
Hydroptilidae			1	
Lepidostomatidae	7	10	16	
Leptoceridae		11		
Limnephilidae	2	1	8	13
Molannidae	6		6	6
Philopotamidae	3		22	15
Phryganeidae	1		1	
Polycentropodidae	1		2	1
Coleoptera (beetles)				
Gyrinidae (adults)	2			
Hydrophilidae (total)			1	2
Dryopidae	5		1	1
Elmidae	95	18	3	26
Diptera (flies)				
Athericidae	18		1	17
Ceratopogonidae	2		3	1
Chironomidae	13	16	69	45
Dixidae		1	1	
Simuliidae		2	1	5

Tabanidae		1	4	1
Tipulidae	3		2	6
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	3	5		2
Physidae	2	1	3	
Planorbidae				1
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1		9	2
TOTAL INDIVIDUALS	275	261	264	299

	Little Ocqueoc River Silver Ck Rd d-s bridge 8/16/2015 **STATION 1**		Ocqueoc River Walker Hwy 8/19/2015 **STATION 2**		Silver Creek u-s Beech Grove Hwy 8/19/2015 **STATION 3**		Silver Creek d-s last drive on Beech Grove Hwy 8/19/2015 **STATION 4**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	35	1	29	1	35	1	33	1
NUMBER OF MAYFLY TAXA	4	0	7	1	3	0	4	0
NUMBER OF CADDISFLY TAXA	9	1	5	0	10	1	6	1
NUMBER OF STONEFLY TAXA	3	1	1	0	1	0	3	1
PERCENT MAYFLY COMP.	5.09	0	29.50	1	18.94	0	12.37	0
PERCENT CADDISFLY COMP.	16.36	0	12.26	0	25.38	0	27.76	0
PERCENT DOMINANT TAXON	34.55	-1	22.61	0	26.14	0	15.05	1
PERCENT ISOPOD, SNAIL, LEECH	1.82	1	2.30	1	1.52	1	1.00	1
PERCENT SURF. AIR BREATHERS	2.18	1	0.00	1	1.14	1	1.00	1
TOTAL SCORE		4		5		4		6
MACROINV. COMMUNITY RATING		**ACCEPT.**		**EXCELLENT**		**ACCEPT.**		**EXCELLENT**

TAXA	Sturgeon River Whitmarsh Road 9/1/2015 **STATION 5**
ANNELIDA (segmented worms)	
Oligochaeta (worms)	31
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	143
Arachnoidea	
Hydracarina	5
Insecta	
Ephemeroptera (mayflies)	
Baetiscidae	1
Baetidae	11
Caenidae	1
Ephemerellidae	5
Heptageniidae	2
Odonata	
Zygoptera (damselflies)	
Calopterygidae	1
Plecoptera (stoneflies)	
Perlidae	1
Pteronarcyidae	10
Megaloptera	
Corydalidae (dobson flies)	1
Trichoptera (caddisflies)	
Brachycentridae	10
Hydropsychidae	21
Limnephilidae	4
Philopotamidae	20
Coleoptera (beetles)	
Dytiscidae (total)	3
Gyrinidae (adults)	10
Elmidae	1
Diptera (flies)	
Ceratopogonidae	1
Chironomidae	41
Simuliidae	4
Tipulidae	1
MOLLUSCA	
Gastropoda (snails)	
Physidae	1
Pelecypoda (bivalves)	
Sphaeriidae (clams)	3
TOTAL INDIVIDUALS	332

Sturgeon River
Whitmarsh Road
9/1/2015
STATION 5

METRIC	Value	Score
TOTAL NUMBER OF TAXA	25	1
NUMBER OF MAYFLY TAXA	5	1
NUMBER OF CADDISFLY TAXA	4	0
NUMBER OF STONEFLY TAXA	2	1
PERCENT MAYFLY COMP.	6.02	-1
PERCENT CADDISFLY COMP.	16.57	-1
PERCENT DOMINANT TAXON	43.07	-1
PERCENT ISOPOD, SNAIL, LEECH	0.30	1
PERCENT SURF. AIR BREATHERS	3.92	-1
TOTAL SCORE		0
MACROINV. COMMUNITY RATING		**ACCEPT.**

TAXA	W B Sturgeon River McEachron Road 9/1/2015 **STATION 6**	Sturgeon River White Road 9/1/2015 **STATION 7**	W B Maple River Pleasantview Road 9/23/2015 **STATION 8**	Maple River Brutus Road 8/31/2015 **STATION 9**
PLATYHELMINTHES (flatworms)				
Turbellaria			1	
ANNELIDA (segmented worms)				
Oligochaeta (worms)	18	12	3	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	7	12	81	39
Decapoda (crayfish)			3	
Isopoda (sowbugs)		2	47	54
Arachnoidea				
Hydracarina	1	2	6	2
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae	1		2	34
Baetidae	13	13	1	25
Caenidae			4	1
Ephemerellidae	4	21		11
Ephemeridae			1	1
Heptageniidae		19	5	1
Isonychiidae		1		
Leptophlebiidae			39	5
Tricorythidae				2
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		7	1	
Gomphidae			3	
Zygoptera (damselflies)				
Calopterygidae		5	2	5
Coenagrionidae			5	2
Plecoptera (stoneflies)				
Nemouridae	1			
Perlidae	3	7		6
Pteronarcyidae	1			2
Hemiptera (true bugs)				
Belostomatidae	1	1		
Corixidae			2	14
Gerridae	1			
Mesoveliidae		1		1
Nepidae		1		
Megaloptera				
Corydalidae (dobson flies)		2		1
Sialidae (alder flies)		1	1	
Trichoptera (caddisflies)				
Brachycentridae	153	33		2
Glossosomatidae	1	13	1	
Hydropsychidae	5	35		51
Hydroptilidae	1		6	
Lepidostomatidae	4	1		3
Leptoceridae	2	1	5	10
Limnephilidae	61		1	2
Molannidae	4		1	1
Philopotamidae	1			1
Phryganeidae	1		1	1
Polycentropodidae	2	5	4	1
Rhyacophilidae	1			
Lepidoptera (moths)				
Pyralidae			1	
Coleoptera (beetles)				
Dytiscidae (total)				1
Gyrinidae (adults)	1		1	7
Haliplidae (adults)			1	
Hydrophilidae (total)	1			1
Dryopidae		1		

Elmidae	6	15	5	4
Diptera (flies)				
Athericidae	1	5		5
Chironomidae	10	25	39	23
Culicidae				1
Simuliidae		19		24
Tabanidae				2
Tipulidae		2		1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			1	1
Hydrobiidae			2	
Physidae	4	3	2	79
Pelecypoda (bivalves)				
Sphaeriidae (clams)		2	25	2
TOTAL INDIVIDUALS	310	267	303	430

	W B Sturgeon River McEachron Road 9/1/2015 **STATION 6**		Sturgeon River White Road 9/1/2015 **STATION 7**		W B Maple River Pleasantview Road 9/23/2015 **STATION 8**		Maple River Brutus Road 8/31/2015 **STATION 9**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	29	1	30	1	34	1	41	1
NUMBER OF MAYFLY TAXA	3	0	4	0	6	1	8	1
NUMBER OF CADDISFLY TAXA	12	1	6	1	7	1	9	1
NUMBER OF STONEFLY TAXA	3	1	1	0	0	-1	2	1
PERCENT MAYFLY COMP.	5.81	0	20.22	0	17.16	0	18.60	0
PERCENT CADDISFLY COMP.	76.13	1	32.96	1	6.27	0	16.74	0
PERCENT DOMINANT TAXON	49.35	-1	13.11	1	26.73	0	18.37	0
PERCENT ISOPOD, SNAIL, LEECH	1.29	1	1.87	1	17.16	-1	31.16	-1
PERCENT SURF. AIR BREATHERS	1.29	1	1.12	1	1.32	1	5.81	0
TOTAL SCORE		5		6		2		3
MACROINV. COMMUNITY RATING		**EXCELLENT**		**EXCELLENT**		**ACCEPT.**		**ACCEPT.**

TAXA	Pigeon River Old Vanderbilt Road 9/25/2015 **STATION 10**	Pigeon River Sturgeon Valley Rd 9/2/2015 **STATION 11**	Pigeon River Pigeon River Road 9/1/2015 **STATION 12**	Mullett Creek South Extension Road 8/31/2015 **STATION 13**
ANNELIDA (segmented worms)				
Hirudinea (leeches)				2
Oligochaeta (worms)	12	26	14	6
ARTHROPODA				
Crustacea				
Amphipoda (scuds)				32
Decapoda (crayfish)	1		1	
Isopoda (sowbugs)	1	4		
Arachnoidea				
Hydracarina	3	2	3	11
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae		18	14	
Baetidae	38	67	5	52
Caenidae		1	1	
Ephemerellidae	40	57	2	
Ephemeridae	1	14	3	
Heptageniidae	2	15	20	
Isonychiidae		6	5	
Leptophlebiidae				2
Tricorythidae		3		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	2	1
Cordulegastridae		2		
Gomphidae		2		
Zygoptera (damselflies)				
Calopterygidae		1	2	
Plecoptera (stoneflies)				
Nemouridae				6
Perlidae	4	2	7	
Perlodidae	6			
Pteronarcyidae	2	1	1	
Hemiptera (true bugs)				
Belostomatidae		1	1	1
Corixidae	1		12	
Gerridae				1
Mesoveliidae				1
Nepidae	1			
Pleidae		1		
Saldidae	1			
Veliidae			2	
Megaloptera				
Corydalidae (dobson flies)		3	1	1
Sialidae (alder flies)	1	1	1	
Trichoptera (caddisflies)				
Brachycentridae	21	2	21	1
Glossosomatidae	20			
Helicopsychidae	3	1	17	
Hydropsychidae	123	55	24	
Hydroptilidae	7	1		
Lepidostomatidae	4		2	
Limnephilidae	1	2		66
Molannidae	1			
Philopotamidae	6	1		
Phryganeidae	1	1	3	6
Polycentropodidae	10	1	1	
Uenoidae		5		
Coleoptera (beetles)				
Dytiscidae (total)				1
Gyrinidae (adults)	4			5
Hydrophilidae (total)		1		1
Noteridae (adults)		1		

Dryopidae			1	3
Elmidae	5	17	37	3
Diptera (flies)				
Athericidae		5	2	
Ceratopogonidae			2	2
Chironomidae	5	18	40	52
Culicidae				3
Dixidae			5	
Simuliidae	5	3		16
Stratiomyidae			1	
Tabanidae	1		2	3
Tipulidae	1			
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			1	
Physidae	2	2		2
Planorbidae			1	2
Pleuroceridae		7	1	
Viviparidae		2	4	
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	8		
TOTAL INDIVIDUALS	336	361	262	282

	Pigeon River Old Vanderbilt Road 9/25/2015 **STATION 10**		Pigeon River Sturgeon Valley Rd 9/2/2015 **STATION 11**		Pigeon River Pigeon River Road 9/1/2015 **STATION 12**		Mullett Creek South Extension Road 8/31/2015 **STATION 13**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	35	1	40	1	37	1	27	0
NUMBER OF MAYFLY TAXA	4	0	8	1	7	1	2	-1
NUMBER OF CADDISFLY TAXA	11	1	9	1	6	1	3	0
NUMBER OF STONEFLY TAXA	3	1	2	1	2	1	1	0
PERCENT MAYFLY COMP.	24.11	1	50.14	1	19.08	0	19.15	0
PERCENT CADDISFLY COMP.	58.63	1	19.11	0	25.95	0	25.89	0
PERCENT DOMINANT TAXON	36.61	-1	18.56	0	15.27	1	23.40	0
PERCENT ISOPOD, SNAIL, LEECH	0.89	1	4.16	0	2.67	1	2.13	1
PERCENT SURF. AIR BREATHERS	2.08	1	1.11	1	6.11	0	4.61	1
TOTAL SCORE		6		6		6		1
MACROINV. COMMUNITY RATING		**EXCELLENT**		**EXCELLENT**		**EXCELLENT**		**ACCEPT.**

TAXA	Black River Chandler Dam Rd 9/2/2015 **STATION 14**	East Branch Black River 2-track off Shingle Mill Rd 9/2/2015 **STATION 15**	Milligan Creek 2-track off Klieber Rd 9/1/2015 **STATION 16**
ANNELIDA (segmented worms)			
Oligochaeta (worms)	9	28	8
ARTHROPODA			
Crustacea			
Decapoda (crayfish)	1		1
Isopoda (sowbugs)	6		
Arachnoidea			
Hydracarina	4		2
Insecta			
Ephemeroptera (mayflies)			
Baetiscidae	1	8	
Baetidae	17	11	18
Ephemerellidae	37	5	1
Ephemeridae		1	
Heptageniidae	5	7	38
Isonychiidae	1		27
Leptophlebiidae		1	
Tricorythidae	6	7	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	4	1	2
Gomphidae		1	5
Zygoptera (damselflies)			
Calopterygidae	2	4	9
Plecoptera (stoneflies)			
Perlidae	3	1	33
Pteronarcyidae		3	
Hemiptera (true bugs)			
Gerridae	1	1	
Mesoveliidae			1
Nepidae		1	
Megaloptera			
Corydalidae (dobson flies)	2	2	1
Sialidae (alder flies)		1	
Trichoptera (caddisflies)			
Brachycentridae	17	53	
Glossosomatidae			1
Helicopsychidae	2	1	3
Hydropsychidae	29	35	55
Hydroptilidae			1
Lepidostomatidae		2	12
Leptoceridae	4	1	3
Limnephilidae	5	4	
Philopotamidae	7	1	7
Phryganeidae	1	2	
Polycentropodidae	11	3	
Uenoidae	1		
Coleoptera (beetles)			
Dytiscidae (total)		1	
Hydrophilidae (total)	1		1
Dryopidae			4
Elmidae	10	7	18
Diptera (flies)			
Athericidae	1		1
Ceratopogonidae			1
Chironomidae	21	49	3
Culicidae	1		
Dixidae		2	2
Simuliidae	59	19	2
Tabanidae			1
Tipulidae		6	3
MOLLUSCA			
Gastropoda (snails)			

Ancylidae (limpets)		1	2
Physidae	2		1
Planorbidae			1
Pelecypoda (bivalves)			
Sphaeriidae (clams)	1	5	1
TOTAL INDIVIDUALS	272	275	269

	Black River Chandler Dam Road 9/2/2015 **STATION 14**		East Branch Black River 2-track off Shingle Mill Rd 9/2/2015 **STATION 15**		Milligan Creek 2-track off Klieber Rd 9/1/2015 **STATION 16**	
METRIC	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	32	1	34	1	34	1
NUMBER OF MAYFLY TAXA	6	1	7	1	4	0
NUMBER OF CADDISFLY TAXA	9	1	9	1	7	1
NUMBER OF STONEFLY TAXA	1	0	2	1	1	0
PERCENT MAYFLY COMP.	24.63	1	14.55	0	31.23	1
PERCENT CADDISFLY COMP.	28.31	0	37.09	1	30.48	1
PERCENT DOMINANT TAXON	21.69	0	19.27	0	20.45	0
PERCENT ISOPOD, SNAIL, LEECH	2.94	1	0.36	1	1.49	1
PERCENT SURF. AIR BREATHERS	1.10	1	1.09	1	0.74	1
TOTAL SCORE		6		7		6
MACROINV. COMMUNITY RATING		**EXCELLENT**		**EXCELLENT**		**EXCELLENT**

TAXA	Indian Creek VanWagoner Road 8/17/2015 **STATION 18**	McGinn Creek M65 8/17/2015 **STATION 19**	Wildcat Creek Hubbard Lake Trail 9/3/2015 **STATION 20**	Thunder Bay River d-s State Street 9/24/2015 **STATION 21**
ANNELIDA (segmented worms)				
Hirudinea (leeches)			1	
Oligochaeta (worms)	1	4	3	39
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	1			19
Decapoda (crayfish)			1	1
Isopoda (sowbugs)				5
Arachnoidea				
Hydracarina	5	1		6
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				4
Baetidae	34	29	22	18
Caenidae				1
Ephemerellidae		1	3	
Ephemeridae			1	1
Heptageniidae		12	13	20
Isonychiidae				3
Leptophlebiidae	5	8		
Potamanthidae				6
Tricorythidae	1	6		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		7	2	
Cordulegastridae		2	5	
Gomphidae			1	5
Libellulidae		4		
Zygoptera (damselflies)				
Calopterygidae		3	32	1
Plecoptera (stoneflies)				
Leuctridae	18			
Nemouridae	15	1		
Perlidae		8	6	1
Perlodidae				1
Pteronarcyidae				1
Hemiptera (true bugs)				
Belostomatidae				1
Corixidae	1			11
Gerridae	1	1	1	
Pleidae				3
Veliidae		1	1	
Megaloptera				
Corydalidae (dobson flies)		4	2	
Sialidae (alder flies)	5	1		
Trichoptera (caddisflies)				
Brachycentridae	2	3	34	1
Glossosomatidae	1	10		
Helicopsychidae				7
Hydropsychidae	6	12	33	45
Leptoceridae			2	1
Limnephilidae	6	10	1	
Molannidae		3	1	
Philopotamidae		1	2	
Phryganeidae		2	3	1
Polycentropodidae		10	5	5
Rhyacophilidae	1			
Coleoptera (beetles)				
Gyrinidae (adults)		1		
Haliplidae (adults)				2
Hydrophilidae (total)	2	2		
Scirtidae (adults)		1		
Elmidae		6		29

Diptera (flies)				
Athericidae	1	1		1
Ceratopogonidae	8	7	1	
Chaoboridae	177			
Chironomidae		91	36	7
Culicidae			1	
Dixidae	2		8	1
Simuliidae	18	88	35	3
Tabanidae	1	3	1	3
Tipulidae	2	11		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)				11
Hydrobiidae				1
Lymnaeidae				1
Physidae		4		2
Planorbidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)	7	10	1	21
TOTAL INDIVIDUALS	322	369	258	289

	Indian Creek VanWagoner Road 8/17/2015 **STATION 18**		McGinn Creek M65 8/17/2015 **STATION 19**		Wildcat Creek Hubbard Lake Trail 9/3/2015 **STATION 20**		Thunder Bay River d-s State Street 9/24/2015 **STATION 21**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	26	1	37	1	30	1	38	1
NUMBER OF MAYFLY TAXA	3	1	5	1	4	0	7	1
NUMBER OF CADDISFLY TAXA	5	0	8	1	8	1	6	1
NUMBER OF STONEFLY TAXA	2	1	2	1	1	0	3	1
PERCENT MAYFLY COMP.	12.42	0	15.18	0	15.12	0	18.34	0
PERCENT CADDISFLY COMP.	4.97	0	13.82	0	31.40	1	20.76	0
PERCENT DOMINANT TAXON	54.97	-1	24.66	0	13.95	1	15.57	1
PERCENT ISOPOD, SNAIL, LEECH	0.31	1	1.08	1	0.39	1	6.92	0
PERCENT SURF. AIR BREATHERS	56.21	-1	1.63	1	1.16	1	5.88	0
TOTAL SCORE		2		6		6		5
MACROINV. COMMUNITY RATING		**ACCEPT.**		**EXCELLENT**		**EXCELLENT**		**EXCELLENT**

TAXA	Indian Creek VanWagoner Road 8/17/2015 **STATION 18**	McGinn Creek M65 8/17/2015 **STATION 19**	Wildcat Creek Hubbard Lake Trail 9/3/2015 **STATION 20**	Thunder Bay River d-s State Street 9/24/2015 **STATION 21**
ANNELIDA (segmented worms)				
Hirudinea (leeches)			1	
Oligochaeta (worms)	1	4	3	39
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	1			19
Decapoda (crayfish)			1	1
Isopoda (sowbugs)				5
Arachnoidea				
Hydracarina	5	1		6
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				4
Baetidae	34	29	22	18
Caenidae				1
Ephemerellidae		1	3	
Ephemeridae			1	1
Heptageniidae		12	13	20
Isonychiidae				3
Leptophlebiidae	5	8		
Potamanthidae				6
Tricorythidae	1	6		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		7	2	
Cordulegastridae		2	5	
Gomphidae			1	5
Libellulidae		4		
Zygoptera (damselflies)				
Calopterygidae		3	32	1
Plecoptera (stoneflies)				
Leuctridae	18			
Nemouridae	15	1		
Perlidae		8	6	1
Perlodidae				1
Pteronarcyidae				1
Hemiptera (true bugs)				
Belostomatidae				1
Corixidae	1			11
Gerridae	1	1	1	
Pleidae				3
Veliidae		1	1	
Megaloptera				
Corydalidae (dobson flies)		4	2	
Sialidae (alder flies)	5	1		
Trichoptera (caddisflies)				
Brachycentridae	2	3	34	1
Glossosomatidae	1	10		
Helicopsychidae				7
Hydropsychidae	6	12	33	45
Leptoceridae			2	1
Limnephilidae	6	10	1	
Molannidae		3	1	
Philopotamidae		1	2	
Phryganeidae		2	3	1
Polycentropodidae		10	5	5
Rhyacophilidae	1			
Coleoptera (beetles)				
Gyrinidae (adults)		1		
Haliplidae (adults)				2
Hydrophilidae (total)	2	2		
Scirtidae (adults)		1		
Elmidae		6		29

Diptera (flies)				
Athericidae	1	1		1
Ceratopogonidae	8	7	1	
Chaoboridae	177			
Chironomidae		91	36	7
Culicidae			1	
Dixidae	2		8	1
Simuliidae	18	88	35	3
Tabanidae	1	3	1	3
Tipulidae	2	11		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)				11
Hydrobiidae				1
Lymnaeidae				1
Physidae		4		2
Planorbidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)	7	10	1	21
TOTAL INDIVIDUALS	322	369	258	289

	Indian Creek VanWagoner Road 8/17/2015 **STATION 18**		McGinn Creek M65 8/17/2015 **STATION 19**		Wildcat Creek Hubbard Lake Trail 9/3/2015 **STATION 20**		Thunder Bay River d-s State Street 9/24/2015 **STATION 21**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	26	1	37	1	30	1	38	1
NUMBER OF MAYFLY TAXA	3	1	5	1	4	0	7	1
NUMBER OF CADDISFLY TAXA	5	0	8	1	8	1	6	1
NUMBER OF STONEFLY TAXA	2	1	2	1	1	0	3	1
PERCENT MAYFLY COMP.	12.42	0	15.18	0	15.12	0	18.34	0
PERCENT CADDISFLY COMP.	4.97	0	13.82	0	31.40	1	20.76	0
PERCENT DOMINANT TAXON	54.97	-1	24.66	0	13.95	1	15.57	1
PERCENT ISOPOD, SNAIL, LEECH	0.31	1	1.08	1	0.39	1	6.92	0
PERCENT SURF. AIR BREATHERS	56.21	-1	1.63	1	1.16	1	5.88	0
TOTAL SCORE		2		6		6		5
MACROINV. COMMUNITY RATING		**ACCEPT.**		**EXCELLENT**		**EXCELLENT**		**EXCELLENT**

TAXA	Anchor Creek Carrier Road 9/14/2015 **STATION 22**	Long Lake Creek County Road 628 9/14/2015 **STATION 23**	Quinn Creek Finley Road 8/18/2015 **STATION 24**	N B Thunder Bay River Truax Road 8/18/2015 **STATION 25**
PORIFERA (sponges)			1	
BRYOZOA (moss animals)			1	
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1		5	
Oligochaeta (worms)	4	2	3	24
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	73	3	24	1
Decapoda (crayfish)	3		4	1
Isopoda (sowbugs)			3	
Arachnoidea				
Hydracarina		1	3	1
Insecta				
Ephemeroptera (mayflies)				
Baetidae	6	7		13
Caenidae	2	37	2	3
Ephemerellidae		72		
Heptageniidae	18	24	1	8
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	4	5	7	4
Gomphidae		8		1
Zygoptera (damselflies)				
Calopterygidae	6	13	22	28
Coenagrionidae		1	2	
Plecoptera (stoneflies)				
Perlidae	1			2
Hemiptera (true bugs)				
Belostomatidae				1
Corixidae			30	9
Gerridae	1		1	1
Mesoveliidae	1			
Pleidae				1
Veliidae	1			2
Megaloptera				
Corydalidae (dobson flies)	2		1	
Sialidae (alder flies)				3
Trichoptera (caddisflies)				
Brachycentridae				1
Helicopsychidae				1
Hydropsychidae	56	6		2
Leptoceridae		20	2	15
Limnephilidae	1	6	6	3
Molannidae	1			
Philopotamidae	6			
Phryganeidae	1	5	2	
Polycentropodidae	3			3
Coleoptera (beetles)				
Dytiscidae (total)	1		2	1
Gyrinidae (adults)			3	
Haliplidae (adults)			1	
Hydrophilidae (total)			2	6
Psephenidae (adults)				1
Dryopidae	2			
Elmidae	15	5	38	75
Gyrinidae (larvae)				1
Diptera (flies)				
Ceratopogonidae		1		19
Chironomidae	11	22	26	50
Culicidae		1		
Dixidae			1	1
Simuliidae	12	5		
Stratiomyidae			1	

Tabanidae	2	1	5	1
Tipulidae	6		2	2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1		29	19
Bithyniidae		8		
Physidae	1		52	14
Planorbidae			4	
Pleuroceridae			1	
Viviparidae				1
Pelecypoda (bivalves)				
Sphaeriidae (clams)	14	6	10	5
TOTAL INDIVIDUALS	256	259	297	324

	Anchor Creek Carrier Road 9/14/2015 **STATION 22**		Long Lake Creek County Road 628 9/14/2015 **STATION 23**		Quinn Creek Finley Road 8/18/2015 **STATION 24**		N B Thunder Bay River Truax Road 8/18/2015 **STATION 25**	
METRIC	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	30	1	23	0	34	1	37	1
NUMBER OF MAYFLY TAXA	3	0	4	0	2	-1	3	0
NUMBER OF CADDISFLY TAXA	6	1	4	0	3	0	6	1
NUMBER OF STONEFLY TAXA	1	0	0	-1	0	-1	1	0
PERCENT MAYFLY COMP.	10.16	0	54.05	1	1.01	-1	7.41	0
PERCENT CADDISFLY COMP.	26.56	0	14.29	0	3.37	0	7.72	0
PERCENT DOMINANT TAXON	28.52	-1	27.80	-1	17.51	0	23.15	0
PERCENT ISOPOD, SNAIL, LEECH	1.17	1	3.09	1	31.65	-1	10.49	0
PERCENT SURF. AIR BREATHERS	1.56	1	0.39	1	13.47	0	6.79	0
TOTAL SCORE		3		1		-3		2
MACROINV. COMMUNITY RATING		**ACCEPT.**		**ACCEPT.**		**ACCEPT.**		**ACCEPT.**

TAXA	N B Thunder Bay River Long Rapids Road 9/24/2015 **STATION 26**	Lower S B Thunder Bay River Hubbard Lake Road 8/17/2015 **STATION 27**	Lower S B Thunder Bay River Beaver Lake Road 8/20/2015 **STATION 28**	King Creek Bussie Road ####### **STATION 29**
ANNELIDA (segmented worms)				
Hirudinea (leeches)			2	1
Oligochaeta (worms)	32	11	20	
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	7	11	28	285
Decapoda (crayfish)	1	18	9	6
Isopoda (sowbugs)		7	2	2
Arachnoidea				
Hydracarina		2		
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae	1	1	13	
Baetidae	55	2	11	6
Caenidae	8	15	14	
Ephemerellidae			1	
Ephemeridae	2	1	2	
Heptageniidae	22	22	13	8
Potamanthidae	21			
Tricorythidae	2			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	1	3
Gomphidae		6	4	
Zygoptera (damselflies)				
Calopterygidae	2	7	22	12
Coenagrionidae	1	2	5	
Plecoptera (stoneflies)				
Perlidae			7	
Pteronarcyidae			5	
Hemiptera (true bugs)				
Belostomatidae	6			1
Corixidae	1			
Gerridae	1			2
Mesoveliidae				1
Nepidae	3			
Notonectidae				1
Pleidae	7			
Veliidae			1	
Megaloptera				
Corydalidae (dobson flies)	1		1	1
Sialidae (alder flies)			1	3
Trichoptera (caddisflies)				
Glossosomatidae			4	1
Helicopsychidae		7	15	
Hydropsychidae	1	3	2	
Hydroptilidae		1		
Leptoceridae	12	1		
Limnephilidae			2	3
Molannidae			1	
Phryganeidae	2			
Polycentropodidae			1	
Psychomyiidae	2			
Coleoptera (beetles)				
Dytiscidae (total)		1	1	
Gyrinidae (adults)				2
Hydrophilidae (total)			1	
Psephenidae (adults)		2		
Dryopidae		1		
Elmidae	5	49	17	10
Scirtidae (larvae)	1			
Diptera (flies)				
Ceratopogonidae	5	2	1	

Chironomidae	22	51	62	2
Culicidae	1			
Dixidae			1	
Tabanidae	34		5	
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1	6	8	1
Hydrobiidae	7			
Lymnaeidae	1			
Physidae	11	2	8	
Pleuroceridae		38	22	
Viviparidae		3	3	1
Pelecypoda (bivalves)				
Dreissenidae		17	14	
Sphaeriidae (clams)	16	5	12	9
Unionidae (mussels)		1	2	
TOTAL INDIVIDUALS	295	296	344	361

METRIC	N B Thunder Bay River Long Rapids Road 9/24/2015 **STATION 26** Value	Score	Lower S B Thunder Bay River Hubbard Lake Road 8/17/2015 **STATION 27** Value	Score	Lower S B Thunder Bay River Beaver Lake Road 8/20/2015 **STATION 28** Value	Score	King Creek Bussie Road 8/18/2015 **STATION 29** Value	Score
TOTAL NUMBER OF TAXA	34	1	31	1	40	1	22	1
NUMBER OF MAYFLY TAXA	7	1	5	1	6	1	2	0
NUMBER OF CADDISFLY TAXA	4	0	4	0	6	1	2	-1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	2	1	0	-1
PERCENT MAYFLY COMP.	37.63	1	13.85	0	15.70	0	3.88	0
PERCENT CADDISFLY COMP.	5.76	0	4.05	0	7.27	0	1.11	-1
PERCENT DOMINANT TAXON	18.64	0	17.23	0	18.02	0	78.95	-1
PERCENT ISOPOD, SNAIL, LEECH	6.78	0	18.92	-1	13.08	0	1.39	1
PERCENT SURF. AIR BREATHERS	6.44	0	1.01	1	0.87	1	1.94	1
TOTAL SCORE		2		1		5		-1
MACROINV. COMMUNITY RATING	**ACCEPT.**		**ACCEPT.**		**EXCELLENT**		**ACCEPT.**	

TAXA	Thunder Bay River Salina Road 8/18/2015 **STATION 30**	Thunder Bay River M65 8/18/2015 **STATION 31**
PORIFERA (sponges)		1
ANNELIDA (segmented worms)		
Oligochaeta (worms)	7	13
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	13	7
Decapoda (crayfish)	1	11
Isopoda (sowbugs)	6	1
Arachnoidea		
Hydracarina	1	
Insecta		
Ephemeroptera (mayflies)		
Baetidae	9	6
Caenidae		1
Ephemerellidae	2	
Ephemeridae		2
Heptageniidae	12	64
Isonychiidae	2	3
Leptophlebiidae	2	
Polymitarcyidae		3
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	4	1
Gomphidae	1	3
Zygoptera (damselflies)		
Calopterygidae	21	14
Coenagrionidae	4	4
Plecoptera (stoneflies)		
Perlidae	18	2
Pteronarcyidae	2	
Hemiptera (true bugs)		
Corixidae		63
Gerridae	1	2
Mesoveliidae	1	
Megaloptera		
Corydalidae (dobson flies)	1	1
Sialidae (alder flies)	4	11
Trichoptera (caddisflies)		
Brachycentridae	4	
Helicopsychidae		1
Hydropsychidae	32	
Hydroptilidae	2	
Leptoceridae	9	
Limnephilidae	3	2
Philopotamidae	1	
Polycentropodidae	14	3
Coleoptera (beetles)		
Dytiscidae (total)	6	2
Gyrinidae (adults)		1
Psephenidae (adults)		4
Elmidae	34	23
Diptera (flies)		
Athericidae	7	
Chironomidae	20	19
Dixidae		9
Simuliidae	4	
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	2	1
Physidae	4	3
Planorbidae	1	
Pleuroceridae		13
Pelecypoda (bivalves)		
Dreissenidae	1	1
Sphaeriidae (clams)	1	6
TOTAL INDIVIDUALS	257	301

	Thunder Bay River Salina Road 8/18/2015 **STATION 30**		Thunder Bay River M65 8/18/2015 **STATION 31**	
METRIC	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	37	1	34	1
NUMBER OF MAYFLY TAXA	5	1	6	1
NUMBER OF CADDISFLY TAXA	7	1	3	0
NUMBER OF STONEFLY TAXA	2	1	1	0
PERCENT MAYFLY COMP.	10.51	0	26.25	1
PERCENT CADDISFLY COMP.	25.29	0	1.99	-1
PERCENT DOMINANT TAXON	13.23	1	21.26	0
PERCENT ISOPOD, SNAIL, LEECH	5.06	0	5.98	0
PERCENT SURF. AIR BREATHERS	3.11	1	23.92	-1
TOTAL SCORE		6		1
MACROINV. COMMUNITY RATING		**EXCELLENT**		**ACCEPT.**

Appendix C.

Procedure 51 - Wadeable Streams Habitat Results

	Little Ocqueoc River		Ocqueoc River		Silver Creek		Silver Creek		
	Silver Ck Rd d-s bridge		Walker Highway		U-s Beech Grove Hwy		D-s last driveway on Beech Grove Hwy		
	RIFFLE/RUN		GLIDE/POOL		RIFFLE/RUN		RIFFLE/RUN		
	STATION 1		**STATION 2**		**STATION 3**		**STATION 4**		
HABITAT METRIC									
Substrate and Instream Cover									
Epifaunal Substrate/ Avail Cover (20)	16		16		18		18		
Embeddedness (20)*	18				18		16		
Velocity/Depth Regime (20)*	13				13		15		
Pool Substrate Characterization (20)**			16						
Pool Variability (20)**			3						
Channel Morphology									
Sediment Deposition (20)	18		18		18		16		
Flow Status - Maint. Flow Volume (10)	10		10		10		10		
Flow Status - Flashiness (10)	8		9		9		8		
Channel Alteration (20)	20		20		20		20		
Frequency of Riffles/Bends (20)*	17				18		18		
Channel Sinuosity (20)**			8						
Riparian and Bank Structure									
Bank Stability (L) (10)	9		9		9		9		
Bank Stability (R) (10)	9		9		9		9		
Vegetative Protection (L) (10)	9		8		9		8		
Vegetative Protection (R) (10)	9		8		9		8		
Riparian Veg. Zone Width (L) (10)	7		9		9		10		
Riparian Veg. Zone Width (R) (10)	10		7		9		10		
TOTAL SCORE (200):	173		150		178		175		
HABITAT RATING:	**EXCELLENT**		**GOOD**		**EXCELLENT**		**EXCELLENT**		
	(NON-		(SLIGHTLY		(NON-		(NON-		
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)		
	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).								
Date:	8/16/2015		8/19/2015		8/19/2015		8/19/2015		
Weather:	Partly Cloudy		Partly Cloudy		Partly Cloudy		Cloudy		
Air Temperature:		Deg. F.	85	Deg. F.	80	Deg. F.	80	Deg. F.	
Water Temperature:	67	Deg. F.	81	Deg. F.		Deg. F.	63.5	Deg. F.	
Ave. Stream Width:	17.3	Feet	18.3	Feet	12.3	Feet	12.5	Feet	
Ave. Stream Depth:	0.43	Feet	2.35	Feet	0.78	Feet	0.63	Feet	
Surface Velocity:	0.97	Ft./Sec.	1.3	Ft./Sec.	100	Ft./Sec.	75	Ft./Sec.	
Estimated Flow:	7.21583	CFS	55.9065	CFS	959.4	CFS	590.625	CFS	
Stream Modifications:	None		None		None		None		
Nuisance Plants (Y/N):	N		Y		N		N		
Report Number:									
STORET No.:	710081		710083		710163		710164		
Stream Name:	e Ocqueoc River		Ocqueoc River		Silver Creek		Silver Creek		
Road Crossing/Location:	Silver Ck Rd d-s bridge		Walker Highway		u-s Beech Grove Hwy		d-s last driveway on Beech Grove Hwy		
County Code:	71		71		71		71		
TRS:	35N03E23		34N03E16		35N04E17		35N04E18		
Latitude (dd):	45.40708		45.33734		45.42676		45.42545		
Longitude (dd):	-84.02893		-84.07274		-83.97912		-84.00592		
Ecoregion:	NLAF		NLAF		NLAF		NLAF		
Stream Type:	Warmwater		Coldwater						
USGS Basin Code:	4070003		4070003		4070003		4070003		
* Applies only to Riffle/Run stream Surveys									
** Applies only to Glide/Pool stream Surveys									
COMMENTS:									

	Sturgeon River
	Whitmarsh Road
	RIFFLE/RUN
	STATION 5
HABITAT METRIC	
Substrate and Instream Cover	
Epifaunal Substrate/ Avail Cover (20)	15
Embeddedness (20)*	15
Velocity/Depth Regime (20)*	18
Pool Substrate Characterization (20)**	
Pool Variability (20)**	
Channel Morphology	
Sediment Deposition (20)	16
Flow Status - Maint. Flow Volume (10)	10
Flow Status - Flashiness (10)	7
Channel Alteration (20)	20
Frequency of Riffles/Bends (20)*	15
Channel Sinuosity (20)**	
Riparian and Bank Structure	
Bank Stability (L) (10)	9
Bank Stability (R) (10)	9
Vegetative Protection (L) (10)	7
Vegetative Protection (R) (10)	10
Riparian Veg. Zone Width (L) (10)	4
Riparian Veg. Zone Width (R) (10)	10
TOTAL SCORE (200):	165
HABITAT RATING:	**EXCELLENT**
	(NON-IMPAIRED)

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).

Date:	9/1/2015	
Weather:	Sunny	
Air Temperature:	80	Deg. F.
Water Temperature:	55.4	Deg. F.
Ave. Stream Width:	27	Feet
Ave. Stream Depth:	1.42	Feet
Surface Velocity:	1.7	Ft./Sec.
Estimated Flow:	65.178	CFS
Stream Modifications:	None	
Nuisance Plants (Y/N):	N	
Report Number:		
STORET No.:	690139	
Stream Name:	Sturgeon River	
Road Crossing/Location:	Whitmarsh Road	
County Code:	69	
TRS:	32N03W31	
Latitude (dd):	45.11304	
Longitude (dd):	-84.59683	
Ecoregion:	NCHF	
Stream Type:	Coldwater	
USGS Basin Code:	4070004	

* Applies only to Riffle/Run stream Surveys

** Applies only to Glide/Pool stream Surveys

COMMENTS:

	West Branch Sturgeon Riv		Sturgeon River		West Branch Maple River		Maple River			
	McEachron Road		White Road		Pleasantview Road		Brutus Road			
	GLIDE/POOL		RIFFLE/RUN		GLIDE/POOL		RIFFLE/RUN			
	STATION 6		**STATION 7**		**STATION 8**		**STATION 9**			
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	18		20		12		13			
Embeddedness (20)*			20				11			
Velocity/Depth Regime (20)*			20				20			
Pool Substrate Characterization (20)**	18				16					
Pool Variability (20)**	17				13					
Channel Morphology										
Sediment Deposition (20)	18		16		15		18			
Flow Status - Maint. Flow Volume (10)	10		10		10		10			
Flow Status - Flashiness (10)	9		8		9		6			
Channel Alteration (20)	20		20		18		20			
Frequency of Riffles/Bends (20)*			18				8			
Channel Sinuosity (20)**	13				18					
Riparian and Bank Structure										
Bank Stability (L) (10)	9		9		10		10			
Bank Stability (R) (10)	9		9		10		10			
Vegetative Protection (L) (10)	9		9		6		9			
Vegetative Protection (R) (10)	9		4		8		7			
Riparian Veg. Zone Width (L) (10)	10		7		6		2			
Riparian Veg. Zone Width (R) (10)	10		4		8		10			
TOTAL SCORE (200):	179		174		159		154			
HABITAT RATING:	**EXCELLENT**		**EXCELLENT**		**EXCELLENT**		**GOOD**			
	(NON-		(NON-		(NON-		(SLIGHTLY			
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)			
	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).									
Date:	9/1/2015		9/1/2015		9/23/2015		8/31/2015			
Weather:	Sunny		Sunny		Sunny		Cloudy			
Air Temperature:	87	Deg. F.	85	Deg. F.	70	Deg. F.	67	Deg. F.		
Water Temperature:		Deg. F.	64	Deg. F.	66	Deg. F.	60	Deg. F.		
Ave. Stream Width:	27	Feet	52	Feet		Feet	44.3	Feet		
Ave. Stream Depth:	1.75	Feet	1.8	Feet	3	Feet	2.04	Feet		
Surface Velocity:	1.8	Ft./Sec.	3.6	Ft./Sec.		Ft./Sec.	1.5	Ft./Sec.		
Estimated Flow:	85.05	CFS	336.96	CFS		CFS	135.558	CFS		
Stream Modifications:	None		None		None					
Nuisance Plants (Y/N):	N		N		N		N			
Report Number:										
STORET No.:	160265		160183		240204		240203			
Stream Name:	h Sturgeon River		Sturgeon River		West Branch Maple River		Maple River			
Road Crossing/Location:	McEachron Road		White Road		Pleasantview Road		Brutus Road			
County Code:	16		16		24		24			
TRS:	33N03W16		34N03W01		37N05W25		36N04W24			
Latitude (dd):	45.24887		45.37179		45.5731		45.49324			
Longitude (dd):	-84.67665		-84.62407		-84.87334		-84.7423			
Ecoregion:	NLAF		NLAF		NLAF		NLAF			
Stream Type:			Coldwater							
USGS Basin Code:	4070004		4070004		4070004		4070004			
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS:										

	Pigeon River		Pigeon River		Pigeon River		Mullett Creek			
	Old Vanderbilt Rd		Sturgeon Valley Rd		Pigeon River Rd		South Extension Rd			
	RIFFLE/RUN		RIFFLE/RUN		RIFFLE/RUN		GLIDE/POOL			
	STATION 10		**STATION 11**		**STATION 12**		**STATION 13**			
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	19		12		17		7			
Embeddedness (20)*	16		9		17					
Velocity/Depth Regime (20)*	18		15		20					
Pool Substrate Characterization (20)**							8			
Pool Variability (20)**							13			
Channel Morphology										
Sediment Deposition (20)	17		10		13		11			
Flow Status - Maint. Flow Volume (10)	10		10		10		10			
Flow Status - Flashiness (10)	10		9		9		9			
Channel Alteration (20)	20		18		20		20			
Frequency of Riffles/Bends (20)*	19		16		13					
Channel Sinuosity (20)**							8			
Riparian and Bank Structure										
Bank Stability (L) (10)	10		9		10		8			
Bank Stability (R) (10)	10		9		10		8			
Vegetative Protection (L) (10)	10		7		8		8			
Vegetative Protection (R) (10)	9		9		9		8			
Riparian Veg. Zone Width (L) (10)	10		8		10		10			
Riparian Veg. Zone Width (R) (10)	10		10		10		10			
TOTAL SCORE (200):	188		151		176		138			
HABITAT RATING:	**EXCELLENT**		**GOOD**		**EXCELLENT**		**GOOD**			
	(NON-		(SLIGHTLY		(NON-		(SLIGHTLY			
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)			
	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).									
Date:	9/25/2015		9/2/2015		9/1/2015		8/31/2015			
Weather:	Partly Cloudy		Sunny		Sunny		Sunny			
Air Temperature:	58	Deg. F.	71	Deg. F.	85	Deg. F.	74	Deg. F.		
Water Temperature:	56	Deg. F.	53.6	Deg. F.		Deg. F.	62	Deg. F.		
Ave. Stream Width:		Feet	45	Feet	48.6	Feet	10.67	Feet		
Ave. Stream Depth:		Feet	0.84	Feet	2.03	Feet	0.95	Feet		
Surface Velocity:		Ft./Sec.	2.34	Ft./Sec.	1.6	Ft./Sec.	0.94	Ft./Sec.		
Estimated Flow:		CFS	88.452	CFS	157.8528	CFS	9.52831	CFS		
Stream Modifications:	None		Habitat Improvement		None		None			
Nuisance Plants (Y/N):	N		N		N		N			
Report Number:										
STORET No.:	690145		690142		160024		160180			
Stream Name:	Pigeon River		Pigeon River		Pigeon River		Mullett Creek			
Road Crossing/Location:	Old Vanderbilt Rd		Sturgeon Valley Rd		Pigeon River Rd		South Extension Rd			
County Code:	69		69		16		16			
TRS:	32N02W25		32N01W20		34N02W24		36N03W01			
Latitude (dd):	45.12815		45.15578		45.33044		45.5399			
Longitude (dd):	-84.5068		-84.46818		-84.49493		-84.6092			
Ecoregion:	NLAF		NLAF		NLAF		NLAF			
Stream Type:	Coldwater		Coldwater		Coldwater		Coldwater			
USGS Basin Code:	4070004		4070004		4070004		4070004			
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS:										

	Black River		East Branch Black River		Milligan Creek	
	Chandler Dam Road		2-track off Shingle Mill Rd		2-track off Klieber Road	
	GLIDE/POOL		GLIDE/POOL		RIFFLE/RUN	
	STATION 14		**STATION 15**		**STATION 16**	
HABITAT METRIC						
Substrate and Instream Cover						
Epifaunal Substrate/ Avail Cover (20)	19		13		19	
Embeddedness (20)*					20	
Velocity/Depth Regime (20)*					20	
Pool Substrate Characterization (20)**	11		7			
Pool Variability (20)**	8		13			
Channel Morphology						
Sediment Deposition (20)	18		17		20	
Flow Status - Maint. Flow Volume (10)	10		10		10	
Flow Status - Flashiness (10)	9		4		10	
Channel Alteration (20)	20		20		20	
Frequency of Riffles/Bends (20)*					18	
Channel Sinuosity (20)**	13		14			
Riparian and Bank Structure						
Bank Stability (L) (10)	9		9		10	
Bank Stability (R) (10)	9		7		10	
Vegetative Protection (L) (10)	7		8		10	
Vegetative Protection (R) (10)	10		9		10	
Riparian Veg. Zone Width (L) (10)	4		10		9	
Riparian Veg. Zone Width (R) (10)	10		4		10	
TOTAL SCORE (200):	157		145		196	
HABITAT RATING:	**EXCELLENT**		**GOOD**		**EXCELLENT**	
	(NON-IMPAIRED)		(SLIGHTLY IMPAIRED)		(NON-IMPAIRED)	
	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).					
Date:	9/2/2015		9/2/2015		9/1/2015	
Weather:	Sunny		Sunny		Sunny	
Air Temperature:	80	Deg. F.	80	Deg. F.	80	Deg. F.
Water Temperature:	59	Deg. F.	59	Deg. F.	64	Deg. F.
Ave. Stream Width:	26.3	Feet	23	Feet	23.5	Feet
Ave. Stream Depth:	1.1	Feet	1.88	Feet	0.45	Feet
Surface Velocity:	2	Ft./Sec.	1.12	Ft./Sec.	0.6	Ft./Sec.
Estimated Flow:	57.86	CFS	48.4288	CFS	6.345	CFS
Stream Modifications:	ank Stabilization		Bank Stabilization		None	
Nuisance Plants (Y/N):	N		N		N	
Report Number:						
STORET No.:	690161		600083		160257	
Stream Name:	Black River		East Branch Black River		Milligan Creek	
Road Crossing/Location:	Chandler Dam Road		two track off Shingle Mill Rd		two-track off Klieber Road	
County Code:	69		60		16	
TRS:	32N01W36		32N01E35		35N01E29	
Latitude (dd):	45.121		45.11291		45.39025	
Longitude (dd):	-84.38663		-84.27574		-84.33642	
Ecoregion:	NLAF		NLAF		NLAF	
Stream Type:	Coldwater				Coldwater	
USGS Basin Code:	4070005		4070005		4070005	
* Applies only to Riffle/Run stream Surveys						
** Applies only to Glide/Pool stream Surveys						
COMMENTS:						

	Indian Creek		McGinn Creek		Wildcat Creek		Thunder Bay River			
	VanWagoner Road		M65		Hubbard Lake Trail		downstream State Street			
	GLIDE/POOL		RIFFLE/RUN		GLIDE/POOL		RIFFLE/RUN			
	STATION 18		**STATION 19**		**STATION 20**		**STATION 21**			
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	16		16		13		18			
Embeddedness (20)*			16				18			
Velocity/Depth Regime (20)*			8				16			
Pool Substrate Characterization (20)**	13				11					
Pool Variability (20)**	8				11					
Channel Morphology										
Sediment Deposition (20)	18		15		11		17			
Flow Status - Maint. Flow Volume (10)	10		9		9		10			
Flow Status - Flashiness (10)	9		9		9		7			
Channel Alteration (20)	20		20		20		14			
Frequency of Riffles/Bends (20)*			15				10			
Channel Sinuosity (20)**	13				18					
Riparian and Bank Structure										
Bank Stability (L) (10)	10		9		9		9			
Bank Stability (R) (10)	10		9		9		9			
Vegetative Protection (L) (10)	10		9		8		8			
Vegetative Protection (R) (10)	10		9		8		8			
Riparian Veg. Zone Width (L) (10)	10		10		7		4			
Riparian Veg. Zone Width (R) (10)	10		10		10		6			
TOTAL SCORE (200):	167		164		153		154			
HABITAT RATING:	**EXCELLENT**		**EXCELLENT**		**GOOD**		**GOOD**			
	(NON-		(NON-		(SLIGHTLY		(SLIGHTLY			
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)			
	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).									
Date:	8/17/2015		8/17/2015		9/3/2015		9/24/2015			
Weather:	Sunny		Partly Cloudy		Rainy		Partly Cloudy			
Air Temperature:	85	Deg. F.	84	Deg. F.	80	Deg. F.	74	Deg. F.		
Water Temperature:	58	Deg. F.	62	Deg. F.	55.4	Deg. F.	62	Deg. F.		
Ave. Stream Width:	7	Feet	16.1	Feet	15.6	Feet		Feet		
Ave. Stream Depth:	0.73	Feet	0.31	Feet	0.69	Feet		Feet		
Surface Velocity:	0.83	Ft./Sec.	1.4	Ft./Sec.	1.2	Ft./Sec.		Ft./Sec.		
Estimated Flow:	4.2413	CFS	6.9874	CFS	12.9168	CFS		CFS		
Stream Modifications:	None		None		Bank Stabilization		Canopy Removal			
Nuisance Plants (Y/N):	N		N		N		N			
Report Number:										
STORET No.:	10129		10128		10136		600085			
Stream Name:	Indian Creek		McGinn Creek		Wildcat Creek		Thunder Bay River			
Road Crossing/Location:	VanWagoner Road		M65		Hubbard Lake Trail		downstream State Street			
County Code:	01		01		01		60			
TRS:	28N05E02		28N05E21		27N06E06		31N04E23			
Latitude (dd):	44.84553		44.80058		44.77003		45.063778			
Longitude (dd):	-83.80598		-83.82836		-83.75041		-83.899889			
Ecoregion:	NLAF		NLAF		NLAF		NLAF			
Stream Type:	Coldwater		Coldwater							
USGS Basin Code:	4070006		4070006		4070006		4070006			
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS:										

	Anchor Creek		Long Lake Creek		Quinn Creek		North Branch Thunder Bay River		
	Carrier Road		County Road 628		Finley Road		Truax Road		
	RIFFLE/RUN		GLIDE/POOL		GLIDE/POOL		GLIDE/POOL		
	STATION 22		**STATION 23**		**STATION 24**		**STATION 25**		
HABITAT METRIC									
Substrate and Instream Cover									
Epifaunal Substrate/ Avail Cover (20)	14		13		12		8		
Embeddedness (20)*	9								
Velocity/Depth Regime (20)*	8								
Pool Substrate Characterization (20)**			13		13		8		
Pool Variability (20)**			13		10		8		
Channel Morphology									
Sediment Deposition (20)	18		16		18		18		
Flow Status - Maint. Flow Volume (10)	10		10		10		10		
Flow Status - Flashiness (10)	2		7		6		7		
Channel Alteration (20)	18		20		19		18		
Frequency of Riffles/Bends (20)*	13								
Channel Sinuosity (20)**			8		8		8		
Riparian and Bank Structure									
Bank Stability (L) (10)	9		8		9		9		
Bank Stability (R) (10)	9		8		9		9		
Vegetative Protection (L) (10)	8		8		8		7		
Vegetative Protection (R) (10)	10		8		8		7		
Riparian Veg. Zone Width (L) (10)	4		10		10		9		
Riparian Veg. Zone Width (R) (10)	10		10		10		10		
TOTAL SCORE (200):	142		152		150		136		
HABITAT RATING:	**GOOD**		**GOOD**		**GOOD**		**GOOD**		
	(SLIGHTLY		(SLIGHTLY		(SLIGHTLY		(SLIGHTLY		
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)		
	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).								
Date:	9/14/2015		9/14/2015		8/18/2015		8/18/2015		
Weather:	Sunny		Sunny		Partly Cloudy		Cloudy		
Air Temperature:	70	Deg. F.	70	Deg. F.	80	Deg. F.	75	Deg. F.	
Water Temperature:		Deg. F.	66	Deg. F.	76	Deg. F.	77	Deg. F.	
Ave. Stream Width:	9.83	Feet	16.3	Feet	15.3	Feet	35.3	Feet	
Ave. Stream Depth:	0.58	Feet	0.92	Feet	1.64	Feet	0.91	Feet	
Surface Velocity:	1.5	Ft./Sec.	1.05	Ft./Sec.	0.167	Ft./Sec.	0.56	Ft./Sec.	
Estimated Flow:	8.5521	CFS	15.7458	CFS	4.190364	CFS	17.98888	CFS	
Stream Modifications:	None		None		None		Canopy Removal		
Nuisance Plants (Y/N):	N		N		N		N		
Report Number:									
STORET No.:	600077		600084		710159		40183		
Stream Name:	Anchor Creek		Long Lake Creek		Quinn Creek		Branch Thunder Bay River		
Road Crossing/Location:	Carrier Road		County Road 628		Finley Road		Truax Road		
County Code:	60		60		71		04		
TRS:	31N04E24		32N04E20		33N05E18		32N05E18		
Latitude (dd):	45.07346		45.14719		45.25475		45.17237		
Longitude (dd):	-83.89644		-83.97809		-83.86155		-83.86364		
Ecoregion:	NLAF		NLAF		NLAF		NLAF		
Stream Type:	Warmwater				Warmwater		Warmwater		
USGS Basin Code:	4070006		4070006		4070006		4070006		
* Applies only to Riffle/Run stream Surveys									
** Applies only to Glide/Pool stream Surveys									
COMMENTS:									

	N B Thunder Bay River		Lower S B Thunder Bay River		Lower S B Thunder Bay River		King Creek			
	Long Rapids Road		Hubbard Lake Road		Beaver Lake Road		Bussie Road			
	RIFFLE/RUN		RIFFLE/RUN		GLIDE/POOL		RIFFLE/RUN			
	STATION 26		**STATION 27**		**STATION 28**		**STATION 29**			
HABITAT METRIC										
Substrate and Instream Cover										
Epifaunal Substrate/ Avail Cover (20)	16		15		17		13			
Embeddedness (20)*	17		18				18			
Velocity/Depth Regime (20)*	12		8				8			
Pool Substrate Characterization (20)**					8					
Pool Variability (20)**					3					
Channel Morphology										
Sediment Deposition (20)	18		18		17		15			
Flow Status - Maint. Flow Volume (10)	10		10		10		9			
Flow Status - Flashiness (10)	10		9		9		9			
Channel Alteration (20)	18		18		20		19			
Frequency of Riffles/Bends (20)*	13		8				8			
Channel Sinuosity (20)**					8					
Riparian and Bank Structure										
Bank Stability (L) (10)	9		9		9		9			
Bank Stability (R) (10)	9		9		9		9			
Vegetative Protection (L) (10)	8		9		9		9			
Vegetative Protection (R) (10)	9		9		8		9			
Riparian Veg. Zone Width (L) (10)	6		7		9		9			
Riparian Veg. Zone Width (R) (10)	9		10		9		9			
TOTAL SCORE (200):	164		157		145		153			
HABITAT RATING:	**EXCELLENT**		**EXCELLENT**		**GOOD**		**GOOD**			
	(NON-		(NON-		(SLIGHTLY		(SLIGHTLY			
	IMPAIRED)		IMPAIRED)		IMPAIRED)		IMPAIRED)			
	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).									
Date:	9/24/2015		8/17/2015		8/20/2015		8/18/2015			
Weather:	Cloudy		Partly Cloudy		Cloudy		Cloudy			
Air Temperature:	65	Deg. F.	86	Deg. F.	75	Deg. F.	67	Deg. F.		
Water Temperature:	60	Deg. F.	87	Deg. F.	72	Deg. F.	70	Deg. F.		
Ave. Stream Width:	65	Feet	70.6	Feet	62.1	Feet	7.5	Feet		
Ave. Stream Depth:	2	Feet	1.13	Feet	1.09	Feet	0.28	Feet		
Surface Velocity:		Ft./Sec.	0.85	Ft./Sec.	0.74	Ft./Sec.	0.65	Ft./Sec.		
Estimated Flow:		CFS	67.8113	CFS	50.08986	CFS	1.365	CFS		
Stream Modifications:	Impounded		None		None		None			
Nuisance Plants (Y/N):	N		N		N		N			
Report Number:										
STORET No.:	40196		40186		40185		40187			
Stream Name:	under Bay River		Branch Thunder Bay River		South Branch Thunder Bay River		King Creek			
Road Crossing/Location:	Long Rapids Road		Hubbard Lake Road		Beaver Lake Road		Bussie Road			
County Code:	04		04		04		04			
TRS:	32N07E33		29N07E28		29N07E10		30N06E12			
Latitude (dd):	45.13398		44.88824		44.93182		45.01878			
Longitude (dd):	-83.6015		-83.58732		-83.57477		-83.65073			
Ecoregion:	NLAF		NLAF		NLAF		NLAF			
Stream Type:			Warmwater		Warmwater		Warmwater			
USGS Basin Code:	4070006		4070006		4070006		4070006			
* Applies only to Riffle/Run stream Surveys										
** Applies only to Glide/Pool stream Surveys										
COMMENTS:										

	Thunder Bay River		Thunder Bay River	
	Salina Road		M65	
	GLIDE/POOL		GLIDE/POOL	
	STATION 30		**STATION 31**	
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	15		15	
Embeddedness (20)*				
Velocity/Depth Regime (20)*				
Pool Substrate Characterization (20)**	7		10	
Pool Variability (20)**	18		8	
Channel Morphology				
Sediment Deposition (20)	13		18	
Flow Status - Maint. Flow Volume (10)	10		9	
Flow Status - Flashiness (10)	2		7	
Channel Alteration (20)	18		20	
Frequency of Riffles/Bends (20)*				
Channel Sinuosity (20)**	13		11	
Riparian and Bank Structure				
Bank Stability (L) (10)	7		9	
Bank Stability (R) (10)	7		9	
Vegetative Protection (L) (10)	8		9	
Vegetative Protection (R) (10)	8		9	
Riparian Veg. Zone Width (L) (10)	9		10	
Riparian Veg. Zone Width (R) (10)	4		9	
TOTAL SCORE (200):	139		153	
HABITAT RATING:	**GOOD**		**GOOD**	
	(SLIGHTLY		(SLIGHTLY	
	IMPAIRED)		IMPAIRED)	
	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).			
Date:	8/18/2015		8/18/2015	
Weather:	Cloudy		Cloudy	
Air Temperature:		Deg. F.	75	Deg. F.
Water Temperature:	75	Deg. F.	77	Deg. F.
Ave. Stream Width:	102	Feet	93.6	Feet
Ave. Stream Depth:	1.98	Feet	2.48	Feet
Surface Velocity:	1.24	Ft./Sec.	1.16	Ft./Sec.
Estimated Flow:	250.4304	CFS	269.26848	CFS
Stream Modifications:	None		None	
Nuisance Plants (Y/N):	N		N	
Report Number:				
STORET No.:	40042		40184	
Stream Name:	hunder Bay River		Thunder Bay River	
Road Crossing/Location:	Salina Road		M65	
County Code:	04		04	
TRS:	31N05E13		32N06E32	
Latitude (dd):	45.08249		45.12058	
Longitude (dd):	-83.75754		-83.72233	
Ecoregion:	NLAF		NLAF	
Stream Type:	Warmwater		Warmwater	
USGS Basin Code:	4070006		4070006	
* Applies only to Riffle/Run stream Surveys				
** Applies only to Glide/Pool stream Surveys				
COMMENTS:				

Appendix D.

Procedure 22 - Nonwadeable Macroinvertebrate Community Results

MACROINVERTEBRATE TEMPLATE

TAXA	SITE 17 Black River 9/23/15 U/S Black River Rd.
ANNELIDA (segmented worms)	
Hirudinea (leeches)	1
Oligochaeta (worms)	4
ARTHROPODA	
Crustacea	
Amphipoda (scuds)	141
Decapoda (crayfish)	1
Isopoda (sowbugs)	39
Arachnoidea	
Hydracarina	2
Insecta	
Ephemeroptera (mayflies)	
Baetidae	2
Caenidae	6
Heptageniidae	10
Potamanthidae	6
Leptohyphidae (Trico.)	8
Odonata	
Zygoptera (damselflies)	
Coenagrionidae	24
Megaloptera	
Sialidae (alder flies)	1
Trichoptera (caddisflies)	
Hydroptilidae	2
Leptoceridae	7
Phryganeidae	1
Polycentropodidae	1
Lepidoptera (moths)	
Pyralidae	1
Coleoptera (beetles)	
Haliplidae (adults)	3
Hydrophilidae (total)	1
Dryopidae (total)	1
Elmidae (total)	3
Diptera (flies)	
Ceratopogonidae	4
Chironomidae	7
Tabanidae	1
MOLLUSCA	
Gastropoda (snails)	
Ancylidae (limpets)	1
Pelecypoda (bivalves)	
Dreissenidae (zebra)	1
Sphaeriidae (fingernail clams)	1

DATE: 9/23/15
RIVER: Black River
STATION NUMBER: U/S Black River Rd.

Attribute	Data Sheet Box #	Value
Total Abundance	1	280
Total Richness	2	28
Number of Ephemeroptera Families	3	5
Number of Plecoptera Families	4	0
Number of Trichoptera Families	5	4
Number of Diptera Taxa	6	3
Trichoptera Abundance	7	11
Abundance of Dominant Taxon	8	141
Shredder Abundance	9	192
Scraper Abundance	10	14
Coll-Filterer Abundance	11	8
Coll-Gath Abundance	12	31
Predator Abundance	13	35

FFG Diversity Workbook	
Numbers calculated automatically	0.373248354
based on FFG abundance above.	0.216096405
	0.146550943
	0.351527457
	0.375
FFG Diversity =	**1.462423159**

Metric Calculations	Value	Metric Score
FFG Diversity (25)	1.462423159	16
Habitat Stability FFG Surrogate (25)	0.098654709	8
% Trichoptera (20)	3.928571429	14
EPT Richness (8)	9	6
Total Richness (7)	28	7
Diptera Richness (5)	3	2
Plecoptera Richness (5)	0	0
% Dominance (5)	50.35714286	2
Total Score=		55