MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
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STAFF REPORT

BIOLOGICAL SURVEYS OF SELECTED SITES IN THE PERE MARQUETTE RIVER WATERSHED IN LAKE, MASON, NEWAYGO, AND OCEANA COUNTIES, MICHIGAN AUGUST 2015

Introduction

Biological and physical habitat conditions of selected water bodies in the Pere Marquette River watershed were assessed at 21 sites by staff of the Michigan Department of Environmental Quality (MDEQ), Surface Water Assessment Section (SWAS), in August 2015. All results and site locations are summarized in Table 1 and site locations are shown in Figure 1. The primary objectives of the assessments were to:

1) Assess the current status of macroinvertebrate communities in individual water bodies.
2) Identify nonpoint sources (NPS) of water quality impairment.
3) Evaluate biological community temporal trends.

Methods

The macroinvertebrate community and physical habitat were qualitatively assessed at 21 sites using SWAS Procedure 51 (Creal et al., 1996; MDEQ 1990) for wadeable streams. A “T” in the site number means that the site is a trend site. If a site is at a road crossing, it is sampled upstream unless otherwise noted. The macroinvertebrate communities were assessed and scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Scores from +4 to -4 are rated acceptable. Negative scores in the acceptable range are considered “low acceptable” tending towards a poor rating, while positive scores in the range are tending towards an excellent rating (“high acceptable”). Habitat evaluations are based on 10 metrics, with a maximum total score of 200. A site 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 assist in determining attainment of the Other Indigenous Aquatic Life and Wildlife (OIALW) designated use.

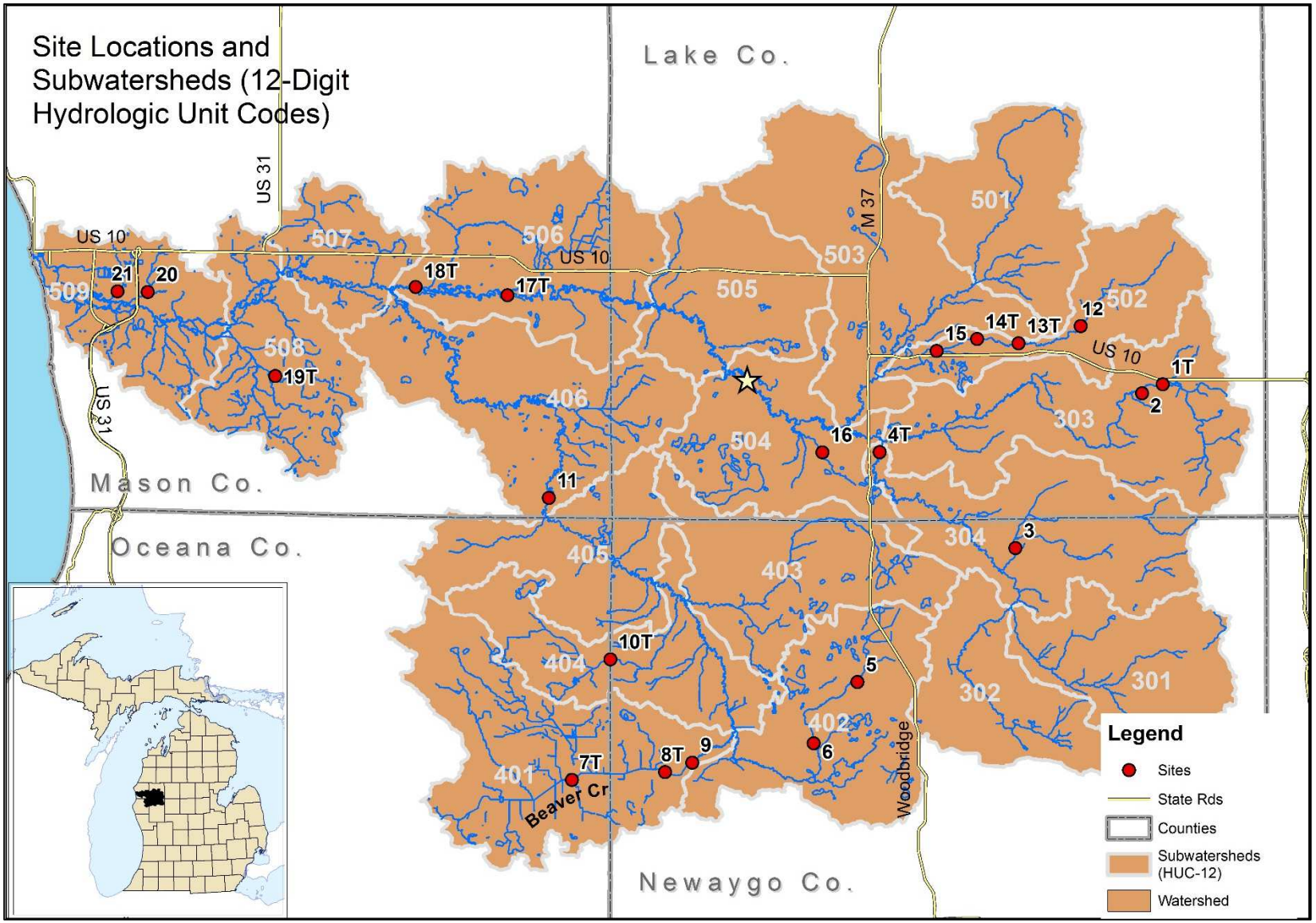

Figure 1. Location of sites and subwatersheds in the Pere Marquette watershed. Subwatersheds are labeled with the last three digits of their 12-digit hydrologic unit code (HUC). The star marks the location of Bowman's Bridge, a popular public access site.

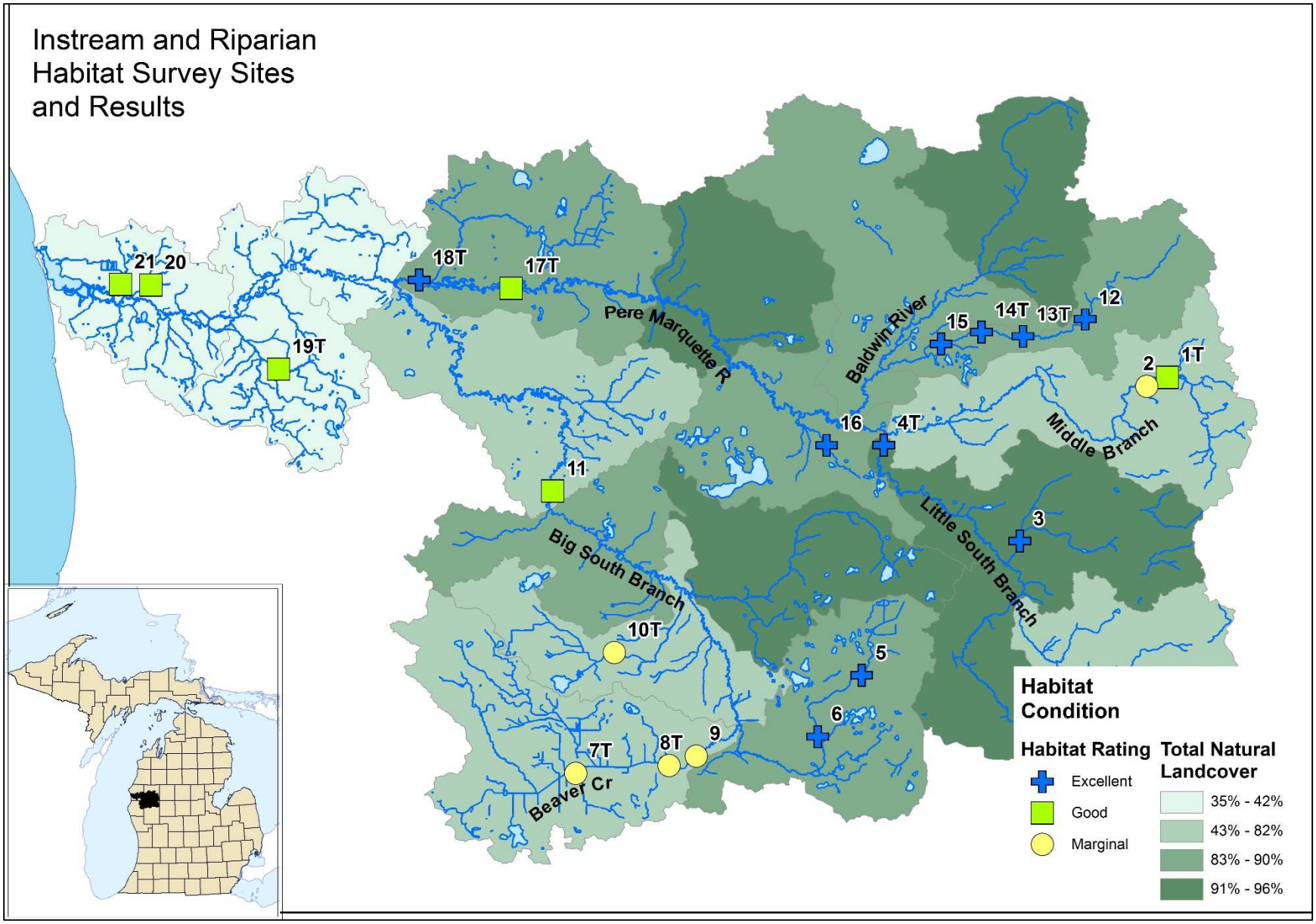

Figure 2. Habitat survey results and percent natural land percent cover by subwatershed. Natural land cover includes all wetland and forest types.

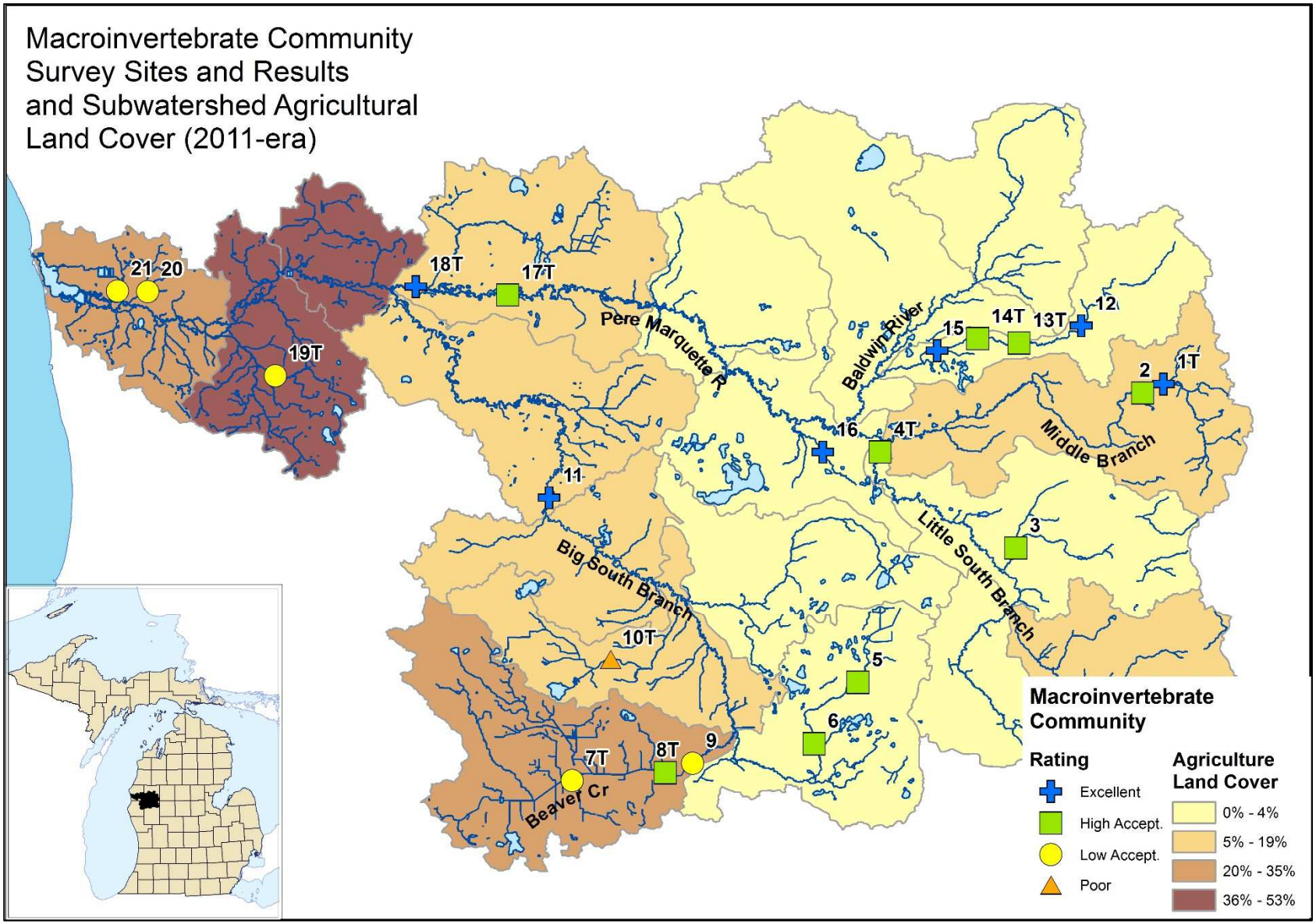

Figure 3. Macroinvertebrate community ratings and percent agricultural land cover (cultivated land and hay/pasture) by subwatershed. For the purposes of this map, scores between +1 and +4 are labelled "High Acceptable" And -4 to 0 are labelled "Low Acceptable".

Site Selection

Two selection methods were used to assess the watershed in 2015: (1) stratified random; and (2) targeted. Eighteen randomly selected sites were assigned to support the SWAS Status (8 sites) and Trend (10 sites) Program. These sites are 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, Water Quality Standards, 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 sites were selected for targeted monitoring based on concerns of stakeholders or staff. Site 12 (Sanborn Creek) was targeted due to planned and completed culvert replacements, which may have a positive effect on the habitat throughout the length of this tributary. Sites 20 and 21 (St. Clair and Mosquito Creeks) were selected for monitoring because they had never been evaluated, and therefore, we could not determine if the designated uses were being met.

Watershed Information

The Pere Marquette watershed is part of HUC 04060101, along with the Lincoln, Big Sable, White, and Pentwater Rivers. The Pere Marquette portion of the watershed is approximately 755 square miles and is located in the Southern Michigan Northern Indiana Till Plains and Northern Lakes and Forests ecoregions (Omernik and Gallant, 2010). In 1978, much of the main stem river was designated as a National Wild and Scenic River, and the main stem along with some major tributaries received a Michigan Natural River designation. These designations offer some protection against destructive uses of the river and riparian zones, but also bring attention from anglers and paddlers. The Pere Marquette River main stem is protected as a coldwater fishery, along with most of its main branches (Big South, Middle, and Little South Branch), while many of the smaller tributaries to these branches are warmwater designated streams (MDNR, 1997). The individual fishery coldwater or warmwater designations for each site can be found in Appendix 2.

The watershed contains portions of the Pere Marquette State Forest and the Huron-Manistee National Forest. The result of the state and federal land management is a watershed that has a high amount of natural landcover such as forests and wetlands (Figure 2), all of which are beneficial to water quality if best management practices are followed.

The largest city in the watershed is Ludington, located in HUC 509 (Pere Marquette River Mouth), nearest Lake Michigan. This subwatershed has the highest human population in the watershed with approximately 9,000 people living there (Table 3) (U.S. Census Bureau, 2010 and 2012). Not surprisingly, this subwatershed also has the highest percent of impervious surfaces and the highest amount of developed land (Table 3) (NOAA, 2011). Vegetated riparian buffers are beneficial to aquatic life because the roots and shoots of plants provide habitat when they extend into the water, roots increase bank stability and filter out pollutants, and tall vegetation provides shade that can keep water cool. A spatial analysis by subwatershed found that 30-meter wide natural land cover buffers were present at between 54 and 99 percent of the

rivers (Table 3). The subwatersheds with the lowest amount of vegetated riparian buffers were those that had high amounts of developed land (509 – Pere Marquette River Mouth), or high amounts of agricultural land (507 – Black Creek and 508 – Swan Creek) (Figure 3).

Most of the survey sites were within the Newaygo Outwash Plain (Subsection VII.3.) in the central part of the watershed (Sites 3-11 and 12-18T) (Albert, 1995). Large streams, like the Main and South Branch Pere Marquette Rivers, tend to trench deeply in the sandy soils, creating tall eroding banks. Stream beds in sandy areas tend to support a lower diversity of macroinvertebrates due to a lack of habitat diversity; for example, Tank Creek had a bed of only sand (Figure 4) providing little habitat diversity (such as layered cobble or gravel), and therefore the macroinvertebrate diversity is not as high as expected for a stream with such intact natural surroundings. This is mainly due to the geography and geology, and not due to human activity; although the sandiness of the soils make the banks sensitive to damage by increased flow flashiness (instability) in agricultural areas (see Figure 2) and other activities. The outwash portion of this subsection has occasional kettle lakes. White and black oak are dominant trees since white pine regeneration was poor following logging. Some areas support prairie-like vegetation rather than forests, due to frost pockets caused by ice block depressions following deglaciation. Wind erosion and the rapid loss of nutrients from soils makes farming cultivation difficult. Nonetheless, agricultural land makes up 25% of the land area in the Beaver Creek subwatershed (040601010401 - Table 2), likely resulting in the evidence of flashiness that was observed (Figure 5 and Figure 6).

Figure 4. The stream bed in Tank Creek (Site 6) was composed of almost 100% sandy substrate.

Figure 5. Beaver Creek at 198th Street (Site 7T) was a trend site with a marginal habitat rating. Bank scour due to flashiness can be seen, and the stream bed was deep muck and sand bars indicating an issue with sediment deposition. The vegetated riparian zone is very narrow and offers little protection from runoff.

Figure 6. Bank scour due to flow flashiness at Beaver Creek at Green Avenue (Site 9).

Sites 19T, 20, and 21 (St. Clair, Mosquito, and Swan Creeks) are in the Manistee Subsection (VII.4). This area is in the far western portion of the watershed near Lake Michigan and is composed of well drained sandy lake plains and end moraines. Intense agriculture use for vegetables and orchards is common due to the air temperature moderating effect of Lake Michigan, which prolongs the growing season and results in slow spring warming. The subwatersheds with the highest percent of agricultural land use, Black Creek at 53% and Swan Creek at 49%, are in the Manistee Subsection (Table 2 and Figure 2). Pere Marquette Lake is typical of the lakes found at the river mouths in this subsection. It was once a bay on Lake Michigan, but falling lake levels and the formation of sand dunes resulted in its separation into a lake. White and red pines were extensively logged and regeneration of these trees has been poor. Forest regeneration tends to occur with the aspens, maple, and birch.

Sites 1T, 2, and 12 (portions of the Middle Branch Pere Marquette and Sanborn Creek) are in the Cadillac sub-subsection (VII.2.1) in the far eastern portion of the watershed. This is a hilly area with excessively well drained soils (coarse and sandy end moraine deposits) resulting in fewer wetlands and lakes. Currently, the ridges support beech-sugar maple forest and the outwash plains support oak or jack pine dominated forest or savannah (barrens). Historically, white and red pines were logged and are no longer common in a natural setting. Riparian areas contain silver maple and ash. Economically, this area is commonly managed for timber production.

New Zealand mud snails have been found throughout the stretch of the Pere Marquette River between M37 and the Bowman Bridge access site near Baldwin (Figure 1), beginning in 2015. This was the first discovery of this invasive species in Michigan and it is probably not a coincidence that it occurred in a popular angling area, since mud snail transport has been linked to wading and fishing gear. Genetic analysis of the snails found in the Pere Marquette showed that they originated in the western United States. Other invasive species that were found are more common in Michigan, such as purple loosestrife (Figure 7). To learn more about mud snails, or other invasive species, please visit www.michigan.gov/invasives.

Figure 7. Purple loosestrife, an invasive species, near the Pere Marquette River - Reek Road canoe launch (Site 18T).

Table 1. Site locations and summary of biological survey results for surveys conducted in August 2015. A "T" in the site number means that the site is a trend site.

Station	Type	Waterbody	Location	Latitude	Longitude	Bug Score	Bug Rating	Habitat Score	Habitat Rating	STORET
1T	trend	M B Pere Marquette River	Depot St.	43.885379	-85.637196	+5	Excellent	128	Good	430624
2	status	Middle Branch Pere Marquette River	Baker Rd.	43.880760	-85.652260	+4	Accept.	85	Marginal	430624
3	status	Pease Creek	17 Mile Rd.	43.799641	-85.744877	+1	Accept.	174	Excellent	620238
4T	trend	Little S B Pere Marquette River	76th St.	43.850246	-85.843296	+4	Accept.	194	Excellent	430569
5	status	Tank Creek	Bingham Ave.	43.729074	-85.859762	+2	Accept.	170	Excellent	620331
6	status	Tank Creek	1 mile d/s 11 Mile Rd.	43.696958	-85.891621	0	Accept.	159	Excellent	620243
7T	trend	Beaver Creek	198th Ave.	43.677744	-86.067085	-4	Accept.	80	Marginal	640331
8T	trend	Beaver Creek	Comstock Rd.	43.681854	-85.999482	+3	Accept.	88	Marginal	620318
9	status	Beaver Creek	Green Ave.	43.686835	-85.979731	-3	Accept.	100	Marginal	620330
10T	trend	Freeman Creek	Maple Island Rd.	43.741071	-86.039180	-6	Poor	82	Marginal	640183
11	status	Big South Branch Pere Marquette River	off end of Porter Rd	43.826264	-86.083896	+5	Excellent	142	Good	530302
12	targeted	Sanborn Creek	40th St.	43.916165	-85.696808	+6	Excellent	164	Excellent	430631
13T	trend	Sanborn Creek	Spruce Rd.	43.907243	-85.742070	+4	Accept.	166	Excellent	430623
14T	trend	Sanborn Creek	Broadway St.	43.909567	-85.772236	+2	Accept.	159	Excellent	430621
15	status	Sanborn Creek	Forman Rd.	43.903345	-85.801739	+7	Excellent	156	Excellent	430632
16	status	Danaher Creek	76th St.	43.850179	-85.884993	+5	Excellent	158	Excellent	430587
17T	trend	Pere Marquette River	Walhalla Rd.	43.933134	-86.114239	+3	Accept.	154	Good	530296
18T	trend	Pere Marquette River	Reek Rd.	43.937423	-86.181044	+5	Excellent	173	Excellent	530028
19T	trend	Swan Creek	Kinney Rd.	43.890082	-86.283215	-1	Accept.	141	Good	530294
20	targeted	Saint Clair Creek	Conrad Rd.	43.934354	-86.376216	-2	Accept.	138	Good	530232
21	targeted	Mosquito Creek	Conrad Rd.	43.934587	-86.398216	-2	Accept.	119	Good	530301

Habitat Scoring Sites
Poor < 56 Marginal 56-104 Good 105-154

Macroinvertebrate Scoring Sites
Excellent >154 Poor < -4 Acceptable -4 to +4 Excellent > +4

Table 2. 2011-era landcover estimates by subwatershed (12-digit HUC). HUCs are the last 3 digits in the 12-digit code (e.g., 040601010301 is shown as 301).

Last 3 Digits of 12-Digit HUC	Subwatershed Name	Total Area	Total Dev. Land	Total Ag. Land	Total Wetland	Total Forested Land	Natural Riparian Buffers	Other (herbaceous, water, barren)
		sq. mi.	%	%	%	%	% of riparian zone in natural cover	%
301	McDuffee Creek	40	3	19	8	59	74	10
302	Headwaters Little South Branch Pere Marquette River	29	3	3	23	64	95	6
303	Middle Branch Pere Marquette River	55	5	13	9	64	85	9
304	Little South Branch Pere Marquette River	46	3	3	8	76	94	11
401	Beaver Creek	58	5	26	30	28	76	12
402	Winnepesaug Creek-Big South Branch Pere Marquette River	44	4	4	18	67	76	7
403	Cedar Creek	40	3	1	23	66	86	7
404	Freeman Creek-Big South Branch Pere Marquette River	35	4	14	23	46	83	13
405	Ruby Creek-Big South Branch Pere Marquette River	34	5	8	15	64	87	9
406	Big South Branch Pere Marquette River	51	5	14	8	64	86	9
501	Cole Creek-Baldwin River	34	2	2	31	52	99	14
502	Sanborn Creek	28	8	1	6	72	78	13
503	Baldwin River	56	9	0	4	75	82	12
504	Danaher Creek-Pere Marquette River	36	8	0	13	67	78	12
505	Tank Creek-Pere Marquette River	33	3	2	3	83	90	9
506	Weldon Creek-Pere Marquette River	51	6	9	13	60	88	11
507	Black Creek-Pere Marquette River	19	9	53	13	18	69	7
508	Swan Creek-Pere Marquette River	34	7	49	17	16	63	11
509	Pere Marquette River (mouth)	31	25	35	14	14	54	11

Table 3. Subwatershed level information on selected indicators of human development in the Pere Marquette watershed, including: wetlands lost since settlement (Fizzell, 2015), impervious surfaces (NOAA, 2011), population and housing units (U.S. Census Bureau, 2010 and 2012), and septic systems. Darker orange shading in the cell represents a higher impact in the subwatershed from that development indicator. HUCs are the last 3 digits in the 12-digit code (e.g., 040601010301 is shown as 301).

Last 3 Digits of 12-Digit HUC	Subwatershed Name	Wetlands Lost	Impervious Surfaces	Human Pop.	Human Pop. Density	Housing Units	Est. Septic Systems
		% of Presettlement	#	#	#/sq.mi.	#	#
301	McDuffee Creek	10	0	490	12	300	300
302	Headwaters Little South Branch Pere Marquette River	9	0	203	7	200	200
303	Middle Branch Pere Marquette River	6	1	1462	27	1500	1500
304	Little South Branch Pere Marquette River	3	0	449	10	600	600
401	Beaver Creek	13	1	1177	20	700	600
402	Winnepesaug Creek-Big South Branch Pere Marquette River	14	0	906	20	1200	1200
403	Cedar Creek	11	0	463	12	800	800
404	Freeman Creek-Big South Branch Pere Marquette River	7	1	608	17	500	500
405	Ruby Creek-Big South Branch Pere Marquette River	13	0	256	8	300	300
406	Big South Branch Pere Marquette River	11	0	507	10	500	500
501	Cole Creek-Baldwin River	2	0	171	5	300	300
502	Sanborn Creek	4	1	951	34	1200	1200
503	Baldwin River	1	1	2733	49	2600	1700
504	Danaher Creek-Pere Marquette River	1	1	1118	31	2600	2600
505	Tank Creek-Pere Marquette River	0	0	181	5	300	300
506	Weldon Creek-Pere Marquette River	9	1	1832	36	1400	1400
507	Black Creek-Pere Marquette River	7	2	1522	82	700	200
508	Swan Creek-Pere Marquette River	2	2	1982	58	1000	800
509	Pere Marquette River	1	10	9049	287	4800	500

Historical Sampling Efforts and Information

The Pere Marquette watershed is monitored every five years, at a minimum, by MDEQ staff. The most recent survey was conducted in 2010. According to that survey, macroinvertebrate communities were found to be acceptable or excellent, with no sites scoring poor (Knoll-Wilmes, 2013). The surveys in 2010 were the first where the trend sites were sampled as part of the watershed trend program; therefore, all sites marked as "trend" in Table 1 were also monitored in 2010 (see Objective 3: Evaluate biological community temporal trends.).

Freeman Creek was sampled frequently (annually from 1996-2003, except 1999) throughout the arrival and establishment of a hog facility (now designated as a Concentration Animal Feeding Operation) (Kohlhepp, 2004). These studies were conducted to determine if the facility had an effect on the macroinvertebrate community in this area, and concluded that no consistent decline in Procedure 51 macroinvertebrate community score occurred, as all sites rated from +1 to +9 and there was considerable variation at each site among years.

Summary of Findings by Monitoring Objective

Objective 1: Assess the current status of macroinvertebrate communities in individual water bodies.

Of the 21 sites where macroinvertebrate community was evaluated, the community was found to be excellent at 6 sites, acceptable at 14, and poor at 1 site (10T) (Appendix 1 and Figure 3). To support the macroinvertebrate community evaluations, the habitat was also evaluated and results are shown in Appendix 2 and Figure 2. All results are summarized in Table 1.

A portion of the survey sites in Table 1 were randomly selected for a study designed to make watershed-wide statements about the macroinvertebrate community as it relates to the OIALW designated use attainment status. These sites are marked as "status" in Table 1. Fourteen randomly selected sites within the Pentwater - Pere Marquette watershed group were sampled to support attainment status calculation (two of these sites were in the Pentwater and are not included in Table 1, but were used for attainment status calculation purposes). Based on the probabilistic monitoring aspect of this watershed group survey, 100 +/- 19 percent of the randomly selected status sites supported the OIALW designated use using biological monitoring procedures. Percent attainment was calculated by dividing the number of random status sites that met Water Quality Standards by the total number of random locations ((14 / 14)100 = 100 percent). This value is coupled with a 95 percent confidence interval to provide our estimation of certainty, meaning there is 95 percent certainty that the true proportion of attainment in the northwest Michigan watershed group is between 81 and 100 percent.

Objective 2: Identify NPS of water quality impairment.

Sanborn Creek was monitored at four sites, three of which (13T, 14T and 15) were randomly selected and one additional site (12) was targeted at 40th Street. Sanborn Creek has a series of undersized and perched culverts, some of which have already been replaced (as was the case at Site 12 at 40th Street). Undersized and perched culverts cause erosion and sediment transport issues (Figure 8), and perched culverts (Figure 9 and Figure 10) can also cause fish passage issues. Several of the remaining old culverts are in the process of being replaced to reduce these issues. In 2015, three of the sites (Site 13T at Spruce Road, 14T at Broadway Street, and 15 at Foreman Road) were located upstream of culverts that were scheduled for replacement but the work had not been completed yet. All of these sites scored within the excellent range for habitat. Sites 13T (Spruce Road) and 14T (Broadway Street) had acceptable macroinvertebrate communities, while sites 12 (40th Street) and 15 (Forman Road) had excellent rated macroinvertebrate communities. The differences in macroinvertebrate community ratings were only slight, and likely were not caused by the presence of new versus older culverts.

Figure 8. Water and sediment tend to accumulate upstream of under-sized culverts, as seen here on Sanborn upstream of Foreman Road (Site 15).

Figure 9. Perched culvert in Sanborn Creek, looking downstream at Spruce Road (Site 13T).

Figure 10. Perched culvert in Sanborn Creek, looking downstream at Broadway Street (Site 14T)

Objective 3: Evaluate biological community temporal trends.

Ten sites (Table 1) within the watershed were randomly selected as trend sites and will be sampled every five years to assess trends in the macroinvertebrate community as it relates to the OIALW designated use attainment status. In order to draw conclusions on the watershed trends, each site must be sampled three times; therefore, trend information cannot be summarized until 2020, when a sufficient amount of data has been collected. In 2015, two trend sites rated excellent (1T and 18T), one scored poor (10T), and the remaining scored between -4 and +3 (acceptable). A score of -4 (close to the poor rating threshold) was found at Beaver Creek at 198th Avenue (site 7T). The habitat at this site was rated marginal, with a score of 80 (the lowest found in this survey), and was limited by heavy sediment deposits, including deep unconsolidated muck beneath the water and sand bars extending above the water level (Figure 5 and Figure 6). Bank scour was also noted. These issues are symptoms of a flashy stream with erosion issues (MDEQ, 1990).

The macroinvertebrate community in Freeman Creek at Maple Island Road (Site 10T) rated -6 (poor) in 2015, and showed a dramatic decline since the previous survey in 2010 where it scored +4 (Knoll-Wilmes, 2013) and previous surveys where it scored as high as +9 (Kohlhepp, 2004). It was noted during the 2015 survey that floating dead organic matter was present (Figure 11) and the instream macroinvertebrate habitat was also nearly completely covered with this unknown flocculent material (samples were not collected for analysis). This decaying matter likely lead to a dominance of the macroinvertebrate community by blood worms (a very tolerant type of Chironomidae) (Appendix 1). Habitat scores were in the marginal category in 2015 and 2010. This area has also been impacted by drainage activities and is a designated county drain (personal communication with Oceana Drain Commissioners Office, December 20, 2016). The MDEQ is investigating the cause of this issue and plans to revisit this site and monitor the macroinvertebrate community for recovery.

Figure 11. Flocculent organic matter covered all surfaces at Freeman Creek (10T), leaving little habitat for macroinvertebrates. The organic matter was not collected or identified.

Conclusions and Future Monitoring Recommendations

Taken as a whole, the macroinvertebrate community and habitat in the Pere Marquette watershed is considered between acceptable and excellent, but the watershed does have tributary areas where problems are evident due to land use (e.g., agriculture) and storm water practices. The lowest macroinvertebrate community and habitat scores found in this survey were found at trend sites (Beaver Creek - 7T and Freeman Creek - 10T), ensuring that these areas are surveyed again in 2020 as long as the trend program continues. These areas are both maintained county drains (personal communication with Oceana Drain Commissioners Office, December 20, 2016) and also have been impacted by excessive sediment inputs and deposition likely due to agricultural activity and flow flashiness caused by drainage activities. St. Clair and Mosquito Creeks, near Ludington, also scored low acceptable and were obviously impacted by the higher levels of development and agriculture in these subwatersheds. Further monitoring at other small tributaries near Ludington (subwatersheds 507, 508, and 509 in Figure 1) should be considered in the future due to the high levels of agriculture and loss of natural vegetated riparian buffers (Table 2).

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Citations

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Appendix 1. Qualitative macroinvertebrate sampling results for the Pere Marquette River and tributaries - August, 2015.

TAXA	Middle Branch Pere Marquette River Depot Street 8/6/2015 **SITE 1T**	Main Branch Pere Marquette River Baker Road 8/6/2015 **SITE 2**	Pease Creek 17 Mile Road 8/12/2015 **SITE 3**	Little South Branch Pere Marquette River downstream 76th Street (Starr Lake Road) 8/6/2015 **SITE 4T**
PLATYHELMINTHES (flatworms)				
Turbellaria				
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1			
Oligochaeta (worms)	1	3	7	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)		2	1	15
Decapoda (crayfish)	3	4		
Arachnoidea				
Hydracarina	1		6	4
Insecta				
Ephemeroptera (mayflies)				
Baetidae	4	6	23	25
Caenidae		2		
Ephemerellidae				6
Heptageniidae	7	4	1	6
Isonychiidae				3
Tricorythidae			6	8
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	3	6	
Gomphidae		10		
Zygoptera (damselflies)				
Calopterygidae	12	6		1
Coenagrionidae			1	
Plecoptera (stoneflies)				
Perlidae				8
Perlodidae	1			
Pteronarcyidae			3	1
Hemiptera (true bugs)				
Corixidae	1	4		
Gerridae	1			
Pleidae	1			
Veliidae	4			
Corydalidae (dobson flies)	7	5	2	1
Sialidae (alder flies)	3	3		
Trichoptera (caddisflies)				
Brachycentridae			43	1
Glossosomatidae		1		6
Helicopsychidae	3	15		
Hydropsychidae			6	62
Leptoceridae	3	19		
Limnephilidae	18	24	3	1
Molannidae	1	8		1
Philopotamidae			2	
Uenoidae	44	3		
Coleoptera (beetles)				
Gyrinidae (adults)			1	
Haliplidae (adults)				
Dryopidae	3	1	1	
Elmidae	28	5	8	40
Psephenidae (larvae)	1			
Diptera (flies)				
Athericidae			2	26
Ceratopogonidae		2	1	
Chironomidae	14	40	22	24
Simuliidae			129	28
Tabanidae	1	4	1	
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	2	1		
Physidae	7		1	1
Valvatidae		1		
Viviparidae		1		
Pelecypoda (bivalves)				
Sphaeriidae (clams)	3	5	1	
TOTAL INDIVIDUALS	176	182	277	269

METRIC EVALUATION	Middle Branch Pere Marquette River Depot Street 8/6/2015 **SITE 1T**		Main Branch Pere Marquette River Baker Road 8/6/2015 **SITE 2**		Pease Creek 17 Mile Road 8/12/2015 **SITE 3**		Little South Branch Pere Marquette River downstream 76th Street (Starr Lake Road) 8/6/2015 **SITE 4T**	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	28	1	27	1	24	0	22	0
NUMBER OF MAYFLY TAXA	2	0	3	0	3	0	5	1
NUMBER OF CADDISFLY TAXA	5	1	6	1	4	0	5	0
NUMBER OF STONEFLY TAXA	1	1	0	-1	1	0	2	1
PERCENT MAYFLY COMP.	6.25	0	6.59	0	10.83	0	17.84	0
PERCENT CADDISFLY COMP.	39.20	1	38.46	1	19.49	0	26.39	0
PERCENT DOMINANT TAXON	25.00	0	21.98	0	46.57	-1	23.05	0
PERCENT ISOPOD, SNAIL, LEECH	5.68	0	1.65	1	0.36	1	0.37	1
PERCENT SURF. AIR BREATHERS	3.98	1	2.20	1	0.36	1	0.00	1
TOTAL SCORE		5		4		1		4
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		ACCEPT.		ACCEPT.

Appendix 1. Qualitative macroinvertebrate sampling results for the Pere Marquette River and tributaries - August, 2015.

TAXA	Tank Creek Bingham Avenue 8/5/2015 **SITE 5**	Tank Creek 1 mi. d/s of 11 Mile Rd 8/5/2015 **SITE 6**	Beaver Creek 198th Avenue 8/5/2015 **SITE 7T**	Beaver Creek Comstock Avenue 8/5/2015 **SITE 8T**
PLATYHELMINTHES (flatworms)				
Turbellaria			2	
ANNELIDA (segmented worms)				
Hirudinea (leeches)			1	
Oligochaeta (worms)	4	1	15	4
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	152	142	70	90
Decapoda (crayfish)	7	6		7
Arachnoidea				
Hydracarina			2	
Insecta				
Ephemeroptera (mayflies)				
Baetidae	4	2	1	30
Caenidae			1	1
Heptageniidae	4	5		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	6	2	1	
Gomphidae	1			3
Zygoptera (damselflies)				
Calopterygidae	28	2		21
Coenagrionidae	2		4	
Plecoptera (stoneflies)				
Perlidae	1	1		
Hemiptera (true bugs)				
Belostomatidae			1	
Corixidae			5	1
Gelastocoridae				
Gerridae	1	1	1	
Nepidae				1
Notonectidae	1			
Pleidae			6	
Veliidae	1			
Megaloptera				
Corydalidae (dobson flies)		1	1	
Sialidae (alder flies)	1			
Trichoptera (caddisflies)				
Brachycentridae	11	100		1
Helicopsychidae	10			
Hydropsychidae	9	5		14
Leptoceridae	8	2		2
Limnephilidae		1		1
Molannidae	1			1
Phryganeidae	2			1
Polycentropodidae	10	2		
Coleoptera (beetles)				
Dytiscidae (total)	2		1	
Gyrinidae (adults)	1		1	1
Haliplidae (adults)			1	
Hydrophilidae (total)				1
Dryopidae				4
Elmidae		1	1	3
Diptera (flies)				
Ceratopogonidae	1			1
Chironomidae	2	2	94	16
Culicidae			2	
Dixidae	1			
Simuliidae	10	2		69
Tabanidae	1			2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	2			1
Physidae	10			2
Planorbidae		1	1	
Viviparidae	1		15	2
Pelecypoda (bivalves)				
Sphaeriidae (clams)	1	4	24	7
Unionidae (mussels)				1
TOTAL INDIVIDUALS	296	283	251	288

METRIC EVALUATION	Tank Creek Bingham Avenue 8/5/2015 **SITE 5** Value	Score	Tank Creek 1 mi. d/s of 11 Mile Rd 8/5/2015 **SITE 6** Value	Score	Beaver Creek 198th Avenue 8/5/2015 **SITE 7T** Value	Score	Beaver Creek Comstock Avenue 8/5/2015 **SITE 8T** Value	Score
TOTAL NUMBER OF TAXA	32	1	20	0	23	0	28	1
NUMBER OF MAYFLY TAXA	2	0	2	-1	2	0	2	0
NUMBER OF CADDISFLY TAXA	7	1	5	0	0	-1	6	1
NUMBER OF STONEFLY TAXA	1	1	1	0	0	-1	0	-1
PERCENT MAYFLY COMP.	2.70	-1	2.47	-1	0.80	-1	10.76	0
PERCENT CADDISFLY COMP.	17.23	0	38.87	1	0.00	-1	6.94	0
PERCENT DOMINANT TAXON	51.35	-1	50.18	-1	37.45	0	31.25	0
PERCENT ISOPOD, SNAIL, LEECH	4.39	0	0.35	1	6.77	0	1.74	1
PERCENT SURF. AIR BREATHERS	2.03	1	0.35	1	7.17	0	1.39	1
TOTAL SCORE		2		0		-4		3
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		ACCEPT.

Appendix 1. Qualitative macroinvertebrate sampling results for the Pere Marquette River and tributaries - August, 2015.

TAXA	Beaver Creek Green Avenue 8/5/2015 **SITE 9**	Freeman Creek Maple Island Avenue 8/5/2015 **SITE 10T**	Big South Branch Pere Marquette River off Porter Road 8/5/2015 **SITE 11**	Sanborn Creek downstream 40th Street 8/12/2015 **SITE 12**
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1		
Oligochaeta (worms)		8	7	4
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	240	38	26	78
Decapoda (crayfish)	5		1	
Isopoda (sowbugs)			12	
Arachnoidea				
Hydracarina		4	2	6
Insecta				
Ephemeroptera (mayflies)				
Baetidae	3		83	13
Caenidae		1		1
Ephemerellidae			5	
Ephemeridae				1
Heptageniidae			12	3
Isonychiidae			15	
Tricorythidae			2	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae				2
Cordulegastridae				1
Gomphidae	1	3	4	
Zygoptera (damselflies)				
Calopterygidae	6	1	1	
Coenagrionidae		1		
Plecoptera (stoneflies)				
Perlidae			5	10
Perlodidae				14
Pteronarcyidae			4	10
Hemiptera (true bugs)				
Corixidae		1	8	
Gerridae		1		1
Notonectidae	1			
Pleidae		9		
Veliidae	1	2		
Megaloptera				
Corydalidae (dobson flies)				1
Trichoptera (caddisflies)				
Brachycentridae	5			10
Glossosomatidae				2
Helicopsychidae				
Hydropsychidae	4		33	6
Limnephilidae	1	2	1	4
Philopotamidae				3
Phryganeidae			1	
Uenoidae				1
Coleoptera (beetles)				
Dytiscidae (total)		1		
Haliplidae (adults)		2		
Dryopidae	3		1	
Elmidae	1	3	16	13
Diptera (flies)				
Athericidae			18	
Ceratopogonidae	1			
Chaoboridae				
Chironomidae	4	138	16	40
Culicidae		5		
Simuliidae	2		15	35
Tabanidae	1			
Tipulidae				2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)			1	
Physidae		10	1	
Pelecypoda (bivalves)				
Sphaeriidae (clams)	3	25	6	1
TOTAL INDIVIDUALS	282	256	296	262

METRIC EVALUATION	Beaver Creek Green Avenue 8/5/2015 **SITE 9**		Freeman Creek Maple Island Avenue 8/5/2015 **SITE 10T**		Big South Branch Pere Marquette River off Porter Road 8/5/2015 **SITE 11**		Sanborn Creek downstream 40th Street 8/12/2015 **SITE 12**	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	17	0	20	0	26	1	25	1
NUMBER OF MAYFLY TAXA	1	-1	1	-1	5	1	4	1
NUMBER OF CADDISFLY TAXA	3	0	1	-1	3	0	6	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1	2	1	3	1
PERCENT MAYFLY COMP.	1.06	-1	0.39	-1	39.53	1	6.87	0
PERCENT CADDISFLY COMP.	3.55	-1	0.78	-1	11.82	0	9.92	0
PERCENT DOMINANT TAXON	85.11	-1	53.91	-1	28.04	0	29.77	0
PERCENT ISOPOD, SNAIL, LEECH	0.00	1	4.30	0	4.73	0	0.00	1
PERCENT SURF. AIR BREATHERS	0.71	1	8.20	0	2.70	1	0.38	1
TOTAL SCORE		-3		-6		5		6
MACROINV. COMMUNITY RATING		ACCEPT.		POOR		EXCELLENT		EXCELLENT

Appendix 1. Qualitative macroinvertebrate sampling results for the Pere Marquette River and tributaries - August, 2015.

TAXA	Sanborn Creek Spruce Road 8/6/2015 **SITE 13T**	Sanborn Creek Broadway Street 8/6/2015 **SITE 14T**	Sanborn Creek upstream Forman Road 8/12/2015 **SITE 15**	Donaher Creek Starr Lake Road (76th 8/12/2015 **SITE 16**
Hirudinea (leeches)				2
Oligochaeta (worms)	26	13	1	9
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	16	21	23	43
Arachnoidea				
Hydracarina	2	3	1	8
Insecta				
Ephemeroptera (mayflies)				
Baetidae	22	8	27	21
Caenidae		5	2	
Ephemerellidae	1			
Ephemeridae			1	1
Heptageniidae	1			
Isonychiidae				
Leptophlebiidae	1			1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1			
Zygoptera (damselflies)				
Calopterygidae			3	
Coenagrionidae			1	
Plecoptera (stoneflies)				
Perlidae	3		11	
Perlodidae	59	14	3	
Pteronarcyidae	1	8	21	
Hemiptera (true bugs)				
Corixidae			3	6
Gerridae	1	2		1
Notonectidae				1
Veliidae	1		2	1
Megaloptera				
Corydalidae (dobson flies)			1	1
Sialidae (alder flies)		1	1	
Trichoptera (caddisflies)				
Brachycentridae	62	45	53	58
Glossosomatidae	1			
Hydropsychidae		1	23	26
Lepidostomatidae	9			
Limnephilidae	4	2	4	17
Philopotamidae			2	
Phryganeidae			1	1
Polycentropodidae	1			
Uenoidae	1			
Coleoptera (beetles)				
Dytiscidae (total)	1	1		
Gyrinidae (adults)	1	1		1
Hydrophilidae (total)		1		
Elmidae	10		1	
Diptera (flies)				
Athericidae	1	3	2	
Chironomidae	29	95	48	55
Dixidae	1	1		2
Simuliidae	14	9	47	16
Tabanidae			1	1
Tipulidae	2		1	1
MOLLUSCA				
Gastropoda (snails)				
Physidae			1	1
Pelecypoda (bivalves)				
Sphaeriidae (clams)		10	1	1
TOTAL INDIVIDUALS	272	244	286	275

METRIC EVALUATION	Sanborn Creek Spruce Road 8/6/2015 **SITE 13T**		Sanborn Creek Broadway Street 8/6/2015 **SITE 14T**		Sanborn Creek upstream Forman Road 8/11/2015 **SITE 15**		Donaher Creek Starr Lake Road (76th Street) 8/12/2015 **SITE 16**	
	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	27	0	20	0	28	1	24	1
NUMBER OF MAYFLY TAXA	4	0	2	0	3	0	3	1
NUMBER OF CADDISFLY TAXA	6	1	3	0	5	1	4	0
NUMBER OF STONEFLY TAXA	3	1	2	1	3	1	0	0
PERCENT MAYFLY COMP.	9.19	0	5.33	0	10.49	0	8.36	0
PERCENT CADDISFLY COMP.	28.68	0	19.67	0	29.02	1	37.09	1
PERCENT DOMINANT TAXON	22.79	0	38.93	-1	18.53	1	21.09	0
PERCENT ISOPOD, SNAIL, LEECH	0.00	1	0.00	1	0.35	1	1.09	1
PERCENT SURF. AIR BREATHERS	1.47	1	2.05	1	1.75	1	3.64	1
TOTAL SCORE		4		2		7		5
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		EXCELLENT		EXCELLENT

Appendix 1. Qualitative macroinvertebrate sampling results for the Pere Marquette River and tributaries - August, 2015.

TAXA	Pere Marquette River Walhalla Road 8/4/2015 **SITE 17T**	Pere Marquette River downstream Reek Road 8/4/2015 **SITE 18**	Swan Creek Kinney Road 8/4/2015 **SITE 19T**	Saint Clair Creek Conrad Rd 8/4/2015 **SITE 20**	Mosquito Creek Conrad Road 8/4/2015 **SITE 21**
PORIFERA (sponges)		1			
ANNELIDA (segmented worms)					
Hirudinea (leeches)		1			
Oligochaeta (worms)	10		12	3	9
ARTHROPODA					
Crustacea					
Amphipoda (scuds)	11	126	161	220	150
Decapoda (crayfish)	3	3			1
Isopoda (sowbugs)				12	11
Insecta					
Ephemeroptera (mayflies)					
Ametropodidae	1				
Baetiscidae					
Baetidae	79	36	1	5	9
Caenidae			1		
Ephemerellidae	1				
Ephemeridae		8			
Heptageniidae	3	13	3		
Isonychiidae	5	1			
Tricorythidae	4				
Odonata					
Anisoptera (dragonflies)					
Aeshnidae	3		1	1	2
Gomphidae		1			
Libellulidae			1		
Zygoptera (damselflies)					
Calopterygidae	9	19	16	1	2
Plecoptera (stoneflies)					
Perlidae	3	2			
Pteronarcyidae	1	1			
Hemiptera (true bugs)					
Belostomatidae		1			
Corixidae	17	21			
Gerridae	1	1	1	2	1
Notonectidae			1		
Saldidae			5		
Veliidae			3	2	1
Megaloptera					
Corydalidae (dobson flies)		1		5	4
Sialidae (alder flies)		1			1
Trichoptera (caddisflies)					
Brachycentridae		2	2	2	8
Hydropsychidae	53	15	1	5	3
Leptoceridae	1	1			
Limnephilidae	1	1	2	3	8
Philopotamidae					1
Phryganeidae				7	
Polycentropodidae		2			
Coleoptera (beetles)					
Gyrinidae (adults)			3		
Hydrophilidae (total)		1		1	
Scirtidae (adults)			3		
Dryopidae	1	2	1	4	
Elmidae			2		
Diptera (flies)					
Athericidae	10	1	1	1	
Ceratopogonidae					1
Chironomidae	11	7	26	7	24
Culicidae			1		
Simuliidae	19	5	2	11	4
Tipulidae			1		
MOLLUSCA					
Gastropoda (snails)					
Ancylidae (limpets)		1			
Lymnaeidae				2	
Physidae	2	5	4		1
Pelecypoda (bivalves)					
Sphaeriidae (clams)		1	2	1	6
TOTAL INDIVIDUALS	249	281	257	295	249

METRIC EVALUATION	Pere Marquette River Walhalla Road 8/4/2015 **SITE 17T** Value	Score	Pere Marquette River downstream Reek Road 8/4/2015 **SITE 18T** Value	Score	Swan Creek Kinney Road 8/4/2015 **SITE 19T** Value	Score	Saint Clair Creek Conrad Rd 8/4/2015 **SITE 20** Value	Score	Mosquito Creek Conrad Road 8/4/2015 **SITE 21** Value	Score
TOTAL NUMBER OF TAXA	23	0	30	1	26	1	20	0	21	0
NUMBER OF MAYFLY TAXA	6	1	4	1	3	0	1	0	1	-1
NUMBER OF CADDISFLY TAXA	3	0	5	1	3	0	4	0	4	0
NUMBER OF STONEFLY TAXA	2	1	2	1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	37.35	1	20.64	1	1.95	-1	1.69	-1	3.61	0
PERCENT CADDISFLY COMP.	22.09	0	7.47	0	1.95	-1	5.76	0	8.03	0
PERCENT DOMINANT TAXON	31.73	-1	44.84	-1	62.65	-1	74.58	-1	60.24	-1
PERCENT ISOPOD, SNAIL, LEECH	0.80	1	2.49	1	1.56	1	4.75	0	4.82	0
PERCENT SURF. AIR BREATHERS	7.23	0	8.54	0	6.61	1	1.69	1	0.80	1
TOTAL SCORE		3		5		-1		-2		-2
MACROINV. COMMUNITY RATING		ACCEPT.		EXCELLENT		ACCEPT.		ACCEPT.		ACCEPT.

Appendix 2. Habitat evaluation for the Pere Marquette River and tributaries - August 2015.

HABITAT METRIC	Middle Branch Pere Marquette River Depot Street GLIDE/POOL **SITE 1T**	Main Branch Pere Marquette River Baker Road GLIDE/POOL **SITE 2**	Pease Creek 17 Mile Road GLIDE/POOL **SITE 3**	Little South Branch Pere Marquette River downstream 76th Street RIFFLE/RUN **SITE 4T**	Tank Creek Bingham Avenue GLIDE/POOL **SITE 5**
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	15	8	16	20	16
Embeddedness (20)*				18	
Velocity/Depth Regime (20)*				20	
Pool Substrate Characterization (20)**	6	5	10		15
Pool Variability (20)**	16	10	16		18
Channel Morphology					
Sediment Deposition (20)	18	5	15	18	15
Flow Status - Maint. Flow Volume (10)	9	8	10	10	10
Flow Status - Flashiness (10)	6	2	10	10	10
Channel Alteration (20)	8	15	20	20	19
Frequency of Riffles/Bends (20)*				20	
Channel Sinuosity (20)**	7	11	19		15
Riparian and Bank Structure					
Bank Stability (L) (10)	10	2	10	10	10
Bank Stability (R) (10)	10	2	10	10	10
Vegetative Protection (L) (10)	10	5	9	10	10
Vegetative Protection (R) (10)	5	2	9	10	10
Riparian Veg. Zone Width (L) (10)	5	8	10	10	8
Riparian Veg. Zone Width (R) (10)	3	2	10	8	4
TOTAL SCORE (200):	128	85	174	194	170
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	EXCELLENT (NON-IMPAIRED)	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:	8/6/2015	8/6/2015	8/12/2015	8/6/2015	8/5/2015
Weather:	Sunny	Cloudy	Partly Cloudy	Partly Cloudy	Sunny
Air Temperature:	80 Deg. F.	78 Deg. F.	76 Deg. F.	Deg. F.	76 Deg. F.
Water Temperature:	70 Deg. F.	68 Deg. F.	64 Deg. F.	60 Deg. F.	72 Deg. F.
Ave. Stream Width:	15 Feet	12 Feet	11.67 Feet	40 Feet	13.5 Feet
Ave. Stream Depth:	1.35 Feet	0.6 Feet	0.98 Feet	1.87 Feet	0.6 Feet
Surface Velocity:	0.02 Ft./Sec.	0.41 Ft./Sec.	1 Ft./Sec.	1.2 Ft./Sec.	0.86 Ft./Sec.
Estimated Flow:	0.405 CFS	2.952 CFS	11.4366 CFS	89.76 CFS	6.966 CFS
Stream Modifications:	Dredged	None	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	430624	430609	620238	430569	620331
Stream Name:	Middle Branch Pere Marquette River	Main Branch Pere Marquette River	Pease Creek	Little South Branch Pere Marquette River	Tank Creek
Road Crossing/Location:	Depot Street	Baker Road	17 Mile Road	downstream 76th Street (Starr Lake Road)	Bingham Avenue
County Code:	43	43	62	43	62
TRS:	17N11W09	17N11W8	16N12W04	17N13W22	16N13W34
Latitude (dd):	43.88538	43.88076	43.799642	43.850012	43.72907
Longitude (dd):	-85.6372	-85.65226	-85.744881	-85.843387	-85.859762
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater	Coldwater
USGS Basin Code:	4060101	4060101	4060101	4060101	4060101

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

COMMENTS:

Appendix 2. Habitat evaluation for the Pere Marquette River and tributaries - August 2015.

HABITAT METRIC	Tank Creek 1 mi. d/s of 11 Mile Rd GLIDE/POOL **SITE 6**	Beaver Creek 198th Avenue GLIDE/POOL **SITE 7T**	Beaver Creek Comstock Avenue GLIDE/POOL **SITE 8T**	Beaver Creek Green Avenue GLIDE/POOL **SITE 9**	Freeman Creek Maple Island Avenue GLIDE/POOL **SITE 10T**
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	13	13	8	5	3
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	11	6	6	6	6
Pool Variability (20)**	5	11	1	11	2
Channel Morphology					
Sediment Deposition (20)	11	5	6	4	16
Flow Status - Maint. Flow Volume (10)	10	8	9	7	10
Flow Status - Flashiness (10)	10	2	4	3	8
Channel Alteration (20)	20	6	11	15	2
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	19	3	3	7	1
Riparian and Bank Structure					
Bank Stability (L) (10)	10	7	8	6	9
Bank Stability (R) (10)	10	7	8	6	9
Vegetative Protection (L) (10)	10	5	8	5	8
Vegetative Protection (R) (10)	10	5	8	5	8
Riparian Veg. Zone Width (L) (10)	10	1	4	10	0
Riparian Veg. Zone Width (R) (10)	10	1	4	10	0
TOTAL SCORE (200):	159	80	88	100	82
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY 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:	8/5/2015	8/5/2015	8/5/2015	8/5/2015	8/5/2015
Weather:	Sunny	Sunny	Sunny	Sunny	Partly Cloudy
Air Temperature:	80 Deg. F.	67 Deg. F.	68 Deg. F.	70 Deg. F.	82 Deg. F.
Water Temperature:	72 Deg. F.	66 Deg. F.	64 Deg. F.	64 Deg. F.	65 Deg. F.
Ave. Stream Width:	13 Feet	9 Feet	27 Feet	17 Feet	13 Feet
Ave. Stream Depth:	0.46 Feet	1.67 Feet	0.66 Feet	0.77 Feet	0.77 Feet
Surface Velocity:	1 Ft./Sec.	0.24 Ft./Sec.	0.37 Ft./Sec.	1 Ft./Sec.	0.44 Ft./Sec.
Estimated Flow:	5.98 CFS	3.6072 CFS	6.5934 CFS	13.09 CFS	4.4044 CFS
Stream Modifications:	None	Dredged	Dredged	Dredged	Dredged
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	620243	640331	620318	620330	640183
Stream Name:	Tank Creek	Beaver Creek	Beaver Creek	Beaver Creek	Freeman Creek
Road Crossing/Location:	1 mi. d/s of 11 Mile Rd	198th Avenue	Comstock Avenue	Green Avenue	Maple Island Avenue
County Code:	62	64	62	62	64
TRS:	15N13W17	18N12W34	15N14W21	15N14W16	16N15W36
Latitude (dd):	43.696974	43.67774	43.68185	43.68683	43.74107
Longitude (dd):	-85.891635	-86.06708	-85.99948	-85.979731	-86.03918
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Warmwater	Warmwater	Warmwater	Coldwater
USGS Basin Code:	4060101	4060101	4060101	4060101	4060101

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

COMMENTS: Floating scums at SITE 10T

Appendix 2. Habitat evaluation for the Pere Marquette River and tributaries - August 2015.

HABITAT METRIC	Big South Branch Pere Marquette River off Porter Road RIFFLE/RUN **SITE 11**	Sanborn Creek downstream 40th Street GLIDE/POOL **SITE 12**	Sanborn Creek Spruce Road GLIDE/POOL **SITE 13T**	Sanborn Creek Broadway Street GLIDE/POOL **SITE 14T**	Sanborn Creek upstream Forman Road GLIDE/POOL **SITE 15**
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	16	15	15	16	15
Embeddedness (20)*	11				
Velocity/Depth Regime (20)*	15				
Pool Substrate Characterization (20)**		10	8	10	10
Pool Variability (20)**		10	15	10	13
Channel Morphology					
Sediment Deposition (20)	15	15	13	15	6
Flow Status - Maint. Flow Volume (10)	9	10	10	10	9
Flow Status - Flashiness (10)	7	10	10	10	10
Channel Alteration (20)	15	19	20	20	20
Frequency of Riffles/Bends (20)*	13				
Channel Sinuosity (20)**		19	15	8	15
Riparian and Bank Structure					
Bank Stability (L) (10)	9	10	10	10	10
Bank Stability (R) (10)	9	10	10	10	10
Vegetative Protection (L) (10)	9	8	10	10	9
Vegetative Protection (R) (10)	9	8	10	10	9
Riparian Veg. Zone Width (L) (10)	3	10	10	10	10
Riparian Veg. Zone Width (R) (10)	2	10	10	10	10
TOTAL SCORE (200):	142	164	166	159	156
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	EXCELLENT (NON-IMPAIRED)	EXCELLENT (NON-IMPAIRED)	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:	8/5/2015	8/12/2015	8/6/2015	8/6/2015	8/12/2015
Weather:	Sunny	Partly Cloudy	Sunny	Sunny	Partly Cloudy
Air Temperature:	80 Deg. F.	75 Deg. F.	78 Deg. F.	70 Deg. F.	75 Deg. F.
Water Temperature:	68 Deg. F.	58 Deg. F.	56 Deg. F.	55 Deg. F.	61 Deg. F.
Ave. Stream Width:	40 Feet	14 Feet	15 Feet	10 Feet	19 Feet
Ave. Stream Depth:	1.72 Feet	0.69 Feet	0.68 Feet	0.92 Feet	0.95 Feet
Surface Velocity:	1.77 Ft./Sec.	0.73 Ft./Sec.	1.4 Ft./Sec.	1.7 Ft./Sec.	1.6 Ft./Sec.
Estimated Flow:	121.776 CFS	7.0518 CFS	14.28 CFS	15.64 CFS	28.88 CFS
Stream Modifications:	None	None	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	530302	430631	430623	430621	430632
Stream Name:	Big South Branch Pere Marquette River	Sanborn Creek	Sanborn Creek	Sanborn Creek	Sanborn Creek
Road Crossing/Location:	off Porter Road	downstream 40th Street	Spruce Road	Broadway Street	Forman Road
County Code:	53	43	43	43	43
TRS:	17N15W34	18N12W5	18N12W34	18N12W32	18N12W31
Latitude (dd):	43.81908	43.91616	43.90724	43.90957	43.90334
Longitude (dd):	-86.08814	-85.696808	-85.74207	-85.77224	-85.801739
Ecoregion:	NLAF	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater	Coldwater
USGS Basin Code:	4060101	4060101	4060101	4060101	4060101

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

COMMENTS:

Appendix 2. Habitat evaluation for the Pere Marquette River and tributaries - August 2015.

HABITAT METRIC	Donaher Creek Starr Lake Road (76th Street) GLIDE/POOL **SITE 16**	Pere Marquette River Walhalla Road GLIDE/POOL **SITE 17T**	Pere Marquette River downstream Reek Road GLIDE/POOL **SITE 18T**	Swan Creek Kinney Road GLIDE/POOL **SITE 19T**	Saint Clair Creek Conrad Rd GLIDE/POOL **SITE 20**
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	11	8	11	10	10
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	10	8	13	10	8
Pool Variability (20)**	10	18	18	6	5
Channel Morphology					
Sediment Deposition (20)	11	18	14	15	10
Flow Status - Maint. Flow Volume (10)	10	10	10	10	9
Flow Status - Flashiness (10)	10	10	10	8	8
Channel Alteration (20)	18	18	19	15	15
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	18	18	18	13	13
Riparian and Bank Structure					
Bank Stability (L) (10)	10	10	10	9	10
Bank Stability (R) (10)	10	10	10	9	10
Vegetative Protection (L) (10)	10	4	10	8	10
Vegetative Protection (R) (10)	10	10	10	8	10
Riparian Veg. Zone Width (L) (10)	10	2	10	10	10
Riparian Veg. Zone Width (R) (10)	10	10	10	10	10
TOTAL SCORE (200):	158	154	173	141	138
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY 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:	8/12/2015		8/4/2015		8/4/2015		8/4/2015		8/4/2015	
Weather:	Sunny		Sunny		Sunny		Sunny		Sunny	
Air Temperature:	78	Deg. F.	80	Deg. F.	80	Deg. F.	75	Deg. F.	80	Deg. F.
Water Temperature:	62	Deg. F.	70	Deg. F.	70	Deg. F.	62	Deg. F.	64	Deg. F.
Ave. Stream Width:	40	Feet	50	Feet	80	Feet	11.33	Feet	8	Feet
Ave. Stream Depth:	0.47	Feet	2.93	Feet	2.57	Feet	0.85	Feet	0.27	Feet
Surface Velocity:	1.01	Ft./Sec.	2.86	Ft./Sec.	1.59	Ft./Sec.	0.55	Ft./Sec.	0.83	Ft./Sec.
Estimated Flow:	18.988	CFS	418.99	CFS	326.904	CFS	5.296775	CFS	1.7928	CFS
Stream Modifications:	None		None		None		None		None	
Nuisance Plants (Y/N):	N		N		N		N		N	
Report Number:										
STORET No.:	430587		530296		530028		530294		530232	
Stream Name:	Donaher Creek		Pere Marquette River		Pere Marquette River		Swan Creek		Saint Clair Creek	
Road Crossing/Location:	Road (76th Street)		Walhalla Road		downstream Reek Road		Kinney Road		Conrad Rd	
County Code:	43		53		53		53		53	
TRS:	17N13W20		18N15W21		18N16W23		17N17W01		18N17W20	
Latitude (dd):	43.850038		43.93313		43.93742		43.89008		43.93436	
Longitude (dd):	-85.884976		-86.11424		-86.18104		-86.28327		-86.376072	
Ecoregion:	NLAF		NLAF		SMNITP		SMNITP		SMNITP	
Stream Type:	Coldwater		Coldwater		Coldwater		Warmwater		Warmwater	
USGS Basin Code:	4060101		4060101		4060101		4060101		4060101	

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

COMMENTS:

Appendix 2. Habitat evaluation for the Pere Marquette River and tributaries - August 2015.

HABITAT METRIC	Mosquito Creek Conrad Road GLIDE/POOL **SITE 21**
Substrate and Instream Cover	
Epifaunal Substrate/ Avail Cover (20)	11
Embeddedness (20)*	
Velocity/Depth Regime (20)*	
Pool Substrate Characterization (20)**	6
Pool Variability (20)**	3
Channel Morphology	
Sediment Deposition (20)	10
Flow Status - Maint. Flow Volume (10)	9
Flow Status - Flashiness (10)	10
Channel Alteration (20)	15
Frequency of Riffles/Bends (20)*	
Channel Sinuosity (20)**	2
Riparian and Bank Structure	
Bank Stability (L) (10)	10
Bank Stability (R) (10)	10
Vegetative Protection (L) (10)	8
Vegetative Protection (R) (10)	8
Riparian Veg. Zone Width (L) (10)	7
Riparian Veg. Zone Width (R) (10)	10
TOTAL SCORE (200):	119
HABITAT RATING:	GOOD (SLIGHTLY 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:	8/4/2015	
Weather:	Sunny	
Air Temperature:	80	Deg. F.
Water Temperature:	65	Deg. F.
Ave. Stream Width:	11	Feet
Ave. Stream Depth:	0.42	Feet
Surface Velocity:	0.64	Ft./Sec.
Estimated Flow:	2.9568	CFS
Stream Modifications:	Dredged	
Nuisance Plants (Y/N):	N	
Report Number:		
STORET No.:	530301	
Stream Name:	Mosquito Creek	
Road Crossing/Location:	Conrad Road	
County Code:	53	
TRS:	18N17W19	
Latitude (dd):	43.93458	
Longitude (dd):	-86.398216	
Ecoregion:	SMNITP	
Stream Type:	Warmwater	
USGS Basin Code:	4060101	

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

COMMENTS: