MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER RESOURCES DIVISION
APRIL 2013

STAFF REPORT

A BIOLOGICAL SURVEY OF THE PERE MARQUETTE RIVER AND LINCOLN RIVER WATERSHEDS NEWAYGO, LAKE, OCEANA, AND MASON COUNTIES, MICHIGAN JULY, AUGUST, AND SEPTEMBER 2010

INTRODUCTION

Objective

A survey of the Pere Marquette River and Lincoln River watersheds (Hydrologic Unit Code 04060101) was conducted by staff of the Surface Water Assessment Section (SWAS) during July, August, and September 2010 to evaluate biological communities and physical conditions of selected locations. Qualitative biological surveys were performed according to the SWAS Procedure 51 (Michigan Department of Environmental Quality [MDEQ], 1990; Creal et al., 1996) at 18 stations (Figure 1). The specific objective of the survey was to:

- Assess the current status and condition of individual waters of the state and determine whether Michigan Water Quality Standards (WQS) are being met.

Background and Historical Sampling Efforts

The Pere Marquette River watershed was sampled by SWAS staff from June through September 2000 (Walker, 2002a and 2002b) as well as July and August 2005 (Wolf-LeSage, 2007). The 2000 survey showed high quality water in most areas of the watershed with some impact from agricultural use. The 2005 survey showed habitat at marginal to excellent with impacts from sand bed load. Macroinvertebrate communities rated from acceptable to excellent with sensitive taxa prevalent at sampling stations. The most recent survey of the Lincoln River watershed was conducted in 2004 (Roush, 2008). Macroinvertebrate community ratings in the 2004 Lincoln survey ranged from acceptable to excellent. WQS were being met at all stations where water quality samples were taken. In 2010, the sampling focus was on habitat and macroinvertebrates in order to review the current status of the Pere Marquette River and Lincoln River watersheds (Figure 1).

The Pere Marquette River watershed has been identified by the Nature Conservancy as one of only two watersheds (the Au Sable River is the other) in the northern Lower Peninsula that is a priority watershed for conservation action because of its high biological significance, ongoing threats, and opportunities for protective action (LeSage and Smith, 2008).

The Pere Marquette River and Lincoln River watersheds are within two ecoregions, the Southern Michigan Northern Indiana Till Plain (SMNITP) and the Northern Lakes and Forests (NLAF) (Omernik and Gallant, 1988). The SMNITP is characterized by lacustrine clay and silt soils, and historically white oak-white pine forest. The NLAF is characterized by nutrient poor glacial soils, coniferous and northern hardwood forests, and extensive sandy outwash plains. The ecoregion of each sampling station is indicated in Tables 3a-3d. The water bodies in the

Pere Marquette River and Lincoln River watersheds are a mix of coldwater and warmwater systems (Tables 3a-3d).

The watersheds are primarily composed of deciduous forest (Lincoln River, 26.5 percent; Pere Marquette River, 38.3 percent) (Figure 2, Table 1). The watersheds are also high in cultivated crops, woody wetlands, and evergreen forest. Both watersheds have very low percentages for medium density and high density development (Table 1).

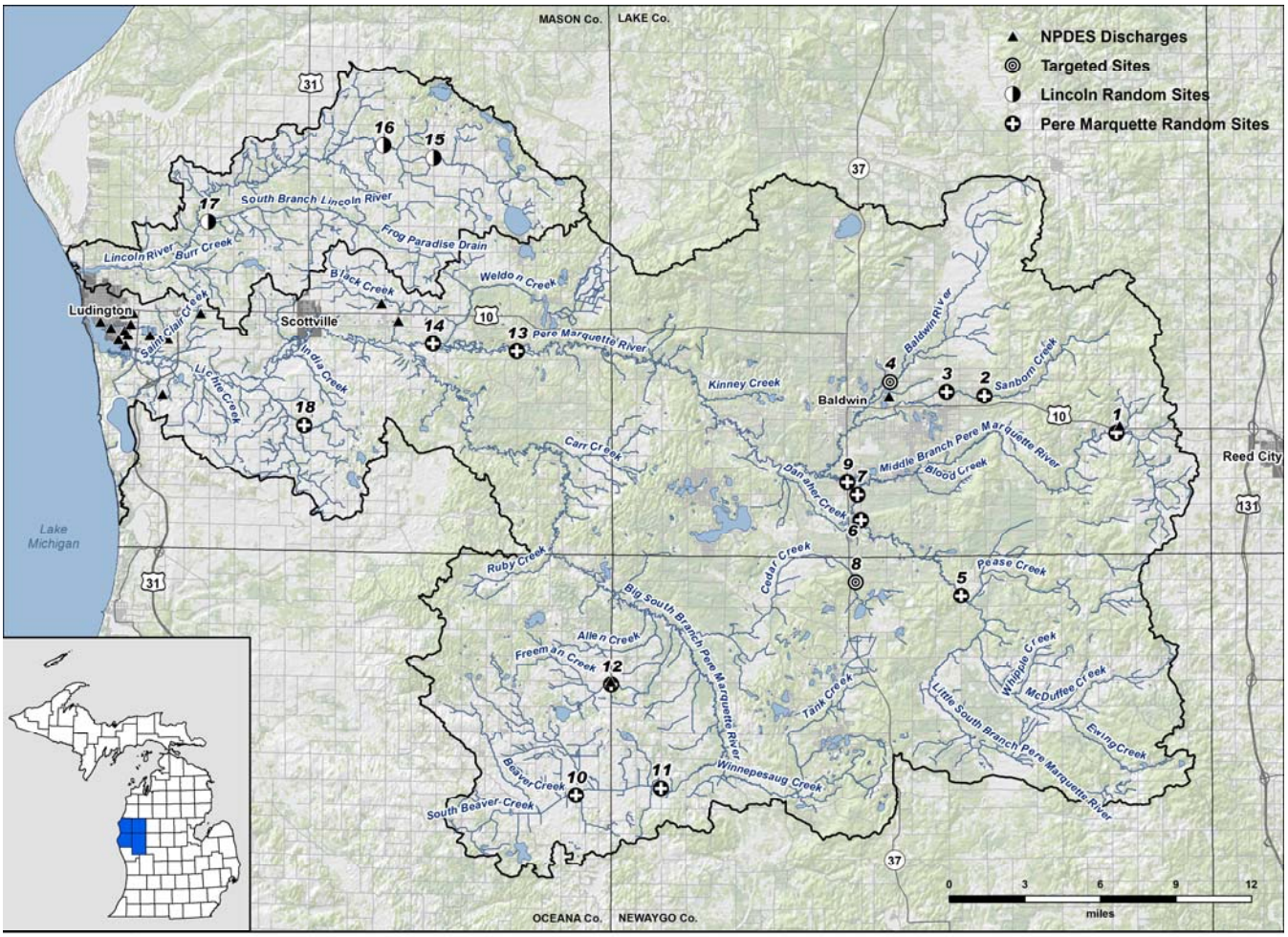

Figure 1. Map of targeted and random survey sites for the 2010 monitoring of the Pere Marquette and Lincoln Watersheds.

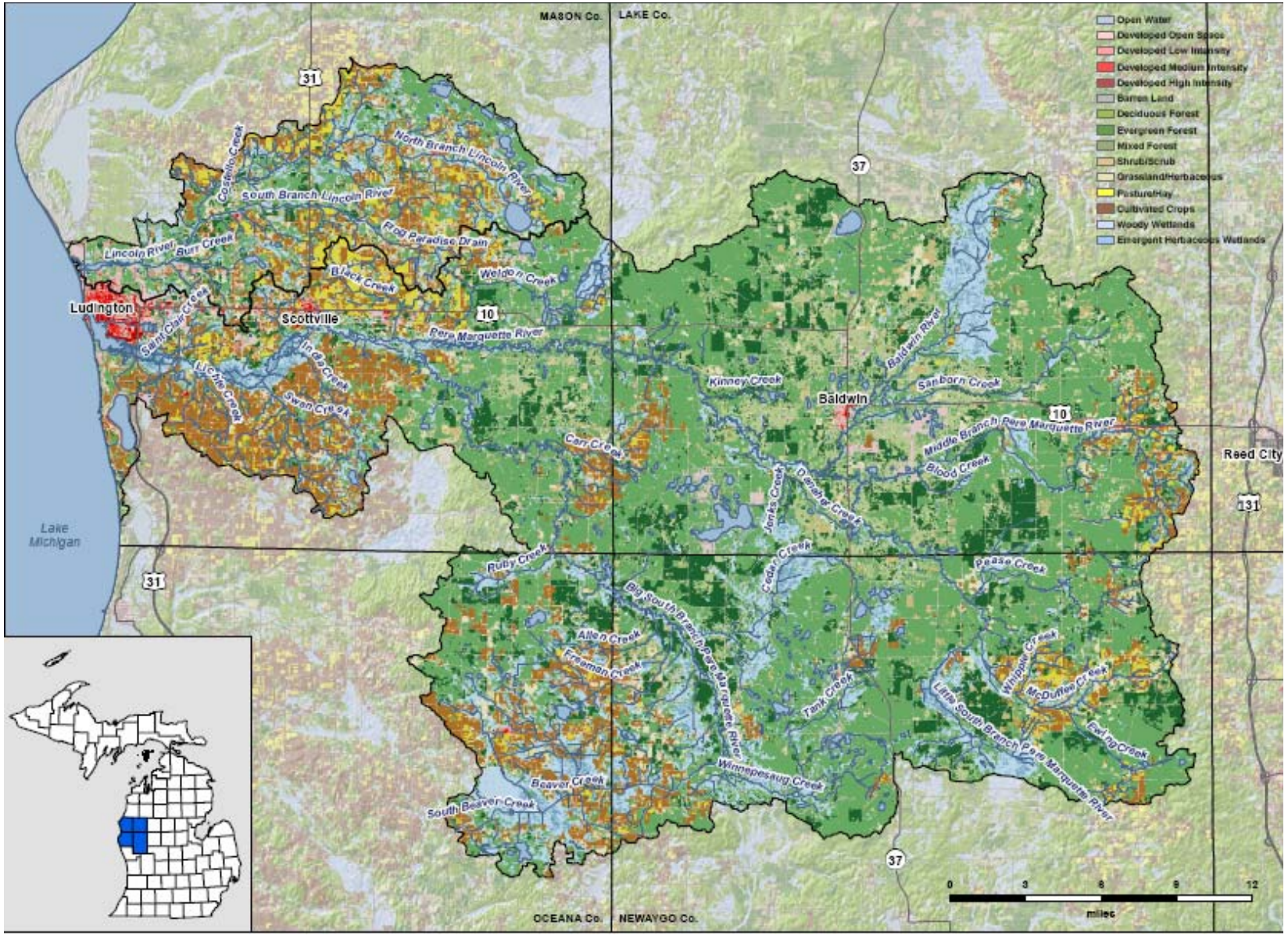

Figure 2. Land Use in the Pere Marquette River and Lincoln River Watersheds.

Table 1. Land Use Percentages for the Lincoln River and Pere Marquette River Watersheds.

Lincoln Watershed

GRIDCODE	Description	Area (sq miles)	Area (acres)	Percentage
11	Open Water	2.4	1554.5	2.4%
21	Developed, Open Space	5.9	3780.0	5.8%
22	Developed, Low Intensity	2.2	1427.9	2.2%
23	Developed, Medium Intensity	0.2	117.8	0.2%
24	Developed, High Intensity	0.0	30.6	0.0%
31	Barren Land	0.1	89.3	0.1%
41	Deciduous Forest	26.9	17239.4	26.5%
42	Evergreen Forest	4.7	2991.2	4.6%
43	Mixed Forest	2.4	1537.9	2.4%
52	Shrub/Scrub	3.1	2006.1	3.1%
71	Grassland/Herbaceous	9.2	5865.9	9.0%
81	Pasture/Hay	8.2	5216.7	8.0%
82	Cultivated Crops	20.0	12796.5	19.7%
90	Woody Wetlands	13.2	8430.6	13.0%
95	Emergent Herbaceous Wetlands	3.0	1921.3	3.0%
		101.6	**65005.8**	**100.0%**

Pere Marquette Watershed

GRIDCODE	Description	Area (sq miles)	Area (acres)	Percentage
11	Open Water	11.2	7143.4	1.5%
21	Developed, Open Space	32.6	20864.0	4.3%
22	Developed, Low Intensity	10.0	6400.9	1.3%
23	Developed, Medium Intensity	2.5	1629.4	0.3%
24	Developed, High Intensity	1.1	692.1	0.1%
31	Barren Land	1.1	683.4	0.1%
41	Deciduous Forest	291.5	186579.0	38.3%
42	Evergreen Forest	87.1	55732.9	11.5%
43	Mixed Forest	56.5	36180.7	7.4%
52	Shrub/Scrub	24.4	15601.1	3.2%
71	Grassland/Herbaceous	38.6	24734.7	5.1%
81	Pasture/Hay	18.1	11606.6	2.4%
82	Cultivated Crops	75.6	48377.5	9.9%
90	Woody Wetlands	89.2	57074.3	11.7%
95	Emergent Herbaceous Wetlands	20.8	13316.7	2.7%
		760.3	**486616.7**	**100.0%**

National Land Cover Dataset 2006. Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PE&RS, Vol. 77(9):858-864.

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METHODS

Procedure 51 describes the methodology for macroinvertebrate and habitat surveys of wadeable streams, and was used to evaluate the stations. Procedure 51 rates macroinvertebrate communities as poor (-9 to -5), acceptable (-4 to +4), and excellent (+5 to +9), based on the proportions of each taxa found, and the sensitivity of the community assemblage to water quality. Habitat was rated on a scale of poor (<56), marginal (56-104), good (105-154), or excellent (>154), based on in-stream and riparian characteristics and impairments.

The Pere Marquette River watershed includes about 281 miles of stream channel, which is divided into 42 segments. The depth and size of portions of the Pere Marquette River preclude the use of Procedure 51 to evaluate macroinvertebrate communities. The SWAS has a procedure for evaluating aquatic communities in nonwadeable streams, which was implemented during the 2010 survey at status and trend sites. Supplementary sites were selected to provide additional sampling locations, if time allowed.

Two site selection methods were used to assess the Pere Marquette River and Lincoln River watershed in 2010: *stratified random* to address statewide, regional, and watershed questions about water quality and *targeted* to address specific areas of interest. A probabilistic monitoring approach, using stratified random site selection was employed during the 2010 field season, including the Pere Marquette River watershed (13 sites) and the Lincoln River watershed (3 sites) (Table 2). Random sample selection was stratified based on stream temperature and flow characteristics, placing streams in two temperature categories (cold and warm) and further classifying them into four size categories (small, medium, large, and very large). The five different temperature/flow classifications established for the Pere Marquette River watershed sampling locations in 2010 are: cold large (CL), cold medium (CM), cold small (CS), warm medium (WM), and warm small (WS). In addition to probabilistic monitoring, two additional sites in the Pere Marquette River watershed were selected for targeted monitoring to fulfill specific monitoring requests, assess known or potential areas of concern or areas where more information is needed, achieve assessment coverage of the watershed, and provide information for National Pollutant Discharge Elimination System activities. These sites included the Baldwin River at 40th Street (Station 4) and Cedar Creek at 17 Mile Road (Station 8). The Baldwin River site had a culvert removed in 2011 and the sampling in 2010 provides pre-data to this work. The Cedar Creek site had low embeddedness and sediment deposition scores and acceptable macroinvertebrate ratings in past surveys. The 2010 sampling provided a follow-up to past surveys. Procedure 51 was used to assess the macroinvertebrate community and habitat at each probabilistic and targeted monitoring site. Approximately 300 individual macroinvertebrates were counted during these surveys at each site.

RESULTS

Habitat Surveys

Habitat in wadeable streams was sampled and scored using Procedure 51 (Tables 3a-3d). Results indicate that habitat was excellent at six sites, good at ten sites, and marginal at two sites (Table 2, Figure 3). The excellent habitat was found at three sites in the Little South Branch of the Pere Marquette River, one site at Cedar Creek, and two sites at the Pere Marquette River (Stations 5-9 and 13). The two marginal sites (Stations 11 and 12) had low available cover, low pool variability, and low sediment deposition scores compared to habitat at the other sites. Overall, the habitat for these locations was high compared to other stream systems due to parts of these water bodies passing through the Manistee National Forest, which provides a thick canopy and cools the water. The forested surroundings allows for trees to naturally fall in the river over time, providing fish and macroinvertebrate habitat.

Macroinvertebrate Community Surveys

Macroinvertebrate communities in wadeable streams were sampled and scored using Procedure 51 (Tables 4a-4e). Results indicate that macroinvertebrate communities were excellent at 7 sites and acceptable at 11 sites (Table 2, Figure 3). No sites scored poor. The excellent, high quality macroinvertebrate communities were found at one site in the Baldwin River, two locations on the Little South Branch of the Pere Marquette River, three stations on the Pere Marquette River, and one site on the North Branch of the Lincoln River (Stations 4-5, 7, 9, and 13-15). The Middle Branch of the Pere Marquette River at Depot Street scored 0 due to low overall macroinvertebrate numbers (131 macroinvertebrates) and the absence of Plecoptera, a sensitive macroinvertebrate order.

Stations that scored excellent for both habitat and macroinvertebrate community include 5, 7, 9, and 13. The two targeted stations were Stations 4 and 8. Station 4, Baldwin River, showed good habitat and excellent macroinvertebrates. Station 4 should improve due to the removal of a culvert upstream from this sample location in 2011. Station 8, Cedar Creek, had excellent habitat and acceptable macroinvertebrates. Station 8 had been sampled in 2005 and had similar results. Station 8 has sand in the system from the road crossing and the input from upstream lakes. Although this station has impacts from sand, the quality of the habitat and macroinvertebrate community was similar in both the 2005 and 2010 surveys.

Table 2: Pere Marquette watershed random and targeted sampling locations for 2010 with habitat and macroinvertebrate rating

							Habitat Evaluation		Macroinvertebrate Community		
Station	**Stream Type**	**Waterbody**	**Location**	**Latitude**	**Longitude**	**Method**	**Ranking**	**Score**	**Ranking**	**Score**	**AUID #**
1	Cold Small	M B Pere Marquette River	Depot Street	43.88538	-85.63720	Random	Good	154	Acceptable	0	040601010303-01
2	Cold Small	Sanborn Creek	Spruce Road	43.90724	-85.74207	Random	Good	127	Acceptable	3	040601010502-01
3	Cold Small	Sanborn Creek	Broadway Street	43.90957	-85.77224	Random	Good	134	Acceptable	3	040601010502-01
4	Cold Medium	Baldwin River	40th Street	43.91530	-85.81720	Targeted	Good	151	Excellent	7	040601010503-02
5	Cold Medium	Little S B Pere Marquette River	Walnut Avenue	43.79198	-85.76115	Random	Excellent	156	Excellent	5	040601010304-02
6	Cold Medium	Little S B Pere Marquette River	James Road	43.83583	-85.84059	Random	Excellent	181	Acceptable	4	040601010304-01
7	Cold Medium	Little S B Pere Marquette River	76th Street	43.85025	-85.84330	Random	Excellent	192	Excellent	7	040601010304-01
8	Cold Small	Cedar Creek	17 Mile Road	43.79996	-85.84492	Targeted	Excellent	177	Acceptable	3	040601010403-01
9	Cold Large	Pere Marquette River	M-37	43.85746	-85.85144	Random	Excellent	163	Excellent	5	040601010504-01
10	Cold Small	Beaver Creek	198th Avenue	43.67774	-86.06708	Random	Good	132	Acceptable	2	040601010401-03
11	Warm Medium	Beaver Creek	Comstock Avenue	43.68185	-85.99948	Random	Marginal	94	Acceptable	1	040601010401-01
12	Cold Small	Freeman Creek	Maple Island Avenue	43.74107	-86.03918	Random	Marginal	78	Acceptable	4	040601010401-01
13	Cold Large	Pere Marquette River	Walhalla Road	43.93313	-86.11424	Random	Excellent	155	Excellent	7	040601010506-02
14	Cold Large	Pere Marquette River	Reek Road	43.93742	-86.18104	Random	Good	135	Excellent	6	040601010506-01
15	Warm Medium	N B Lincoln River	Reek Road	44.04404	-86.18082	Random	Good	140	Excellent	5	040601010201-01
16	Warm Medium	N B Lincoln River	Custer Road	44.05101	-86.22078	Random	Good	147	Acceptable	4	040601010201-01
17	Cold Small	S B Lincoln River	Victory Road	44.00708	-86.36032	Random	Good	121	Acceptable	2	040601010202-01
18	Warm Small	Swan Creek	Kinney Road	43.89008	-86.28327	Random	Good	124	Acceptable	2	040601010508-02

Future Biosurvey Recommendations

Surveys were conducted at probabilistic and targeted locations throughout the Pere Marquette River watershed in the 2010 sampling season. Through this biosurvey, valuable information was gathered regarding current conditions. After reviewing the collected data, it is important to identify areas that should be resampled in future biosurveys. Sites that should be sampled are any that scored on the lower end in macroinvertebrate and habitat in the 2010 survey. These sites would include Station 1 (Middle Branch of the Pere Marquette River) due to macroinvertebrate score; Station 12 (Freeman Creek) due to habitat score; Stations 10 and 11 (Beaver Creek), 17 (South Branch of the Lincoln River), and 18 (Swan Creek) due to habitat and macroinvertebrates scores relative to other stations.

In addition, the Baldwin River and Sanborn Creek should be assessed downstream from the culverts that were removed in 2011 to monitor potential improvement. Culverts tend to back up water bodies above a culvert thereby creating an impoundment, decreasing dissolved oxygen, increasing the temperature, and creating a more stagnant system. Below a culvert, the flow tends to be higher due to the constriction of the culvert speeding up the velocity and creating deep pools below the culvert due to erosion. Improvements in habitat and macroinvertebrate scores would be anticipated in these two streams. Some additional areas to sample in future surveys include Lichte Creek and India Creek due to dense agriculture as well as water bodies surrounding Scottville due to high intensity development.

The Pere Marquette River and Lincoln River watersheds currently have impairments due to polychlorinated biphenyls (PCBs) and mercury (Hg) either in the water column or fish tissue (Table 5). The SWAS is in the process of drafting two Total Maximum Daily Loads for inland waters affected by PCBs and Hg. Upon completion of the required reductions (94 percent) for PCBs, all the water bodies in Table 5 should no longer be impaired for PCBs. The inland waters Hg TMDL should remove impairment from five of the listed AUIDs in Table 5.

Field work by: Molly Rippke, Aquatic Biologist
Seth Wright, Aquatic Biologist, Great Lakes Environmental Center
Surface Water Assessment Section
Water Resources Division

Report by: Marcy Knoll, Aquatic Biologist
Surface Water Assessment Section
Water Resources Division

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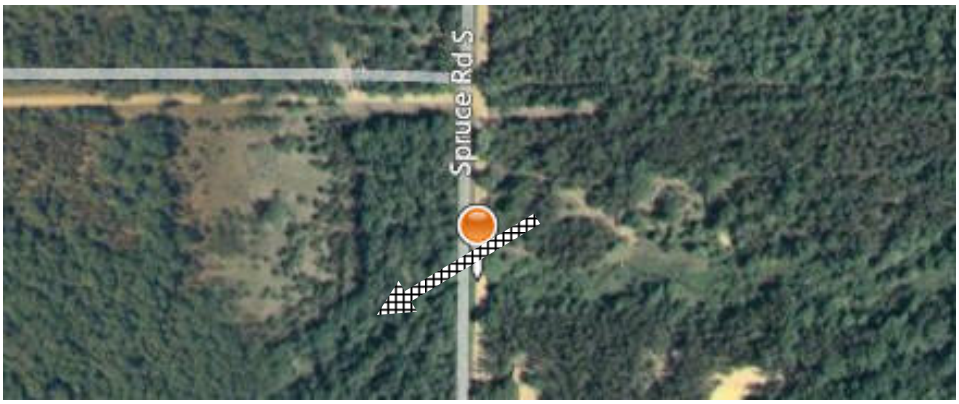
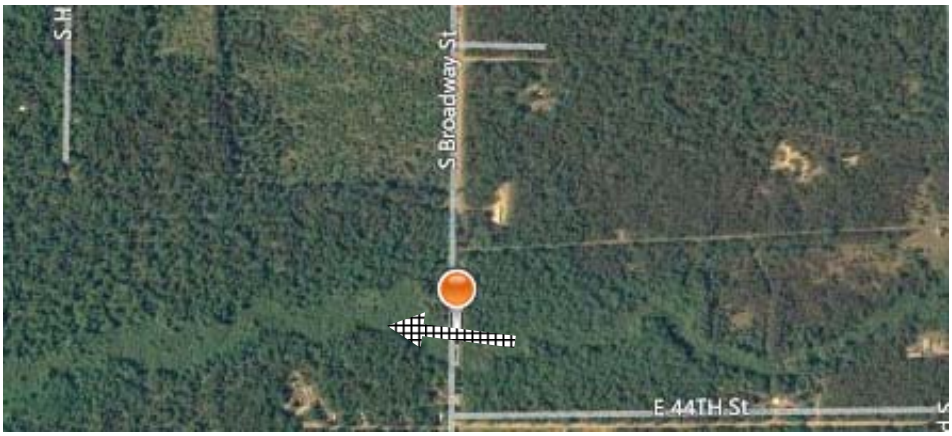
Figure 3. Aerial Photos and Summary Assessments of Habitat and Macroinvertebrates at Sampling Sites. *Black and white checked arrows provide the flow of each stream.

Middle Branch Pere Marquette River at Depot Street (Station 1).
Habitat: Good; Macroinvertebrates: Acceptable
Visual Assessment: Open water is not visible due to canopy cover or low flow/water levels while channel sinuosity is apparent further west.



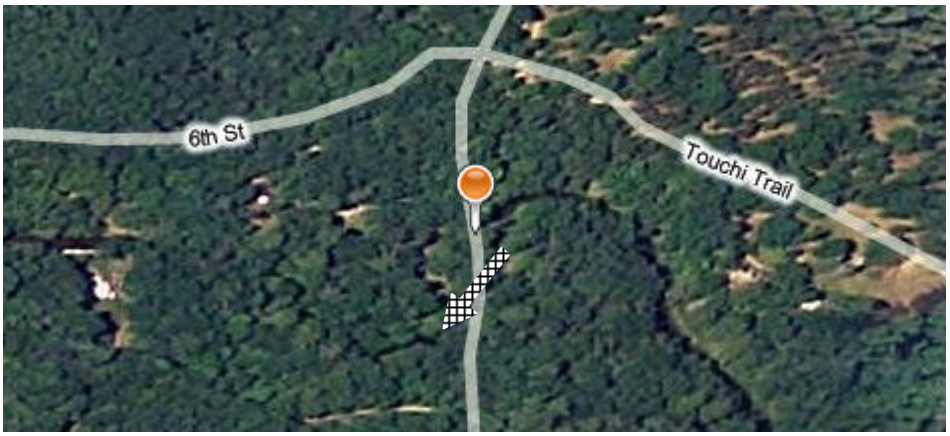
Sanborn Creek at Spruce Road (Station 2).
Habitat: Good; Macroinvertebrates: Acceptable
Visual Assessment: Open water is not visible either due to canopy cover or wetland-like shoreline and algae cover, which represents slow stagnant water that is not optimal for high quality habitat or macroinvertebrate communities. Slower water means more siltation, which covers ideal cobble/gravel habitat for macroinvertebrates.



Sanborn Creek at Broadway Street (Station 3).
Habitat: Good; Macroinvertebrates: Acceptable
Visual Assessment: Open water is not visible from the aerial photo due to heavy vegetation and low flow. Important macroinvertebrate community habitat is not present with silt covering the gravel/cobble.

Baldwin River at 40th Street (Station 4).
Habitat: Good; Macroinvertebrates: Excellent
Visual Assessment: This portion of the river has good channel sinuosity with forested cover surrounding the water body, which provides a thick canopy and shades the water body. In effect the temperature of the water cools and the dissolved oxygen increases in the water.

Little South Branch Pere Marquette River at Walnut Avenue (Station 5).
Habitat: Excellent; Macroinvertebrates: Excellent
Visual Assessment: Excellent, natural channel sinuosity is present with good forest habitat surrounding it. There is not any apparent channelization providing natural flows of water and sediment in the system.



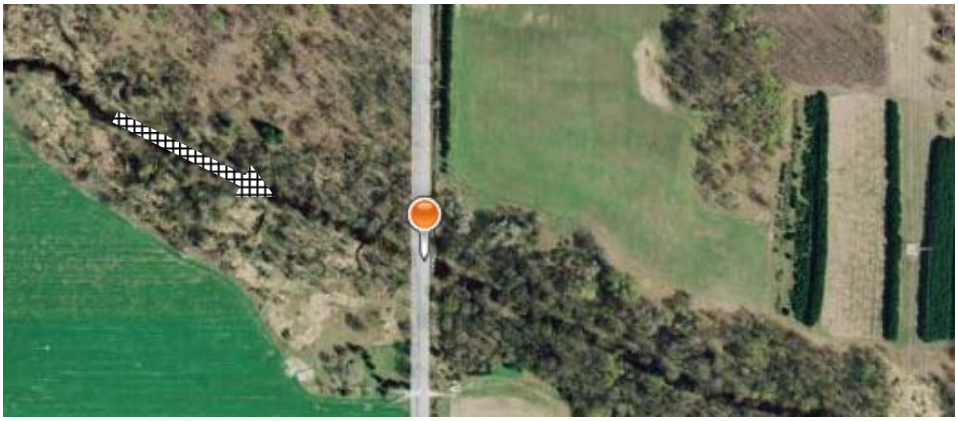
Little South Branch Pere Marquette River at James Road (Station 6).
Habitat: Excellent; Macroinvertebrates: Acceptable
Visual Assessment: This portion of the river has good channel sinuosity along with good forest habitat surrounding, and no apparent channelization of the river channel.

Little South Branch Pere Marquette River at 76th Street (Station 7).
Habitat: Excellent; Macroinvertebrates: Excellent
Visual Assessment: This portion of the river flows through the Manistee National Forest area providing a thick canopy leading to shaded/cooler water. The forested area provides fallen trees in the river over time leading to additional habitat.

Cedar Creek at 17 Mile Road (Station 8).
Habitat: Excellent; Macroinvertebrates: Acceptable
Visual Assessment: There is not any obvious channel sinuosity showing manipulation of the system over time. There is some limited forested cover along the river, wetland shoreline along one side of the river, but not much flow due to wetland vegetation slowing the channel.

Pere Marquette River at M-37 (Station 9).
Habitat: Excellent; Macroinvertebrates: Excellent
Visual Assessment: This portion of the river has very high canopy coverage. The shade from the trees provides cooler water temperatures and provides habitat from fallen trees in the channel. There is apparent channel sinuosity and no obvious signs of impairment to the stream aside from the road crossing.

Beaver Creek at 198th Avenue (Station 10).
Habitat: Good; Macroinvertebrates: Acceptable
Visual Assessment: This portion of the creek is extremely channelized. The water body flows through an agricultural area with no apparent buffer strips to trap flowing sediments from the agriculture fields. The system appears to have been manipulated and possibly moved over the years to provide square agricultural fields.



Beaver Creek at Comstock Avenue (Station 11).
Habitat: Marginal; Macroinvertebrates: Acceptable
Visual Assessment: This portion of the creek is channelized through an agricultural area and is not the natural channel. The channel has been manipulated and straightened removing sinuosity; however, the channel does have buffer strips on either side to help with sedimentation into the creek.

Freeman Creek at Maple Island Avenue (Station 12).
Habitat: Marginal; Macroinvertebrates: Acceptable
Visual Assessment: The creek is channelized through an agricultural area creating an unnatural channel, decreasing sinuosity, and changing the flow of the creek. There are minimal buffer strips on either side of the channel to aid in trapping loose sediments.

Pere Marquette River at Walhalla Road (Station 13).
Habitat: Excellent; Macroinvertebrates: Excellent
Visual Assessment: This portion of the river has excellent habitat heterogeneity. There is natural channel sinuosity providing for natural flow in the system along with vegetation along the channel. In addition, there is a feeder stream bringing an input of dissolved oxygen into the system and increasing the system for habitat and macroinvertebrate communities.

Pere Marquette River at Reek Road (Station 14).
Habitat: Good; Macroinvertebrates: Excellent
Visual Assessment: This portion of the stream has excellent habitat heterogeneity for macroinvertebrates due to forested cover, wetland vegetation, and shoreline vegetation to prevent sedimentation. The channel has natural sinuosity and various different habitats to support various types of wildlife.

North Branch Lincoln River at Reek Road (Station 15).
Habitat: Good; Macroinvertebrates: Excellent
Visual Assessment: This stream has excellent habitat heterogeneity for macroinvertebrates between forested areas, wetland areas, and shoreline vegetation. There is channel sinuosity throughout this stretch of river allowing natural flows of water and sediment through the area.

North Branch Lincoln River at Custer Road (Station 16).
Habitat: Good; Macroinvertebrates: Acceptable
Visual Assessment: This portion of the river has natural channel sinuosity and open water, but not much of a variety of habitats. There is some vegetation along the shoreline to prevent sedimentation.

South Branch Lincoln River at Victory Road (Station 17).
Habitat: Good; Macroinvertebrates: Acceptable
Visual Assessment: This stretch of river shows impacts to the shoreline with clearing of vegetation therefore reducing habitat. There is natural channel sinuosity, but not much vegetation along the shoreline to provide habitat complexity.

Swan Creek at Kinney Road (Station 18).
Habitat: Good; Macroinvertebrates: Acceptable
Visual Assessment: This stretch of the creek is near an agricultural field, which provides runoff of sediments and high nutrients in the system. There is natural channel sinuosity within this stretch; however, the accumulation of sediments from the agriculture fields could lead to reduced macroinvertebrate habitat.

Table 3A. Habitat evaluation for Pere Marquette Watershed for July, August, September 2010

	M B Pere Marquette River Depot Street GLIDE/POOL STATION 1	Sanborn Creek Spruce Road RIFFLE/RUN STATION 2	Sanborn Creek Broadway Street RIFFLE/RUN STATION 3	Baldwin River 40th Street GLIDE/POOL STATION 4
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	15	15	10	11
Embeddedness (20)*		3	2	
Velocity/Depth Regime (20)*		6	6	
Pool Substrate Characterization (20)**	10			11
Pool Variability (20)**	13			18
Channel Morphology				
Sediment Deposition (20)	16	3	3	5
Flow Status - Maint. Flow Volume (10)	8	10	10	10
Flow Status - Flashiness (10)	8	9	10	10
Channel Alteration (20)	18	15	20	18
Frequency of Riffles/Bends (20)*		8	13	
Channel Sinuosity (20)**	15			15
Riparian and Bank Structure				
Bank Stability (L) (10)	10	10	10	10
Bank Stability (R) (10)	10	10	10	10
Vegetative Protection (L) (10)	10	10	10	10
Vegetative Protection (R) (10)	9	10	10	10
Riparian Veg. Zone Width (L) (10)	7	9	10	8
Riparian Veg. Zone Width (R) (10)	5	9	10	5
TOTAL SCORE (200):	154	127	134	151
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY 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:	8/31/2010	8/31/2010	8/31/2010	8/31/2010
Weather:	Partly Cloudy	Sunny	Sunny	Sunny
Air Temperature:	85 Deg. F.	85 Deg. F.	88 Deg. F.	88 Deg. F.
Water Temperature:	72 Deg. F.	58 Deg. F.	62 Deg. F.	63 Deg. F.
Ave. Stream Width:	12 Feet	10 Feet	12 Feet	25 Feet
Ave. Stream Depth:	1.5 Feet	0.6 Feet	5 Feet	2 Feet
Surface Velocity:	0.2 Ft./Sec.	1 Ft./Sec.	1 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	3.6 CFS	6 CFS	60 CFS	25 CFS
Stream Modifications:	None	None	None	None
Nuisance Plants (Y/N):	N	N	N	N
Report Number:				
STORET No.:	430624	430623	430621	430622
Stream Name:	M B Pere Marquette River	Sanborn Creek	Sanborn Creek	Baldwin River
Road Crossing/Location:	Depot Street	Spruce Road	Broadway Street	40th Street
County Code:	43	43	43	43
TRS:	17N11W09	18N12W34	18N12W32	18N13W25
Latitude (dd):	43.88538	43.90724	43.90957	43.9153
Longitude (dd):	-85.6372	-85.74207	-85.77224	-85.8172
Ecoregion:	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater
USGS Basin Code:	4060101	4060101	4060101	4060101

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

Table 3B. Habitat evaluation for Pere Marquette Watershed for July, August, September 2010

	Little S B Pere Marquette River Walnut Avenue RIFFLE/RUN STATION 5	Little S B Pere Marquette River off James Road GLIDE/POOL STATION 6	Little S B Pere Marquette River 76th Street (Starr Lake Road) RIFFLE/RUN STATION 7	Cedar Creek 17 Mile Road GLIDE/POOL STATION 8
HABITAT METRIC				
Substrate and Instream Cover				
Epifaunal Substrate/ Avail Cover (20)	15	15	19	13
Embeddedness (20)*	15		20	
Velocity/Depth Regime (20)*	10		20	
Pool Substrate Characterization (20)**		13		13
Pool Variability (20)**		20		16
Channel Morphology				
Sediment Deposition (20)	15	13	13	15
Flow Status - Maint. Flow Volume (10)	10	10	10	10
Flow Status - Flashiness (10)	10	10	10	10
Channel Alteration (20)	15	20	20	20
Frequency of Riffles/Bends (20)*	13		20	
Channel Sinuosity (20)**		20		20
Riparian and Bank Structure				
Bank Stability (L) (10)	10	10	10	10
Bank Stability (R) (10)	10	10	10	10
Vegetative Protection (L) (10)	10	10	10	10
Vegetative Protection (R) (10)	8	10	10	10
Riparian Veg. Zone Width (L) (10)	10	10	10	10
Riparian Veg. Zone Width (R) (10)	5	10	10	10
TOTAL SCORE (200):	156	181	192	177
HABITAT RATING:	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:	9/1/2010	9/1/2010	8/31/2010	9/1/2010
Weather:	Rainy	Cloudy	Sunny	Rainy
Air Temperature:	75 Deg. F.	85 Deg. F.	85 Deg. F.	70 Deg. F.
Water Temperature:	63 Deg. F.	65 Deg. F.	65 Deg. F.	72 Deg. F.
Ave. Stream Width:	25 Feet	35 Feet	30 Feet	5 Feet
Ave. Stream Depth:	1.2 Feet	2 Feet	1.5 Feet	0.3 Feet
Surface Velocity:	0.75 Ft./Sec.	1 Ft./Sec.	1.5 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	22.5 CFS	70 CFS	67.5 CFS	0.75 CFS
Stream Modifications:	None	None	None	None
Nuisance Plants (Y/N):	N	N	N	N
Report Number:				
STORET No.:	620319	430612	430569	620273
Stream Name:	Little South Branch Pere Marquette River	Little S B Pere Marquette River	Little S B Pere Marquette River	Cedar Creek
Road Crossing/Location:	Walnut Avenue	off James Road	76th Street (Starr Lake Road)	17 Mile Road
County Code:	62	43	43	62
TRS:	16N12W9	17N13W22	17N13W22	16N13W10
Latitude (dd):	43.79198	43.85303	43.850012	43.79993
Longitude (dd):	-85.76115	-85.84175	-85.843387	-85.84477
Ecoregion:	NLAF	NLAF	NLAF	NLAF
Stream Type:	Coldwater	Coldwater	Coldwater	Warmwater
USGS Basin Code:	4060101	4060101	4060101	4060101

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

Table 3C. Habitat evaluation for Pere Marquette Watershed for July, August, September 2010

	Pere Marquette River M-37 RIFFLE/RUN STATION 9	Beaver Creek 198th Avenue GLIDE/POOL STATION 10	Beaver Creek Comstock Avenue GLIDE/POOL STATION 11	Freeman Creek Maple Island Avenue GLIDE/POOL STATION 12	Pere Marquette River Walhalla Road GLIDE/POOL STATION 13
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	16	11	5	5	13
Embeddedness (20)*	20				
Velocity/Depth Regime (20)*	10				
Pool Substrate Characterization (20)**		13	6	10	1
Pool Variability (20)**		16	1	3	18
Channel Morphology					
Sediment Deposition (20)	10	10	5	6	10
Flow Status - Maint. Flow Volume (10)	10	10	10	10	10
Flow Status - Flashiness (10)	10	8	3	6	10
Channel Alteration (20)	18	13	11	3	18
Frequency of Riffles/Bends (20)*	13				
Channel Sinuosity (20)**		5	5	1	20
Riparian and Bank Structure					
Bank Stability (L) (10)	10	10	8	10	10
Bank Stability (R) (10)	10	10	8	10	10
Vegetative Protection (L) (10)	10	10	10	6	10
Vegetative Protection (R) (10)	10	10	10	6	10
Riparian Veg. Zone Width (L) (10)	9	3	8	1	5
Riparian Veg. Zone Width (R) (10)	7	3	4	1	10
TOTAL SCORE (200):	163	132	94	78	155
HABITAT RATING:	EXCELLENT (NON-IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	MARGINAL (MODERATELY IMPAIRED)	MARGINAL (MODERATELY 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:	8/31/2010	9/2/2010	9/2/2010	9/2/2010	9/1/2010
Weather:		Cloudy	Cloudy	Cloudy	Cloudy
Air Temperature:	85 Deg. F.	Deg. F.	72 Deg. F.	Deg. F.	80 Deg. F.
Water Temperature:	65 Deg. F.	Deg. F.	68 Deg. F.	65 Deg. F.	70 Deg. F.
Ave. Stream Width:	50 Feet	9 Feet	30 Feet	6 Feet	60 Feet
Ave. Stream Depth:	2 Feet	2.5 Feet	0.2 Feet	0.3 Feet	2 Feet
Surface Velocity:	1.5 Ft./Sec.	0.2 Ft./Sec.	0.3 Ft./Sec.	0.2 Ft./Sec.	1 Ft./Sec.
Estimated Flow:	150 CFS	4.5 CFS	1.8 CFS	0.36 CFS	120 CFS
Stream Modifications:	None	Dredged	Dredged	Dredged	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	430008	640331	620318	640183	530296
Stream Name:	Pere Marquette River	Beaver Creek	Beaver Creek	Freeman Creek	Pere Marquette River
Road Crossing/Location:	M-37	198th Avenue	Comstock Avenue	Maple Island Avenue	Walhalla Road
County Code:	43	64	62	64	53
TRS:	17N13W15	18N12W34	15N14W21	16N15W36	18N15W21
Latitude (dd):	43.85746	43.67774	43.68185	43.74107	43.93313
Longitude (dd):	-85.85144	-86.06708	-85.99948	-86.03918	-86.11424
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Coldwater	Warmwater	Warmwater	Coldwater	Coldwater
USGS Basin Code:	4060101	4060101	4060101	4060101	4060101

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

Table 3D. Habitat evaluation for Pere Marquette Watershed for July, August, September 2010

	Pere Marquette River Reek Road GLIDE/POOL STATION 14	N B Lincoln River Reek Road (Cleveland Street) GLIDE/POOL STATION 15	N B Lincoln River Custer Road GLIDE/POOL STATION 16	S B Lincoln River Victory Road RIFFLE/RUN STATION 17	Swan Creek Kinney Road GLIDE/POOL STATION 18
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	8	11	8	10	7
Embeddedness (20)*				13	
Velocity/Depth Regime (20)*				11	
Pool Substrate Characterization (20)**	8	10	6		7
Pool Variability (20)**	10	5	18		8
Channel Morphology					
Sediment Deposition (20)	5	8	3	10	10
Flow Status - Maint. Flow Volume (10)	10	10	10	10	10
Flow Status - Flashiness (10)	10	7	8	5	6
Channel Alteration (20)	15	18	20	18	13
Frequency of Riffles/Bends (20)*				6	
Channel Sinuosity (20)**	15	11	20		10
Riparian and Bank Structure					
Bank Stability (L) (10)	10	10	8	8	9
Bank Stability (R) (10)	10	10	8	5	8
Vegetative Protection (L) (10)	10	10	10	7	8
Vegetative Protection (R) (10)	10	10	10	7	8
Riparian Veg. Zone Width (L) (10)	5	10	8	8	10
Riparian Veg. Zone Width (R) (10)	9	10	10	3	10
TOTAL SCORE (200):	135	140	147	121	124
HABITAT RATING:	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY IMPAIRED)	GOOD (SLIGHTLY 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:	9/1/2010	9/1/2010	9/1/2010	9/1/2010	9/16/2010
Weather:	Partly Cloudy	Cloudy	Cloudy	Cloudy	Rainy
Air Temperature:	80 Deg. F.	80 Deg. F.	80 Deg. F.	Deg. F.	62 Deg. F.
Water Temperature:	70 Deg. F.	72 Deg. F.	71 Deg. F.	66 Deg. F.	58 Deg. F.
Ave. Stream Width:	80 Feet	22 Feet	18 Feet	18 Feet	12 Feet
Ave. Stream Depth:	1.5 Feet	0.3 Feet	1 Feet	1.5 Feet	1 Feet
Surface Velocity:	1 Ft./Sec.	0.25 Ft./Sec.	0.25 Ft./Sec.	0.5 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	120 CFS	1.65 CFS	4.5 CFS	13.5 CFS	6 CFS
Stream Modifications:	None	None	None	None	None
Nuisance Plants (Y/N):	N	N	N	N	N
Report Number:					
STORET No.:	530028	530295	530218	530211	530294
Stream Name:	Pere Marquette River	N B Lincoln River	N B Lincoln River	S B Lincoln River	Swan Creek
Road Crossing/Location:	Reek Road	Reek Road (Cleveland Street)	Custer Road	Victory Road	Kinney Road
County Code:	53	53	53	53	53
TRS:	18N16W23	19N16W13	19N16W10	19N17W28	17N17W01
Latitude (dd):	43.93742	44.04404	44.0512209	44.007468	43.89008
Longitude (dd):	-86.18104	-86.18082	-86.2201335	-86.3600823	-86.28327
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	SMNITP
Stream Type:	Coldwater	Coldwater	Warmwater	Coldwater	Warmwater
USGS Basin Code:	4060101	4060101	4060101	4060101	4060101

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

Table 4A. Qualitative macroinvertebrate sampling results for Pere Marquette Watershed for July, August, September 2010

TAXA	M B Pere Marquette River Depot Street 8/31/2010 STATION 1	Sanborn Creek Spruce Road 8/31/2010 STATION 2	Sanborn Creek Broadway Street 8/31/2010 STATION 3	Baldwin River 40th Street 8/31/2010 STATION 4
ANNELIDA (segmented worms)				
Hirudinea (leeches)	2			
Oligochaeta (worms)	1	17	42	2
ARTHROPODA				
Crustacea				
Amphipoda (scuds)		42	52	39
Decapoda (crayfish)	7	1		
Arachnoidea				
Hydracarina		1		1
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				8
Baetidae	3	13	19	17
Caenidae	3			
Ephemerellidae		4	2	5
Heptageniidae	12	1	1	4
Tricorythidae				8
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1			1
Gomphidae	4			
Zygoptera (damselflies)				
Calopterygidae	5			8
Plecoptera (stoneflies)				
Perlidae		5	2	1
Perlodidae		3	3	1
Pteronarcyidae		16	19	3
Hemiptera (true bugs)				
Belostomatidae	1			
Corixidae	4			11
Gerridae	4		1	
Veliidae	2	1	1	
Megaloptera				
Corydalidae (dobson flies)				1
Sialidae (alder flies)		1	1	1
Trichoptera (caddisflies)				
Brachycentridae		83	45	32
Helicopsychidae	16			
Hydropsychidae		41	7	69
Lepidostomatidae				2
Leptoceridae	5			
Limnephilidae	8	1	3	4
Molannidae	2			
Philopotamidae				3
Uenoidae	5			1
Coleoptera (beetles)				
Gyrinidae (adults)		1	2	
Dryopidae	3			
Elmidae	20	6	1	9
Diptera (flies)				
Athericidae		1	1	5
Chironomidae	12	21	61	14
Dixidae			1	
Ptychopteridae			1	
Sciomyzidae			1	
Simuliidae		13	17	5
Tabanidae		1	1	2
Tipulidae		1	4	1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	9			
Physidae	2		5	2
Pelecypoda (bivalves)				
Sphaeriidae (clams)		1	8	1
TOTAL INDIVIDUALS	131	275	301	261

Table 4A. Macroinvertebrate metric evaluation of Pere Marquette Watershed for July, August, September 2010

METRIC	M B Pere Marquette River Depot Street 8/31/2010 STATION 1 Value	Score	Sanborn Creek Spruce Road 8/31/2010 STATION 2 Value	Score	Sanborn Creek Broadway Street 8/31/2010 STATION 3 Value	Score	Baldwin River 40th Street 8/31/2010 STATION 4 Value	Score
TOTAL NUMBER OF TAXA	23	0	23	0	26	0	30	1
NUMBER OF MAYFLY TAXA	3	0	3	0	3	0	5	1
NUMBER OF CADDISFLY TAXA	5	0	3	0	3	0	6	1
NUMBER OF STONEFLY TAXA	0	-1	3	1	3	1	3	1
PERCENT MAYFLY COMP.	13.74	0	6.55	0	7.31	0	16.09	0
PERCENT CADDISFLY COMP.	27.48	0	45.45	1	18.27	0	42.53	1
PERCENT DOMINANT TAXON	15.27	1	30.18	-1	20.27	0	26.44	0
PERCENT ISOPOD, SNAIL, LEECH	9.92	0	0.00	1	1.66	1	0.77	1
PERCENT SURF. AIR BREATHERS	8.40	0	0.73	1	1.66	1	4.21	1
TOTAL SCORE		0		3		3		7
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.		ACCEPT.		EXCELLENT

Table 4B. Qualitative macroinvertebrate sampling results for Pere Marquette Watershed for July, August, September 2010

TAXA	Little S B Pere Marquette River Walnut Avenue 9/1/2010 STATION 5	Little S B Pere Marquette River off James Road 9/1/2010 STATION 6	Little S B Pere Marquette River 76th Street (Starr Lake Road) 8/31/2010 STATION 7	Cedar Creek 17 Mile Road 9/1/2010 STATION 8
PLATYHELMINTHES (flatworms)				
Turbellaria	2			
ANNELIDA (segmented worms)				
Oligochaeta (worms)	23	12	3	11
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	8	12	32	30
Decapoda (crayfish)	1	1		3
Arachnoidea				
Hydracarina		6	3	2
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae	1	14	3	6
Baetidae	27	18	8	1
Caenidae				18
Ephemerellidae	9	1	2	
Heptageniidae	9	9	6	1
Isonychiidae		2	1	
Tricorythidae	13	7	3	1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		2		7
Gomphidae		1	3	1
Libellulidae	1		1	
Zygoptera (damselflies)				
Calopterygidae	9	2	6	53
Coenagrionidae				2
Plecoptera (stoneflies)				
Perlidae	2	6	5	
Pteronarcyidae			1	
Hemiptera (true bugs)				
Corixidae	1			
Gerridae		1		1
Notonectidae				1
Pleidae	1			
Veliidae			1	
Megaloptera				
Corydalidae (dobson flies)	1	3	4	2
Sialidae (alder flies)	1	1	1	
Trichoptera (caddisflies)				
Brachycentridae	7	2	4	11
Glossosomatidae	3	1	38	
Helicopsychidae	12	2	2	1
Hydropsychidae	58	53	43	40
Hydroptilidae	1			
Lepidostomatidae		4		
Leptoceridae	2	5	10	3
Limnephilidae	4	2		
Philopotamidae	1	1	1	
Phryganeidae	1			
Polycentropodidae	6	2	14	2
Uenoidae			3	
Coleoptera (beetles)				
Dryopidae			2	1
Elmidae	6	4	6	1
Diptera (flies)				
Athericidae	15	10	3	
Chironomidae	43	22	13	34
Empididae	2			
Simuliidae	11	18	15	
Stratiomyidae		1		
Tabanidae	1	3	2	
Tipulidae	1	2		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	3	4	1	5
Hydrobiidae	8	1		
Physidae	10	9	3	5
Planorbidae	1			
Pelecypoda (bivalves)				
Sphaeriidae (clams)	3	5	6	12
TOTAL INDIVIDUALS	308	249	249	255

Table 4B. Macroinvertebrate metric evaluation of Pere Marquette Watershed for July, August, September 2010

METRIC	Little S B Pere Marquette River Walnut Avenue 9/1/2010 STATION 5 Value	Score	Little S B Pere Marquette River off James Road 9/1/2010 STATION 6 Value	Score	Little S B Pere Marquette River 76th Street (Starr Lake Road) 8/31/2010 STATION 7 Value	Score	Cedar Creek 17 Mile Road 9/1/2010 STATION 8 Value	Score
TOTAL NUMBER OF TAXA	38	1	37	1	34	1	27	1
NUMBER OF MAYFLY TAXA	5	1	6	1	6	1	5	1
NUMBER OF CADDISFLY TAXA	10	1	9	1	8	1	5	0
NUMBER OF STONEFLY TAXA	1	0	1	0	2	1	0	-1
PERCENT MAYFLY COMP.	19.16	0	20.48	0	9.24	0	10.59	0
PERCENT CADDISFLY COMP.	30.84	1	28.92	0	46.18	1	22.35	0
PERCENT DOMINANT TAXON	18.83	0	21.29	0	17.27	0	20.78	0
PERCENT ISOPOD, SNAIL, LEECH	7.14	0	5.62	0	1.61	1	3.92	1
PERCENT SURF. AIR BREATHERS	0.65	1	0.80	1	0.40	1	0.78	1
TOTAL SCORE		5		4		7		3
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		EXCELLENT		ACCEPT.

Table 4C. Qualitative macroinvertebrate sampling results for Pere Marquette Watershed for July, August, and September 2010

TAXA	Pere Marquette River M-37 8/31/2010 STATION 9	Beaver Creek 198th Avenue 9/2/2010 STATION 10	Beaver Creek Comstock Avenue 9/2/2010 STATION 11	Freeman Creek Maple Island Avenue 9/2/2010 STATION 12
PLATYHELMINTHES (flatworms)				
Turbellaria		1		
ANNELIDA (segmented worms)				
Hirudinea (leeches)				2
Oligochaeta (worms)	4	2	2	7
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	1	110	112	23
Decapoda (crayfish)			1	4
Isopoda (sowbugs)	21			
Arachnoidea				
Hydracarina	8			1
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae	8			8
Baetidae	70	1	12	7
Caenidae		9		5
Ephemerellidae	5			
Heptageniidae	5		1	1
Leptophlebiidae			1	
Tricorythidae	16			
Odonata				
Anisoptera (dragonflies)				
Aeshnidae		1	1	6
Gomphidae	2			2
Zygoptera (damselflies)				
Calopterygidae	6	3	46	10
Coenagrionidae		70	1	7
Plecoptera (stoneflies)				
Perlidae	6			
Pteronarcyidae	1			
Hemiptera (true bugs)				
Belostomatidae		1	1	
Corixidae	5	1	3	2
Gerridae		1		
Notonectidae			7	1
Pleidae	1	4	1	
Veliidae				6
Megaloptera				
Corydalidae (dobson flies)		1		
Sialidae (alder flies)			1	3
Trichoptera (caddisflies)				
Brachycentridae	16		4	
Glossosomatidae	1			
Helicopsychidae		1		35
Hydropsychidae	10	8	19	2
Hydroptilidae				1
Leptoceridae	6	8		
Limnephilidae	2	2	2	
Phryganeidae				1
Polycentropodidae	1	2		
Coleoptera (beetles)				
Dytiscidae (total)				1
Haliplidae (adults)		1	1	3
Hydrophilidae (total)			1	
Dryopidae			4	
Elmidae	14	1	2	71
Diptera (flies)				
Athericidae	4			
Ceratopogonidae				5
Chironomidae	47	43	12	24
Culicidae				1
Simuliidae	24	2	29	
Tabanidae	1		1	3
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		3		2
Physidae	11		2	2
Planorbidae		2		1
Viviparidae		1	1	
Pelecypoda (bivalves)				
Pisidiidae		1		
Sphaeriidae (clams)		1	4	2
TOTAL INDIVIDUALS	296	281	272	249

Table 4C. Macroinvertebrate metric evaluation of Pere Marquette Watershed for July, August, and September 2010

METRIC	Pere Marquette River M-37 8/31/2010 STATION 9 Value	Score	Beaver Creek 198th Avenue 9/2/2010 STATION 10 Value	Score	Beaver Creek Comstock Avenue 9/2/2010 STATION 11 Value	Score	Freeman Creek Maple Island Avenue 9/2/2010 STATION 12 Value	Score
TOTAL NUMBER OF TAXA	27	1	27	1	27	1	32	1
NUMBER OF MAYFLY TAXA	5	1	2	0	3	0	4	1
NUMBER OF CADDISFLY TAXA	6	1	5	1	3	0	4	1
NUMBER OF STONEFLY TAXA	2	1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMP.	35.14	1	3.56	0	5.15	0	8.43	0
PERCENT CADDISFLY COMP.	12.16	0	7.47	0	9.19	0	15.66	0
PERCENT DOMINANT TAXON	23.65	0	39.15	-1	41.18	-1	28.51	0
PERCENT ISOPOD, SNAIL, LEECH	10.81	-1	2.14	1	1.10	1	2.81	1
PERCENT SURF. AIR BREATHERS	2.03	1	2.85	1	5.15	1	5.62	1
TOTAL SCORE		5		2		1		4
MACROINV. COMMUNITY RATING		EXCELLENT		ACCEPT.		ACCEPT.		ACCEPT.

Table 4D. Qualitative macroinvertebrate sampling results for Pere Marquette Watershed for July, August, September 2010

TAXA	Pere Marquette River Walhalla Road 9/1/2010 STATION 13	Pere Marquette River Reek Road 9/1/2010 STATION 14	N B Lincoln River Reek Road (Cleveland Street) 9/1/2010 STATION 15	N B Lincoln River Custer Road 9/1/2010 STATION 16
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1			
Oligochaeta (worms)	8			13
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	17	19	48	62
Decapoda (crayfish)	8	2	1	9
Isopoda (sowbugs)		4		
Arachnoidea				
Hydracarina	2		1	
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				5
Baetidae	30	72	43	4
Caenidae				1
Ephemerellidae	2	2	1	
Ephemeridae	2	1		4
Heptageniidae	27	3	3	1
Isonychiidae	11		1	
Leptophlebiidae			1	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1			2
Gomphidae				1
Libellulidae			2	
Zygoptera (damselflies)				
Calopterygidae	22	7	13	28
Plecoptera (stoneflies)				
Perlidae	3	3		
Pteronarcyidae	3	1		
Hemiptera (true bugs)				
Belostomatidae			1	1
Corixidae	3	10		
Gerridae			1	1
Nepidae	1			1
Veliidae			2	1
Megaloptera				
Corydalidae (dobson flies)				1
Sialidae (alder flies)	1		2	9
Trichoptera (caddisflies)				
Brachycentridae	5	15	2	7
Helicopsychidae			4	
Hydropsychidae	40	29	21	18
Leptoceridae	10	1		10
Limnephilidae	1			
Philopotamidae	1	2		
Phryganeidae			1	1
Polycentropodidae	1	2	1	4
Coleoptera (beetles)				
Dryopidae			1	4
Elmidae	1		4	2
Diptera (flies)				
Athericidae	2	2		
Ceratopogonidae			1	2
Chironomidae	8	7	63	26
Culicidae				1
Simuliidae	5	60	20	8
Stratiomyidae	1			1
Tabanidae	3		1	2
Tipulidae				8
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1	1		
Physidae	14	1		
Planorbidae			2	
Viviparidae				1
Pelecypoda (bivalves)				
Sphaeriidae (clams)	3		7	5
TOTAL INDIVIDUALS	238	244	248	244

Table 4D. Macroinvertebrate metric evaluation of Pere Marquette Watershed for July, August, September 2010

METRIC	Pere Marquette River Walhalla Road 9/1/2010 STATION 13 Value	Score	Pere Marquette River Reek Road 9/1/2010 STATION 14 Value	Score	N B Lincoln River Reek Road (Cleveland Street) 9/1/2010 STATION 15 Value	Score	N B Lincoln River Custer Road 9/1/2010 STATION 16 Value	Score
TOTAL NUMBER OF TAXA	32	1	21	0	27	1	33	1
NUMBER OF MAYFLY TAXA	5	1	4	1	5	1	5	1
NUMBER OF CADDISFLY TAXA	6	1	5	1	5	1	5	1
NUMBER OF STONEFLY TAXA	2	1	2	1	0	-1	0	-1
PERCENT MAYFLY COMP.	30.25	1	31.97	1	19.76	1	6.15	0
PERCENT CADDISFLY COMP.	24.37	0	20.08	0	11.69	0	16.39	0
PERCENT DOMINANT TAXON	16.81	1	29.51	0	25.40	0	25.41	0
PERCENT ISOPOD, SNAIL, LEECH	6.72	0	2.46	1	0.81	1	0.41	1
PERCENT SURF. AIR BREATHERS	2.10	1	4.10	1	1.61	1	2.46	1
TOTAL SCORE		7		6		5		4
MACROINV. COMMUNITY RATING		EXCELLENT		EXCELLENT		EXCELLENT		ACCEPT.

Table 4E. Qualitative macroinvertebrate sampling results for Pere Marquette Watershed for July, August, September 2010

TAXA	S B Lincoln River Victory Road 9/1/2010 STATION 17	Swan Creek Kinney Road 9/16/2010 STATION 18
ANNELIDA (segmented worms)		
Oligochaeta (worms)	3	15
ARTHROPODA		
Crustacea		
Amphipoda (scuds)	106	92
Decapoda (crayfish)	4	1
Isopoda (sowbugs)		3
Arachnoidea		
Hydracarina	1	1
Insecta		
Ephemeroptera (mayflies)		
Baetidae	21	12
Ephemerellidae	1	
Heptageniidae	4	15
Leptophlebiidae		1
Odonata		
Anisoptera (dragonflies)		
Aeshnidae	2	1
Zygoptera (damselflies)		
Calopterygidae	4	29
Hemiptera (true bugs)		
Belostomatidae		1
Corixidae		1
Gerridae	1	1
Mesoveliidae		1
Nepidae	1	
Megaloptera		
Corydalidae (dobson flies)	1	1
Sialidae (alder flies)	2	
Trichoptera (caddisflies)		
Brachycentridae	13	2
Glossosomatidae	1	
Hydropsychidae	14	4
Lepidostomatidae	1	
Leptoceridae		1
Limnephilidae	1	5
Molannidae	1	
Phryganeidae	1	1
Coleoptera (beetles)		
Dytiscidae (total)		1
Dryopidae	1	3
Elmidae	7	1
Diptera (flies)		
Chironomidae	24	39
Culicidae		1
Dixidae		2
Ptychopteridae		1
Simuliidae	49	33
Tabanidae	5	1
Tipulidae		1
MOLLUSCA		
Gastropoda (snails)		
Ancylidae (limpets)	1	
Physidae	14	10
Pelecypoda (bivalves)		
Sphaeriidae (clams)	10	15
TOTAL INDIVIDUALS	294	296

Table 4E. Macroinvertebrate metric evaluation of Pere Marquette Watershed for July, August, September 2010

METRIC	S B Lincoln River Victory Road 9/1/2010 STATION 17 Value	Score	Swan Creek Kinney Road 9/16/2010 STATION 18 Value	Score
TOTAL NUMBER OF TAXA	28	1	32	1
NUMBER OF MAYFLY TAXA	3	0	3	0
NUMBER OF CADDISFLY TAXA	7	1	5	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMP.	8.84	0	9.46	0
PERCENT CADDISFLY COMP.	10.88	0	4.39	0
PERCENT DOMINANT TAXON	36.05	0	31.08	0
PERCENT ISOPOD, SNAIL, LEECH	5.10	0	4.39	0
PERCENT SURF. AIR BREATHERS	0.68	1	2.36	1
TOTAL SCORE		2		2
MACROINV. COMMUNITY RATING		ACCEPT.		ACCEPT.

Table 5. 2012 assessment units within the Pere Marquette River and Lincoln River watersheds, their designated use support, and any causes of impairment (Goodwin et al., 2012).

Waterbody	Uses	Use Support	Causes	
Includes: Baker Creek, Blood Creek and Middle Branch Pere Marquette River	OIAL	Not Supporting	PCB in water column	
	CWF	Insufficient Information		
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Sanborn Creek	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Baldwin River and Bray Creek	TBC	Insufficient Information		
	PBC	Insufficient Information		
	OIAL	Not Supporting	Hg in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Little South Branch Pere Marquette River	OIAL	Not Supporting	PCB in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Little South Branch Pere Marquette River	OIAL	Not Supporting	PCB in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Little South Branch Pere Marquette River and Pease Creek	OIAL	Not Supporting	PCB in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Cedar Creek and Triple Lakes Creek	CWF	Insufficient Information		
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Pere Marquette River	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Beaver Creek and South Beaver Creek	OIAL	Not Supporting	PCB in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Beaver Creek	OIAL	Not Supporting	PCB in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Pere Marquette River	OIAL	Not Supporting	Hg in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: Pere Marquette River, not including tributaries	OIAL	Not Supporting	Hg in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue
Includes: North Branch Lincoln River	TBC	Insufficient Information		
	TBC	Insufficient Information		
Includes: Frog Paradise Drain and South Branch Lincoln River	NA			
Includes: Swan Creek	OIAL	Not Supporting	Hg in water column	
	Fish Con	Not Supporting	PCB in water column	PCB in Fish Tissue