MI/EGLE/WRD-20/001

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

St. Joseph River Watershed Report

Water Resources Division

Surface Water Assessment Section

Upper and Lower St. Joseph River Watersheds

Berrien, Branch, Calhoun, Cass, Hillsdale, Kalamazoo, St. Joseph, and Van Buren Counties

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ST. JOSEPH RIVER WATERSHED REPORT

1 INTRODUCTION

1.1 Purpose

Many Michigan Department of Environment, Great Lakes, and Energy (EGLE) water quality monitoring and water pollution control programs are implemented according to a five-year rotating watershed cycle to promote program integration and effective watershed management. In line with this approach, water quality monitoring within this five-year cycle occurs two years prior to National Pollutant Discharge Elimination System (NPDES) watershed permit issuance or renewal. Status and trends are also determined using approximately 900 statewide probabilistically chosen river and stream locations over the five-year basin cycle period.

Michigan has 57 major watersheds based on the United States Geological Survey's (USGS) eight-digit Hydrologic Unit Codes (HUC). Water quality assessment efforts focus on a subset of these major watersheds each year.

Environmental monitoring within these major watersheds is an essential component of EGLE's mission. The main goals of EGLE, Surface Water Assessment Section (SWAS), monitoring efforts are to:

1. Assess the current status and condition of waters of the state and determine whether water quality standards (WQS) are being met.
2. Address monitoring requests submitted by internal and external customers
3. Evaluate biological community spatial and temporal water quality trends.
4. Identify new and emerging water quality problems.

The purpose of this report is to summarize the biological and habitat data collected during the 2015 and 2016 targeted watershed surveys, as well as document additional chemical, biological, and physical monitoring data generated by EGLE and its partners in recent years. This report covers the following eight-digit HUCs:

04050001--St. Joseph River Watershed

This area is referred to as the St. Joseph River Watershed (SJW) throughout this document. Because this watershed is so large, it has been separated into two parts to allow for adequate monitoring, which takes place over two years (Figure 1). The Upper St. Joseph River was sampled in 2015 and the Lower was sampled in 2016 by EGLE SWAS.

Note: The Michigan Department of Environmental Quality (MDEQ) was renamed EGLE in 2019. Reference to both agency names may be in this document depending on when the data was collected, surveys were conducted, or reports were completed.

2 WATERSHED DESCRIPTION

The SJW is the third largest river basin in Michigan and includes waters in Berrien, Branch, Calhoun, Cass, Hillsdale, Kalamazoo, St. Joseph, and Van Buren Counties in Michigan, as well as several counties in Indiana, and lies within the Southern Michigan/Northern Indiana Drift

Plains Ecoregion (Albert, 1995). This large watershed originates in Hillsdale County at Baw Beese Lake and widens to include a portion of Indiana and eventually drain to Lake Michigan at St. Joseph, Michigan. The SJW drains approximately 4,685 square miles: 3,000 in Michigan and 1,685 in Indiana. This document will include information only pertaining to the Michigan portion of the SJW (Figure 1).

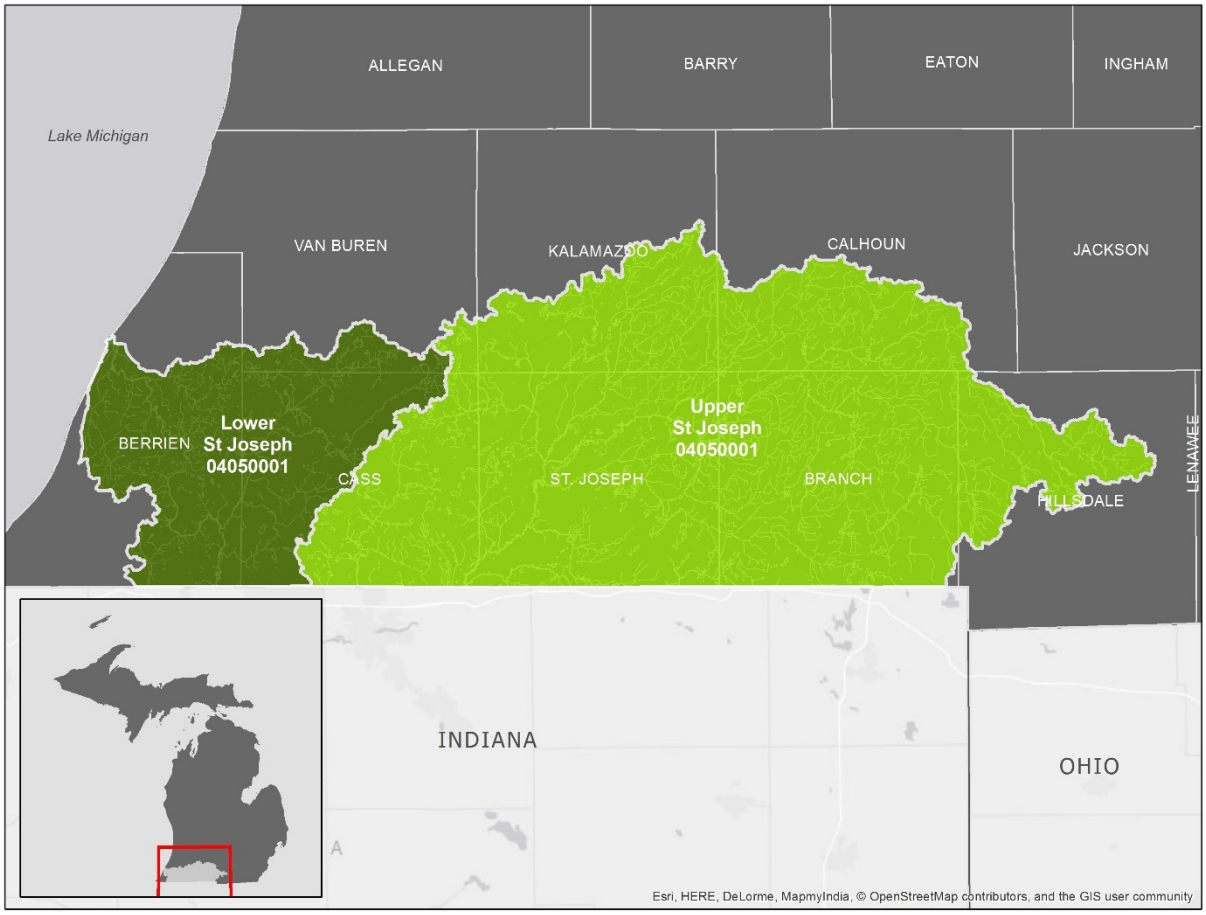

Figure 1. SJW including the division of the Upper and Lower sections.

2.1 Natural Features

Glacial retreat over 10,000 years ago shaped much of the SJW landscape leaving deposits consisting of a mosaic of outwash sands, sorted and unsorted sands and gravel, fine loam material, and lake plain. Over half of the surficial geology consists of outwash sand and gravel, which ranks third among Lower Peninsula watersheds behind only the Manistee and Boardman Rivers. Some of the highest elevations, reaching nearly 570 feet above Lake Michigan, are located near the headwaters in Hillsdale County. This upper area contains the highest gradient streams as well as a substantial number of swales, lakes, and wetlands supplying much of the cooler water to the system. The middle section, draining the majority of the SJW, goes from medium to large with considerably lower gradient. The lower section of the watershed is in a relatively confined valley as it cuts through the Kalamazoo moraine until the last eight miles where it flows across a lake plain to the mouth in St. Joseph Michigan (Albert, 1995) (Wesley &

Duffy, 1999). The lower SJW contains a considerable amount of designated trout (coldwater) streams as classified by the Michigan Department of Natural Resources (MDNR) (Figure 2).

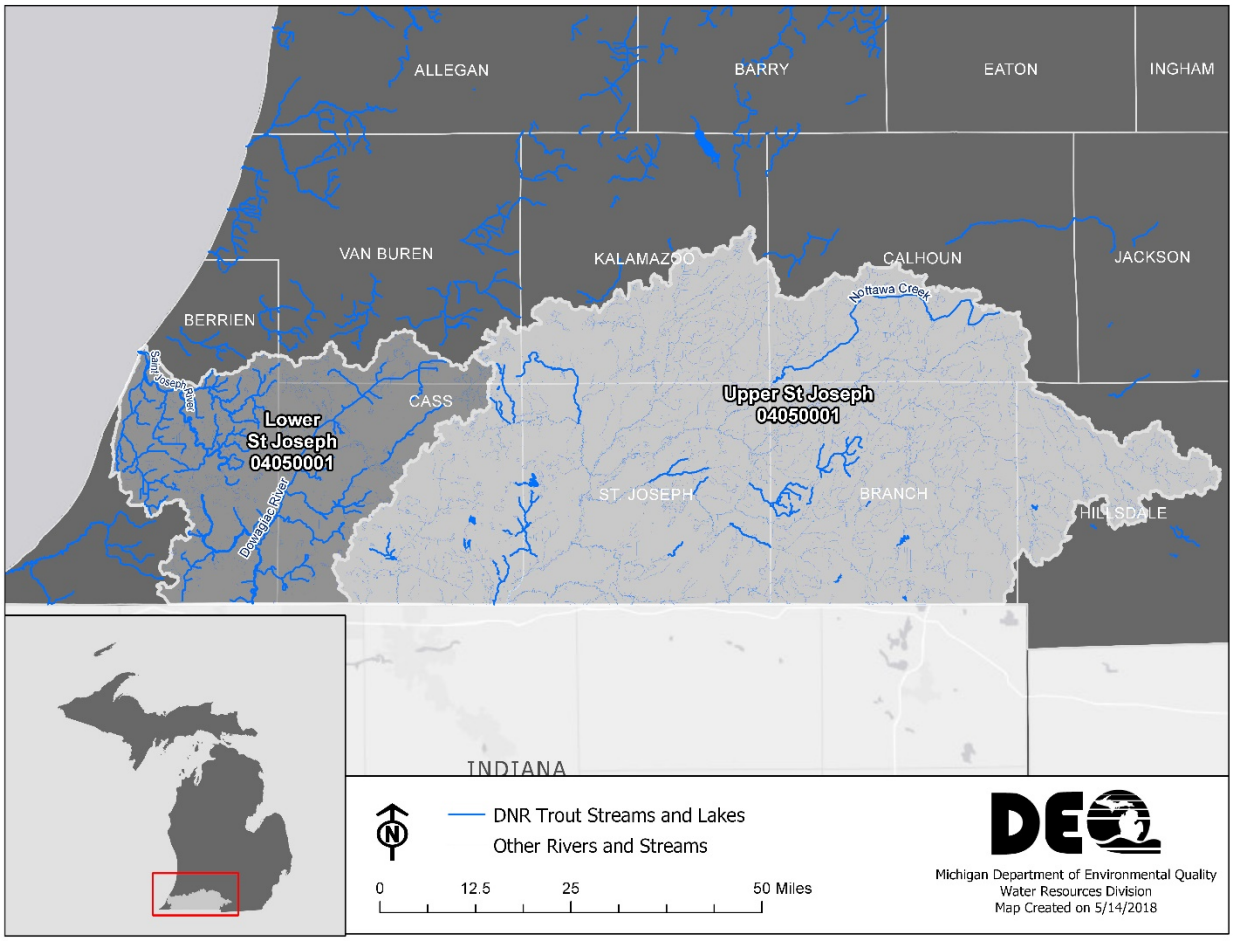

Figure 2. Designated trout streams and lakes in the SJW.

2.2 Land Use

Prior to European settlement, the SJW consisted of large tracts of deciduous forest, streams, lakes, wetlands, and prairies. This natural landscape supported a very diverse population of fish and wildlife. Native Americans and Europeans found this fertile land with vast prairies easy to convert to agricultural use and the majority of forests were logged by the 1900s. Dams were constructed along the river to provide power to industry and a growing population and over 50 percent of wetlands have been lost to development. This extensive development within the watershed has led to a variety of water quality issues (Degraves, 2005).

Current land cover (Figure 3) in the SJW is dominated by cultivated crops (>49 percent) with wooded wetlands, deciduous forest, and pasture/hay making up much of the remaining land use (Jin et al., 2013).

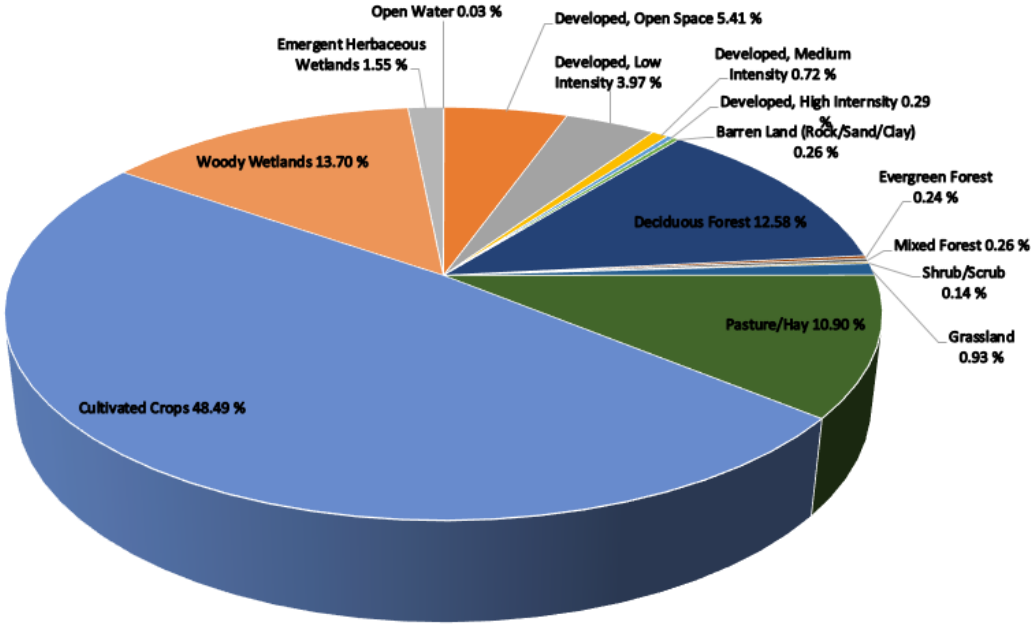

Figure 3. Current land use in the SJW (Jin, et al., 2013).

2.3 Attainment Status

The Federal Water Pollution Control Act (PL 92-500), also known as the Clean Water Act (CWA), requires states to provide the United States Environmental Protection Agency (USEPA) with an assessment of water quality. EGLE currently fulfills these reporting requirements through the submission of a biennial Integrated Report, which describes the attainment status of Michigan's surface waters relative to the designated uses specified in Michigan's WQS (MDEQ, 2006b) (see text box for description of designated uses).

Designated Uses
All surface waters of the state are designated and protected at a minimum for all of the following designated uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, and fish consumption (R 323.1100[1][a]-[g] of the Part 4 Rules, WQS, promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended). In addition, all surface waters of the state are designated and protected for total body contact recreation from May 1 to October 1 (R 323.1100[2]). Specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes Connecting Channels are designated and protected for coldwater fisheries (R 323.1100[4]-[7]). Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and Connecting Channels are designated and protected as public water supply sources (R 323.1100[8]).

The Integrated Report (MDEQ, 2016) includes a chapter on assessment methodology (Chapter 4), which describes the data and information used to determine designated use support, explains how these data and information are used to determine designated use support for surface waters of the state, and describes how surface water resources are reported using five categories: fully supporting, partially supporting, not supporting, insufficient information, or not assessed. Waters that do not support their designated uses or meet WQS are considered impaired and require the development of a Total Maximum Daily Load (TMDL), unless it is determined the impairment is not caused by a pollutant (e.g., channelization) or other approved pollution control mechanisms (e.g. contaminated sediment cleanup) are in place and are expected to result in designated use attainment.

Beginning in 2016, the Water Resources Division (WRD) decreased the sampling effort used to develop statistical assessment evaluations of macroinvertebrate communities in rivers and streams at the watershed scale in favor of obtaining statewide estimates only. In 2015 and 2016, 16 randomly selected sites within the SJW watershed were sampled to support statewide attainment status calculation for the other indigenous aquatic life and wildlife designated use. Additionally, each of the sites sampled within the SJW watershed are used for assessing the designated use support status of their associated individual assessment units.

2.3.1 *TMDLs*

When a lake or stream does not meet WQS for a pollutant, a study must be completed to determine the amount of a pollutant that a water body can receive from point sources and nonpoint sources (NPS) and still meet WQS, including a margin of safety. A TMDL is a document that determines how much pollutant load a lake or stream can assimilate and allocates the loads to sources. The purpose of the TMDL is to gather data, identify pollutant sources, and develop appropriate goals and reasonable assurance that will ensure WQS are met and designated uses are restored (MDEQ, 2018f) (https://www.michigan.gov/egle/about/Organization/Water-Resources/tmdls/statewide-mercury-tmdl).

The SJW currently has several TMDLs completed for *E. coli* for specific areas within the watershed. These TMDLs include 32 miles of the lower St. Joseph River (2004), Eau Claire Village Drain and Farmers Creek (2008), Pine and Mill Creeks (2009), and Little Portage Creek (2012). A statewide TMDL for *E. coli* with additional locations within the SJW has been completed and submitted to the USEPA. (MDEQ, 2018b) (MDEQ, 2018a)

Statewide TMDLs for Polychlorinated Biphenyls (PCB) and mercury have been submitted and approved by the USEPA. These TMDLs address inland water bodies listed as not attaining WQS in the SJW due to these two contaminants. Several water bodies are listed as not supporting the designated use of other indigenous aquatic life and wildlife due to ambient water concentrations of mercury and PCBs, which exceed WQS. These water bodies are addressed by the approved statewide mercury and PCB TMDLs developed by the MDEQ (MDEQ, 2018c) (MDEQ, 2018f)

The SJW has several water bodies that are listed as not supporting designated uses of fish consumption due to the bioaccumulation of chemicals in fish tissue.

2.3.2 *Fish Consumption Advisories*

In addition to the statewide fish consumption advisory for mercury and PCBs, the Michigan Department of Health and Human Services (MDHHS) has placed specific consumption advisories on sections of the SJW. PCBs and mercury are the driving contaminants of these advisories. DDT and perfluorooctane sulfonate (PFOS) have also been cited as a cause for the advisory. Species collected for analysis include: Black Crappie, Bluegill, Brown Bullhead, Brown Trout, Carp, Channel Catfish, Largemouth Bass, Northern Hog Sucker, Northern Pike, Rock Bass, Smallmouth Bass, Sucker Species, and Walleye.

2.3.3 *Permitted Discharges*

The NPDES permit process was initiated by the federal Water Pollution Control Act amendments of 1972. The purpose of the program is to control the discharge of pollutants into surface waters by imposing effluent limitations on point source discharges to protect human health and the environment (MDEQ, 2018e). Currently, authority for NPDES permit issuance rests with EGLE. All NPDES permits are written to ensure that surface waters that receive discharges will meet WQS. Michigan's WQS are designed to not only protect for aquatic life ("fishable") and recreation ("swimmable") uses, but also protect for other uses of the receiving waters, including agriculture, public and industrial water supply, and navigation.

There are 451 NPDES permits impacting surface water in the SJW. Locations of permitted facilities are presented in Figure 4 and additional information regarding specific permits can be found on the EGLE Web site (MDEQ, 2018d). Activities that are permitted include Wastewater Treatment Plants (WWTP), storm water discharge, concentrated animal feeding operations (CAFO), and industrial discharges.

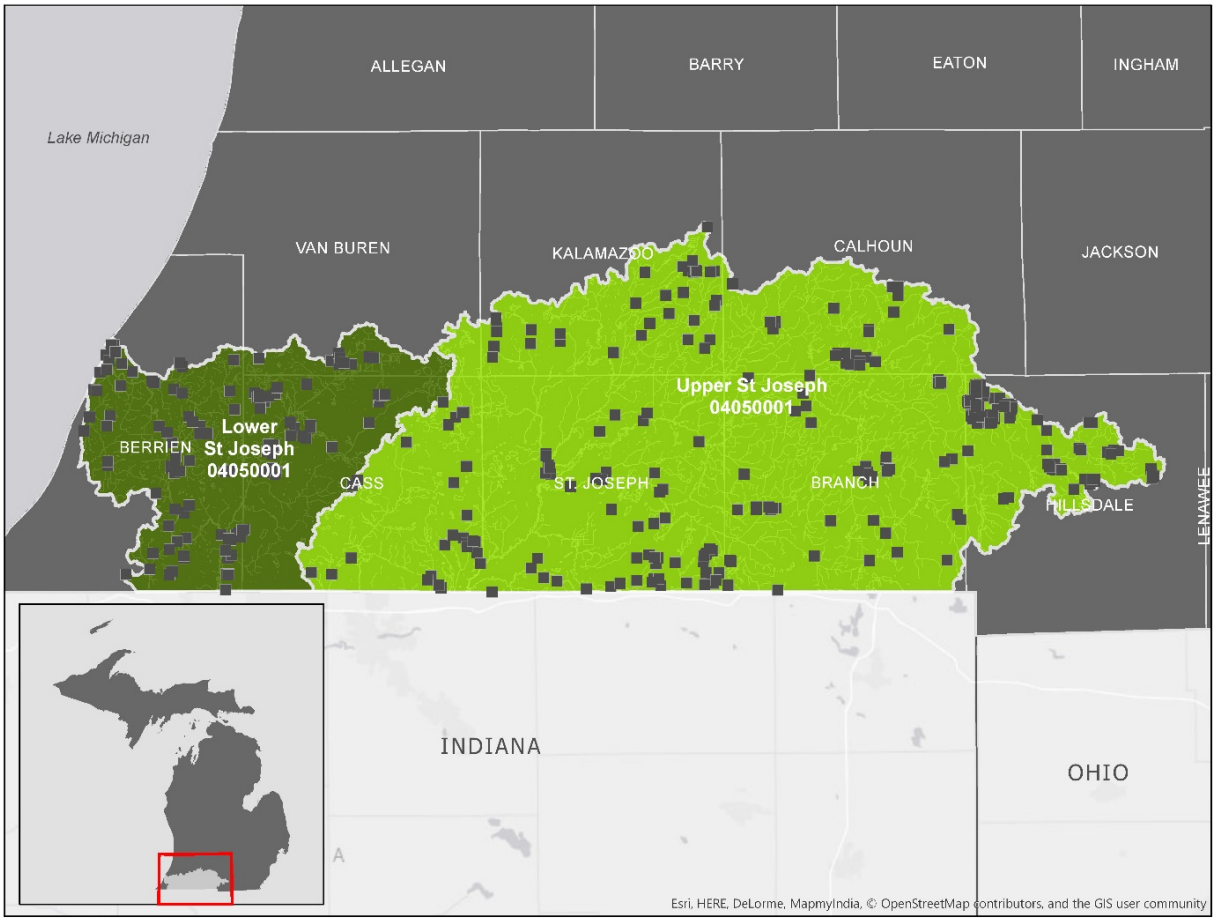

Figure 4. Location of NPDES permitted facilities within the SJW.

2.4 Invasive Species

An invasive species is defined as a species that is not native and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health. Michigan's aquatic ecosystems are experiencing significant negative effects from aquatic invasive species (AIS) that are currently present in the state and are continually threatened by new invasions (MDEQ, 2014).

To assist with the tracking of currently established AIS and the potential discovery of undocumented species, EGLE biologists currently include an AIS survey component into their site assessments. The AIS survey conducted at each site is not exhaustive and it is possible that certain species may have been present and not observed. These surveys are compiled by SWAS AIS staff and the data are entered into the Midwest Invasive Species Information Network (MISIN). Additional species information as well as distribution information can be found on the MISIN Web site (MISIN, 2019).

2.5 Watershed Management Plans (WMP)

A WMP serves as a guide for communities to protect and improve water quality and considers all uses, pollutant sources, and impacts within a drainage area. More than 150 WMPs have been developed across Michigan at the local level utilizing EGLE grants awarded by the NPS Program. Grant funding for implementation of best management practices (BMP) identified within the WMPs is available through the federal CWA as well as the Clean Michigan Initiative (CMI) NPS Pollution Control Grant Program. The SJW contains seven (Figure 5) approved or pending WMPs (MDEQ, 2017). The SJW has an approved WMP for the entire watershed and there are six other WMPs within the SJW focused on smaller watersheds. More information can be found on EGLE's Web site under the NPS Section (MDEQ, 2019a). These WMPs were approved under the CMI administrative rules and were funded under Section 319 of the CWA (MDEQ, 2017).

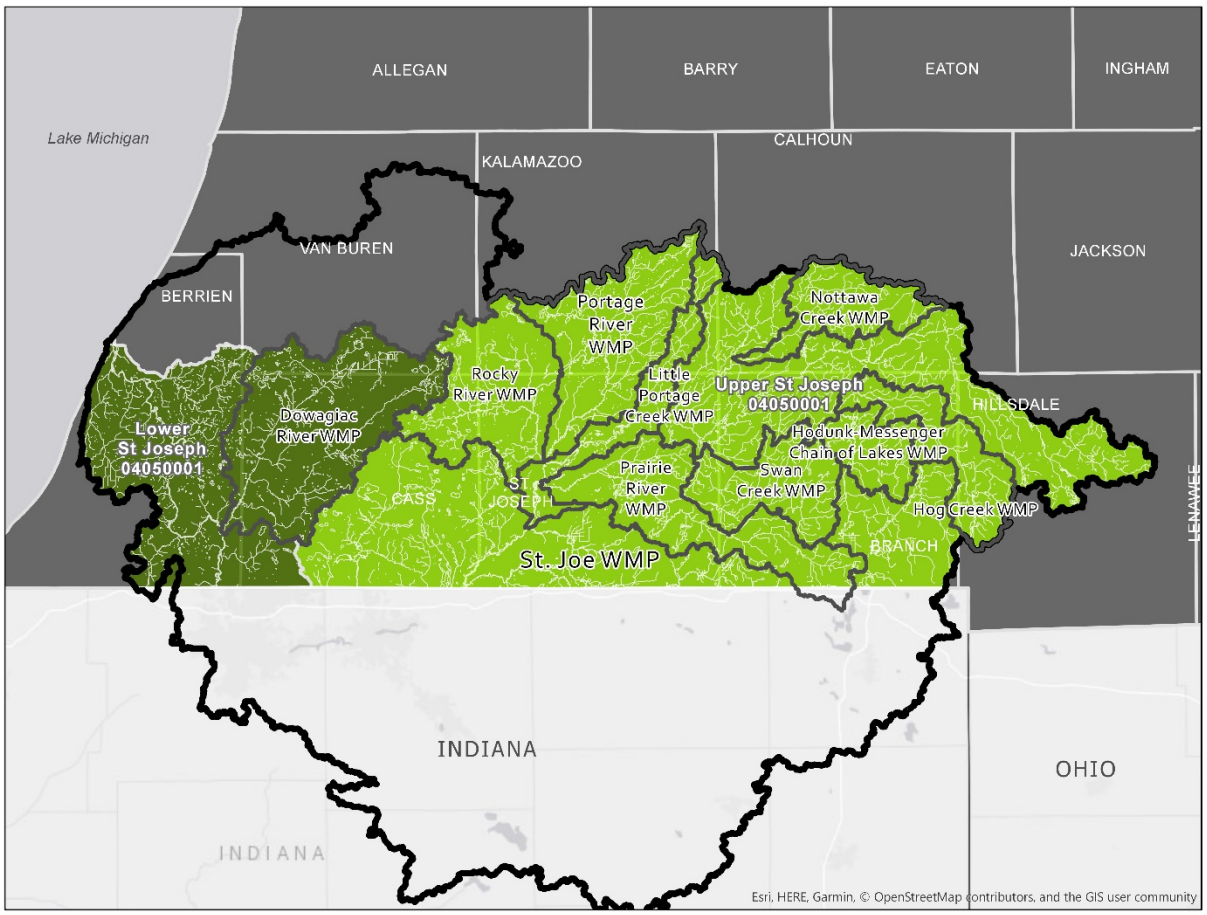

Figure 5. Locations of the Watershed Management Plans (WMP) within the SJW as well as the WMP covering the entire SJW.

2.5.1 *St. Joseph River Watershed*

The St. Joseph River Watershed Management Plan was developed by the Friends of the St. Joe River Association and was approved as meeting both CMI and Section 319 criteria in 2005. The St. Joseph River watershed planning area is 2,998,400 acres in size and covers portions of Berrien, Branch, Calhoun, Cass, Hillsdale, Kalamazoo, St. Joseph, and Van Buren Counties, Michigan; and DeKalb, Elkhart, Kosciusko, Lagrange, Noble, St. Joseph, and Steuben Counties, Indiana. Land cover in the planning area is 70 percent agricultural, 17 percent forested, 6 percent wetland, 5 percent residential, and 2 percent water. Designated uses addressed within the planning area include agricultural water supply, navigation, warmwater fisheries, coldwater fisheries, other indigenous aquatic life and wildlife, partial body contact recreation, and total body contact recreation. Pollutants of concern in the watershed include sediment, nutrients, pathogens, pesticides, herbicides, and other toxins (MDEQ, 2017).

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2.5.2 *ROCKY RIVER WATERSHED*

The Rocky River Watershed Management Plan was prepared by the St. Joseph County Conservation District and was approved as meeting CMI criteria in 2003 and Section 319 criteria in 2004. The planning area is in portions of Cass, St. Joseph, Van Buren, and Kalamazoo Counties and is approximately 112,100 acres in size. Land cover within the planning area is 64.6 percent agricultural, 21.8 percent forested, 9.9 percent wetland, 2.5 percent water, and 1.1 percent urban. Designated uses addressed within the planning area include navigation, warmwater fisheries, other indigenous aquatic life and wildlife, and partial and total body contact recreation. Pollutants of concern include sediment, nutrients, bacteria (*E. coli*), and hydrologic flow (MDEQ, 2017).

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2.5.3 *LITTLE PORTAGE CREEK WATERSHED*

The Little Portage Creek Watershed Management Plan was developed by the Calhoun County Conservation District and was approved as meeting CMI and Section 319 criteria in 2016. The Little Portage Creek planning area is approximately 60,000 acres in size and located in St. Joseph, Kalamazoo, and Calhoun Counties. Land cover within the planning area is 71 percent agriculture, 14 percent forested, 5 percent open field, 4 percent urban, 3 percent water, and 3 percent wetland. Impaired designated uses include partial and total body contact recreation and warmwater fisheries. Primary pollutants of concern include sediment and *E. coli* (MDEQ, 2017).

https://docs.wixstatic.com/ugd/37b657_0c56351002fe4e13a16fa91e34763df9.pdf

2.5.4 *PORTAGE RIVER WATERSHED*

The Portage River Watershed Management Plan was developed by the Calhoun County Conservation District and was approved as meeting CMI and Section 319 criteria in 2016. The planning area is approximately 125,500 acres in size and located in Kalamazoo and St. Joseph Counties. Land cover within the planning area is 60 percent agriculture, 18 percent forested, 7 percent wetland, 6 percent urban, 5 percent open field, and 4 percent water. The impaired designated use within the watershed is total body contact. Pollutants of concern include pathogens, sediment, and hydrologic issues (MDEQ, 2017).

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2.5.5 *PRAIRIE RIVER WATERSHED*

The Prairie River Watershed Management Plan was developed by the Branch County Conservation District and was approved as meeting both CMI and Section 319 criteria in 2014. The Prairie River planning area is 116,668 acres in size. The planning area is in portions of Branch and St. Joseph Counties, Michigan; and Steuben County, Indiana. Land cover in the planning area is 69 percent agricultural production, 12 percent forested, 12 percent wetland, 4 percent urban, and 3 percent water. No water bodies in the Prairie River watershed are currently identified as having impaired designated uses. The pollutant of concern in the watershed is *E. coli* (MDEQ, 2017).

A copy of the Prairie River watershed is available upon request.

2.5.6 *Nottawa Creek Watershed*

The Nottawa Creek Watershed Management Plan was developed by the Calhoun Conservation District and received CMI approval in 2000. The planning area covers 59,196 acres. Land cover within the watershed is 68 percent agricultural, 13 percent forested, 10 percent wetland, and 9 percent nonfarm lands. Designated uses addressed within the planning area include warmwater fisheries, and partial and total body contact recreation. Pollutants include sediment, nutrients, pathogens, and pesticides (MDEQ, 2017).

https://docs.wixstatic.com/ugd/37b657_988a7146d1074984ba582e861a11657c.pdf

2.5.7 *Dowagiac River Watershed*

The Dowagiac River Watershed Management Plan was developed by Cass Conservation District and was approved as meeting CMI criteria in 2002. The Dowagiac River planning area lies within the St. Joseph River Basin and located in Cass, Van Buren, and Berrien Counties. The planning area is 183,117 acres. Land cover within the planning area is 55 percent agricultural, 34 percent forest/wetlands, 6 percent residential, 0.3 percent industrial, 0.1 percent commercial, and 4 percent other. Designated uses addressed within the planning area include cold- and warmwater fisheries, other indigenous aquatic life and wildlife, and partial body contact recreation. The management plan addresses the following pollutants: sediment, nutrients, changes in hydrologic flow, and *E. coli* (MDEQ, 2017).

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2.5.8 *Swan Creek Watershed*

The Swan Creek Watershed Management Plan was approved as meeting CMI criteria in 2000. The planning area is in portions of Branch and St. Joseph Counties and is 70,630 acres in size. Land cover within the planning area is 71 percent cropland, 18 percent forested, 5 percent wetland, 3 percent other, 1 percent pastureland, and 1 percent urban. Pollutants of concern within the planning area include sediment and phosphorus (MDEQ, 2017).

A copy of the Swan Creek WMP is available upon request.

2.5.9 *Hog Creek Watershed*

The Hog Creek Watershed Project was developed by the Hillsdale Conservation District and was approved as meeting CMI and Section 319 criteria in 2005. The Hog Creek planning area is 68,928 acres in size. The planning area is in portions of Hillsdale and Branch Counties. Land cover within the planning area is 73 percent agriculture, 16 percent forested, 4 percent open fields, 4 percent water or wetland, and 3 percent urban. None of the designated uses are known to be impaired. The Hog Creek Watershed Management Plan addresses the sources of sediment and pathogens (MDEQ, 2017).

A copy of the Hog Creek WMP is available upon request.

2.5.1 *Hodunk-Messenger Chain of Lakes Watershed*

The Hodunk-Messenger Chain of Lakes Watershed Management Plan was developed by the Branch County Conservation District and was approved as meeting both CMI and Section 319 criteria in 2009. The Hodunk-Messenger Chain of Lakes Watershed planning area covers 39,386 acres in Branch County. Land cover in the planning area is 70 percent agricultural,

15 percent forested, 7 percent urban, 4 percent wetland, and 3.5 percent water. Impaired designated uses in the watershed are other indigenous aquatic life and wildlife, and total body contact recreation. Pollutants of concern in the watershed are pathogens and sediment (MDEQ, 2017).

A copy of the Hodunk-Messenger Chain of Lakes WMP is available upon request.

2.6 NPS Projects

Although only one NPS project is currently active in the SJW, several have been implemented in the SJW since 1991. A list of projects dating back to 2005 is presented in Table 1. These projects have addressed watershed issues such as water contamination, sedimentation/erosion, and public education. NPS success stories are available for projects conducted within the SJW on the Dowagiac River and Rocky River. The Dowagiac River project reconnected a separated meander, which greatly improved in-stream habitat and macroinvertebrate populations. The Rocky River project eliminated an unrestricted cattle access point, which was impacting the physical habitat of the stream and its macroinvertebrate populations.

More project-specific information and short summaries of work completed can be found in the project fact sheets located on the EGLE Web site (MDEQ, 2019b).

Table 1. EGLE NPS Program Projects in the SJW from 2005-2021.

Project Name	Organization	Project Description	End Date
Hog Creek Watershed Planning	Hillsdale Conservation District	The Hog Creek watershed covers 68,928 acres in western Hillsdale and eastern Branch Counties, eventually outletting to the Coldwater River at Hodunk, then onto the St. Joseph River at Union City. The designated uses are warmwater fishery, habitat for other indigenous aquatic life and wildlife, agriculture, and partial or total body contact recreation. Land use is 73 percent agricultural, 4 percent wetlands, 16 percent forested, 3 percent urban, and 4 percent open fields and other. Primary water quality concerns include sediment delivery from stream bank instability, road/stream crossings, agriculture and construction site runoff, nutrients and bacteria from livestock wastes and septic tank systems, and nutrient and pesticides from agricultural and other runoff. The project goal is to complete a watershed inventory, identify and prioritize NPS contaminants and their sources, and develop and write an approved comprehensive WMP.	6/30/2005
St. Joseph River SWAT Model	Friends of the St. Joe River Association	The Friends of the St. Joseph River was awarded an EGLE Section 319 NPS grant to develop a WMP for the St. Joseph River watershed. During the project, the USEPA issued new requirements for watershed management plans funded through Section 319 grant monies. These requirements call for additional quantification of sources of pollutants and expected reductions in pollutants with recommended BMPs. The project reported additional tasks beyond the planning project work plan to ensure the WMP meets the Nine Elements. It used a watershed GIS-based modeling approach to quantify potential load reductions and associated costs for nutrients and pesticides with BMPs applied in three agricultural tributary watersheds. Models used included SWAT (Soil and Water Assessment Tool) and Landscape Analyst.	6/30/2005
St. Joseph River Planning	Friends of the St. Joe River Association, Inc.	The St. Joseph River watershed spans the Michigan-Indiana border and empties into Lake Michigan at St. Joseph, Michigan. The watershed includes 3,742 river miles and drains 4,685 square miles from 14 counties in Michigan and Indiana. Over 1.5 million people live in this agricultural watershed. The watershed includes 32 impaired waters (included in Michigan's Section 303(d) list) with TMDLs not yet developed. The St. Joseph River is the largest contributor of atrazine to Lake Michigan. It has also been estimated that 5 percent of the sediment loading via tributaries into Lake Michigan is derived from the St. Joseph River. Several Section 319 projects have been conducted in subwatersheds in both Michigan and Indiana, yet no comprehensive planning effort for the entire watershed has been attempted. The chief goal of this watershed management planning proposal is to unite stakeholders in a concerted effort to address water quality concerns across jurisdictional boundaries by developing an approvable WMP for the St. Joseph River basin, including both Michigan and Indiana.	6/30/2005
Nottawa Creek BMP Implementation	Calhoun Conservation District	This project proposes to stabilize three eroding stream banks and implement BMPs at 11 agricultural sites. The proposed BMPs will be implemented as part of the Nottawa Creek Section 319 Watershed Project, which aims to reduce erosion and sedimentation in the Nottawa Creek watershed. The watershed project consists of 59,196 acres in Calhoun County. Land uses in the watershed consist of agriculture (dominant use), forestland, wetlands, and urban/rural non-farm. Sediment and nutrients are listed as the primary pollutants threatening water quality in Nottawa Creek.	9/30/2006
Dowagiac River MEANDR Restoration II	Cass Conservation District	The Dowagiac River is a unique coldwater stream in southern Michigan that shares characteristics to northern trout streams. The "Meeting the Ecological & Agricultural Needs within the Dowagiac River System" (MEANDERS) was formed in 1994. Their mission is to protect and restore the ecological function of the Dowagiac River system while maintaining an agricultural-based infrastructure to the community. Projects are being planned and implemented to protect the hydrology and the riparian corridor as well as managing animal waste and sediment in the watershed.	8/31/2007

Project Name	Organization	Project Description	End Date
Hog Creek Implementation	Hillsdale Conservation District	In order to meet its goals, the Hog Creek Watershed Project will choose specific BMPs and develop and implement a Resource Management System within the critical areas that pose the greatest risk to water quality. Priority will be placed on improving those sites that have severely eroded stream banks, uncontrolled livestock access, unstable channel grade, and poor land use practices. Along with this, an extensive Information and Education program will continue and expand, designed to build strong partnerships with stakeholders, landowners, and decision-makers to raise awareness about and accomplish sound watershed management. This will increase residents' understanding of resource concerns and possible solutions. Public participation will be strongly encouraged through Stream Search, Clean-up Days, Information Workshops, and student/volunteer water quality testing.	9/30/2008
Rocky River Watershed Implementation	St. Joseph County Conservation District	This project will protect the Rocky River through the implementation of land use planning tools, conservation practices, and stakeholder awareness and education programs.	6/30/2009
Hodunk-Messenger Chain of Lakes Watershed Planning	Branch Conservation District	The chief goal of this watershed management project is to protect and improve water quality through the development of EGLE-approvable Comprehensive WMP. This project will detail the resource concerns, problems, needs, and solutions for the distinctive yet threatened water and land resources in the Hodunk-Messenger Chain of Lakes watershed. It will then recommend mitigation, protection, restoration, and education efforts necessary to sustain and/or enhance water quality. The planning process and the resulting plan will be grounded in broad public participation and will have a diverse and focused information/education program and a long-range land use management plan.	7/31/2009
City of Sturgis Sustainable Storm Water Demonstration	City of Sturgis	This project will implement Low Impact Development practices for the Nye Drain, which is a subwatershed of the St. Joseph River watershed. Nye Drain is located in St. Joseph County and is approximately 17 percent urban.	9/30/2011
City of St Joseph ARRA TMDL Planning Grant	City of St. Joseph	This project will develop an implementation strategy for the city of St. Joseph to address the St. Joseph River TMDL (*E. coli* - 937 square miles). The numeric target of 130 *E. coli* per 100 milliliters (mL) will be used as the goal of the TMDL. A Quality Assurance Project Plan will outline the sampling design and professional crews will conduct wet-weather sampling at storm sewer outfall locations to identify sources of *E. coli*. A TMDL Compliance Plan will identify watershed-specific BMP implementation plans, including Green Infrastructure solutions; explain how to integrate urban storm water runoff management into the City's planning process for development and redevelopment; and promote public education and community engagement in preventing urban runoff pollution at the source. The project will include adding storm sewer feature classes to a GIS database for use in planning, illicit discharge elimination, spill response, and maintenance programs.	9/30/2011
City of Niles - TMDL Planning Grant	City of Niles	This project will develop an implementation strategy for the city of Niles to address the St. Joseph River TMDL (*E. coli* - 937 square miles). The numeric target of 130 *E. coli* per 100 mL will be used as the goal of the TMDL. A Quality Assurance Project Plan will outline the sampling design and professional crews will conduct wet-weather sampling at storm sewer outfall locations to quantify sources of *E. coli*. A TMDL Compliance Plan will identify watershed-specific BMP implementation plans, including Green Infrastructure solutions; explain how to integrate urban storm water runoff management into the City's planning process for development and redevelopment; and promote public education and community engagement in preventing urban runoff pollution at the source. The project will include adding storm sewer feature classes to a GIS database for use in planning, illicit discharge elimination, spill response, and maintenance programs.	9/30/2011
Hollywood Road Storm Water Basin Wetland Demo Facility	Berrien County Drain Commission	The Hollywood Road Storm Water Basin is in the Hollywood Drain, which is tributary to Hickory Creek and the St. Joseph River. An existing in-line detention basin within the Hollywood Drain currently provides virtually no treatment of the first flush, bank-full and small storm events and has increased localized flooding problems during larger storm events. As this Drain is upstream of Hickory Creek, a Section 303(d) listed water body for habitat modifications due to channelization, it is critical that this basin be retrofitted to control peak flows; reduction of suspended solids and nutrients is also desirable.	7/31/2011
Prairie River Watershed Planning	Branch Conservation District	The Prairie River watershed is a 176 square mile watershed in southern Branch and St. Joseph Counties. This project will focus on addressing known EGLE priority nonattainment impairments, and protecting/enhancing water quality. This watershed is a highly irrigated, agricultural area, where pathogens, sediment, nutrients, and increased hydrologic flow are concerns. This is the largest watershed in the St. Joseph River system without a watershed plan. Michigan's Integrated Report shows the Prairie River contains sections of acceptable/excellent water quality for macroinvertebrates, with sections of quality coldwater fishery. Land uses are 67 percent agriculture, 12 percent forested, 14 percent wetlands and 7 percent urban. Sources of pollution include agricultural/residential runoff, stream/lake banks, road crossings, construction, and septic systems. Key objectives will focus on conservation, mitigation, education, and land use planning to produce an EGLE-approvable watershed plan.	6/30/2014
Portage River/Little Portage Creek Watershed Planning	Calhoun Conservation District	Located in Kalamazoo and St. Joseph Counties, the Portage River and Little Portage Creek encompass 185,505 acres. Land uses in the Portage River are 14 percent wetland, 16 percent forest, 67 percent agriculture, and 2 percent urban. Little Portage Creek land uses are 3 percent wetland, 12 percent forest, 80 percent agriculture, and 0.6 percent urban. Both watersheds fail to support total and partial body contact recreation caused by *E. coli*. Little Portage Creek additionally fails to support its warmwater fishery due to other anthropogenic substrate alterations. Pollutant sources include agriculture, wildlife, faulty septic systems, and storm water runoff.	6/30/2015

Project Name	Organization	Project Description	End Date
Cass County Assessment Pilot Project	Michigan Gateway Community Foundation	Install monitoring wells, conduct aquifer pumping tests, install staff gages in streams, collect miscellaneous stream flow measurements, use multiple methods to determine streambed conductance, create groundwater models.	12/31/2018
Ox Creek Low Impact Development - Phase I	Berrien County Drain Commission	The overall project goal is to reduce priority pollutants (sediment and flow) and begin Phase I of the restoration of an impaired water body (Ox Creek) and make substantial progress towards achieving TMDL total suspended solids load reduction targets. Below are specific goals and measurable objectives.	9/30/2021

3 MONITORING

3.1 River and Stream Biological Surveys

Monitoring by EGLE SWAS biologists generally follows a five-year rotating cycle, and the results are summarized in watershed reports such as this. Previous reports for the SJW were completed in 2007 (MDEQ, 2006a) and 2011 (MDEQ, 2011) for the lower SJW and 2005 (MDEQ, 2005) and 2010 (MDEQ, 2010) in the upper SJW. Invertebrate assessment scores from status and trend sites assessed during these previous sampling events are presented in Table 2.

Biological and physical habitat conditions of selected streams located in the SJW were most recently assessed by EGLE in 2015 and 2016. Qualitative macroinvertebrate community surveys were performed using Procedure 51 (MDEQ, 2008) on wadeable streams at 30 locations. Sample locations are presented in Figure 6.

Eleven trend sites were identified to determine watershed and statewide water quality trends. These sites will be monitored every five years to determine water quality trends within the watershed. Sixteen sites were selected using a stratified random selection process with the goal of addressing statewide and watershed-specific water quality concerns and attainment status.

Three sites were sampled as part of the SWAS targeted monitoring program. These sites were submitted to EGLE as locations of concern or needs for additional information.

The specific water bodies and the scores determined at each are presented in Table 2.

Table 2. Location and scores of water bodies monitored in 2010-2011 and 2015-2016 by EGLE in the SJW.

SITE ID[3]	STORET	WATER BODY NAME	LATITUDE	LONGITUDE	COUNTY	HABITAT SCORE 2015-16[1]	INVERT SCORE 2015-16[2]	INVERT SCORE 2010-11[2]	COMMENTS
1U	750337	Fawn River Drain	41.85342	-85.55999	St. Joseph	109	-1	--	Status
2U	120250	South Branch Hog Creek	42.02926	-84.97127	Branch	173	7	--	Status
3U	300295	Sand Creek	42.01466	-84.77151	Hillsdale	137	8	--	Status
4U	750338	Fawn River	41.80961	-85.57858	St. Joseph	156	4	--	Status
5U	120003	Swan Creek	41.89612	-85.22038	Branch	140	8	--	Status
6U	750339	Prairie River	41.84874	-85.31545	St. Joseph	141	4	--	Status
7U	120251	Sauk River	41.93562	-85.00986	Branch	165	8	--	Status
8U	750319	Bear Creek	42.05772	-85.35625	St. Joseph	146	5	--	Status
9U	300296	Beebe Creek	41.934592	-84.518353	Hillsdale	110	1	--	Status
10U	750340	Fawn River	41.82478	85.58104	St. Joseph	165	2	--	Status
11U	750341	Unnamed Trib to Prairie River	41.91297	-85.40957	St. Joseph	67	0	--	Status
12U	750341	Prairie River	41.854606	-85.33094954	St. Joseph	151	4	--	Status
13U	120252	Sand Creek	41.95588	-84.728149	Hillsdale	171	6	--	Status
14U	750275	Spring Creek	42.06419	-85.60689	St. Joseph	179	2	--	Status
15U	120253	Unnamed Trib to Prairie River	41.85931	-85.23348	Branch	93	-2	--	Status
16U	750324	Spring Creek	42.03811	-85.64919	St. Joseph	139	3	3	Trend
17U	390607	Unnamed Trib to Portage River	42.19779	-85.41293	Kalamazoo	180	5	4	Trend
18U	750280	Rocky River	41.945093	-85.637014	St. Joseph	132	5	5	Trend
19U	120245	Blackwell Drain	42.02827	-85.19361	Branch	117	2	-3	Trend
20U	750327	Nottawa Creek	42.04024	-85.33234	St. Joseph	125	4	2	Trend
21U	120242	Hog Creek	42.02921	-85.04859	Branch	142	4	4	Trend
22U	750001	St. Joseph River	41.97248	-85.30265	St. Joseph	162	8	8	Trend
23U	750326	St. Joseph River	42.00758	-85.41126	Branch	156	8	4	Trend
1L	110804	Pipestone Creek	42.06007	-86.39644	Berrien	118	1	--	Status
2L	140111	Brandywine Creek	41.79741	-86.21458	Cass	177	3	1	Trend
3L	140168	Dowagiac River	42.04969	-86.06932	Cass	140	3	4	Trend
4L	110732	Hickory Creek	41.92757	-86.4704	Berrien	83	-5	-4	Trend
5L	110805	Old Bitty Creek	41.8565	-86.36527	Berrien	112	-1	--	Targeted
6L	130324	Prairie River	41.8019	-85.11673	Branch	93	0	--	Targeted
7L	120254	Prairie River	41.8391	-85.19303	Branch	153	5	--	Targeted

[1]Habitat scores (>154-Excellent, 105-154-Good, 56-104-Marginal, <56-Poor).

[2]Invertebrate assessment scores (+5 to +9-Excellent, +4 to -4-Acceptable, -5 to -9-Poor)

[3]Locations with "U' and "L" denote Upper and Lower SJW locations.

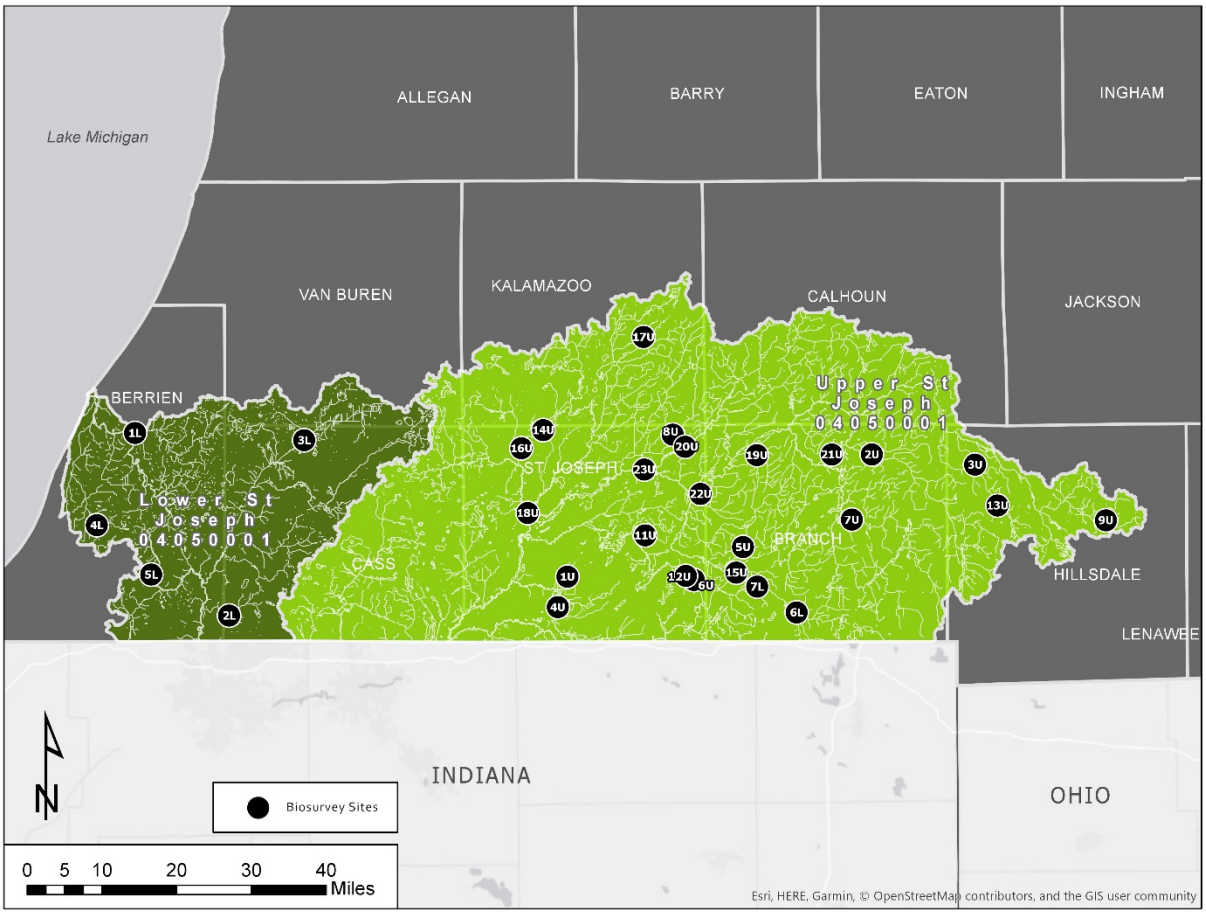

Figure 6. 2015-2016 biosurvey locations in the SJW.

3.1.1 *Status and Trend Site Details*

Scores for all sites can be found in Table 2 and in Appendix A. For benthic invertebrates, 12 of the 30 sites scored Excellent; 17 of the 30 sites scored Acceptable, with 12 of those scoring in the upper half of the Acceptable range; only 3 were in the lower Acceptable range. One site scored Poor. In addition, stream habitat was Excellent at 10 locations, Good at 16, and Marginal at only 4 locations. No sites were rated Poor for habitat.

Eleven trend sites (Table 2) were resampled using Procedure 51 during 2015-2016. Nearly all locations scored within 3 points of the previous sampling effort (2010-2011), which is within typical margins of variation. Two locations (19U and 23U) were outside of this range, with 19U having a 5-point difference and 23U having a 4-point difference, both with higher scores in the more recently conducted surveys. These two locations will be monitored again during the next cycle.

3.1.1.1 Upper St. Joseph River (2015)

Fifteen status locations and 8 trend locations were surveyed in the Upper St. Joseph River in 2015 (Figure 6, Table 2). All sites scored either Excellent or Acceptable. Site 15U (Unnamed tributary to Prairie River) was the only site that scored on the lower end of the Acceptable range with a score of -2. A habitat score of 93 (Marginal) was also documented at this location. This location is a maintained agricultural drain, which was noted as being somewhat recently dredged. The stream was channelized with agricultural fields running immediately adjacent to the stream on both sides. The lack of canopy cover, recent dredging, and significant vegetative growth in the stream channel likely are affecting invertebrate diversity.

3.1.1.2 Lower St. Joseph River (2016)

One status and 3 trend locations were surveyed in the Lower St. Joseph River in 2016 (Figure 6, Table 2). All sites except one scored in the upper end of Acceptable for invertebrates. Site 4L (Hickory Creek) scored -5 (Poor) for invertebrates and 83 (Marginal) for habitat. The stream was noted as being very channelized, with less than 10 feet of vegetated buffer along the edge, which was immediately adjacent to an agricultural field on one side and an animal pasture on the other. This site also scored Poor for invertebrates when it was surveyed in 2011.

3.1.2 *Targeted Monitoring*

3.1.2.1 Prairie River

Low flow conditions in 2012 severely impacted the population of naturally reproducing brown trout in this stream leading to several years of monitoring by the MDNR. The MDNR requested that 2 locations on Prairie River (6L-Bowers Road and 7L-Orland Road; Figure 6, Table 2) be sampled for habitat and invertebrates to supplement fisheries and temperature data collected by the MDNR since 2011. At location 6L at Bowers Road, the habitat scored 93 (marginal) and invertebrates scored 0 (acceptable). This location was found to be very sandy/silty with several areas of unstable substrate pockets. Long filamentous algae were also noted as prevalent within the sampling reach. The site was mainly open canopy along the edge of agricultural fields. Location 7L at Orland Road scored 153 (good) for habitat and 5 (excellent) for invertebrates. This location contained clean in-stream habitat consisting mainly of cobble and gravel.

3.1.2.2 Old Bitty Creek

Invertebrate and habitat data on Old Bitty Creek (5L) was requested by the MDNR to supplement fisheries data. Assessment was focused at this location in response to downstream sedimentation, which perhaps was due to land use practices near the creek or from a culvert replacement that took place upstream. Bank failures were noted at several locations within the reach as well as fine sediment covering much of the in-stream substrate. Several cement blocks were also noted in the stream reach. Habitat scored 112 (Good) and invertebrates scored -1 (Acceptable).

3.1.3 *INVASIVE SPECIES*

In August 2017, the WRD assisted the Nature Conservancy with an AIS early detection survey in the lower St. Joseph River. This was part of a larger AIS surveillance effort among the Great Lakes states through a Great Lakes Restoration Initiative- (GLRI) funded project. The surveillance is primarily focused on aquatic plants. The lower St. Joseph River was identified as one of Michigan's highest risk sites for new AIS introduction through a rigorous evaluation of Great Lake risk assessments (The Nature Conservancy, 2015).

Sampling was conducted over 3 days between the Lake Michigan confluence and the I-94 crossing. Most areas were depauperate or had low abundance of aquatic plants, likely a result of turbidity, flow, and boating traffic. The confluence of the Paw Paw and St. Joseph River was found to have a diverse aquatic plant community of both native and invasive species. The most notable invasive aquatic species found was Carolina Fanwort (Cobomba) in a backwater marina. No watch list AIS species were observed. A complete report of findings is still under development by the Nature Conservancy.

3.1.4 *MDNR RIVER AND STREAM MONITORING*

The MDNR, Fisheries Division, staff has conducted several fish collections on the rivers and tributaries (Table 3) in the SJW since 2013. These collections are spread throughout the SJW and are conducted for various purposes including stocking evaluations and population estimates. Completed water body reports (MDNR, 2019a) and survey-specific information can be requested through MDNR staff (MDNR, 2019b).

Table 3. Rivers and Tributaries Surveyed by the MDNR, Fisheries Division, in the SJW from 2013-2017.

River/Tributary	Year	County	Purpose
25th Street Ditch	2017	Van Buren	General Survey
Dowagiac Creek	2017	Cass	Fish Survey
Curtis Creek	2017	St. Joseph	Fish Survey
Pokagon Creek	2016	Cass	Fish Survey
EB Paw Paw	2016	Van Buren	Fish Survey
Mill Creek	2016	Berrien	Fish Survey
Big Meadow Drain	2015	Berrien	Fish Survey
Pokagon Creek	2015	Cass	Fish Survey
Prairie River	2015	St. Joseph	Fish Survey
Fawn River	2014	St. Joseph	Fish Survey
Brush Creek	2014	Van Buren	Fish Survey
Prairie River	2014	St. Joseph	Fish Survey
Pokagon Creek	2014	Cass	Fish Survey
Old Bitty Creek	2014	Berrien	Fish Survey
McCoy Creek	2013	Berrien	Fish Survey
Pipestone Creek	2013	Berrien	Fish Survey
Fisher Creek	2013	Branch	Fish Survey
Prairie River	2013	St. Joseph	Fish Survey
Sand Creek	2013	Berrien	Fish Survey

3.2 Lakes

3.2.1 *LAKE MONITORING*

From 2001-2010, with assistance from the USGS, EGLE monitored 729 public access lakes greater than 25 acres in size as part of the Lake Water Quality Assessment (LWQA) Program. The SJW contained 90 of these lakes (Figure 7). The primary objectives of the LWQA Program were to determine trophic conditions, identify waters of high and low quality, determine changes over time, identify emerging issues, and protect inland lake quality. Data are stored in the USGS National Water Information System (USGS, 2014).

In 2007, 2012, and 2017 the USEPA and its state, tribal, federal, and other partners implemented a survey of the nation's lakes, ponds, and reservoirs. The National Lakes Assessment (NLA) was designed to estimate the percentage of lakes that are in good, fair, or poor condition. The survey examined ecological, water quality, and recreational indicators with the goal of assessing how widespread key stressors (nitrogen, phosphorus, and acidification) are impacting the nation's lakes. Eight lakes in the SJW were surveyed in 2012 and 2017 during the NLA effort (Figure 7). Specific information can be found on the USEPA Web site (USEPA, 2019).

The Cooperative Lakes Monitoring Program (CLMP) is a volunteer monitoring program, which helps citizens monitor indicators of water quality in their lake and to document changes over time. The CLMP has monitored 28 lakes in the SJW since 2015 (Figure 7). Specific data can be found on the Michigan Clean Water Corps (MiCorps) Web site (MiCorps, 2019).

Six lakes (Figure 7) were sampled from 1999-2009 as part of the Michigan State University (MSU) sediment coring project funded through a grant by EGLE. Mercury concentrations were found to peak in the 1950s followed by a decrease until the late 1990s and then increase until the surface portion of the sample (Parsons et al., 2006). Individual lake information can be found on EGLE's Web site (EGLE, 2019b).

The MDNR, Fisheries Division, staff has conducted several fish collections on 46 lakes in the SJW since 2010. These collections are spread throughout the SJW (Figure 7) and are conducted for various purposes including stocking evaluations and population estimates. Completed water body reports and survey-specific information can be requested through MDNR staff (MDNR, 2019b).

A list of lakes sampled by each program is contained in Appendix B. Locations of the lakes sampled in the SJW are presented in Figure 7.

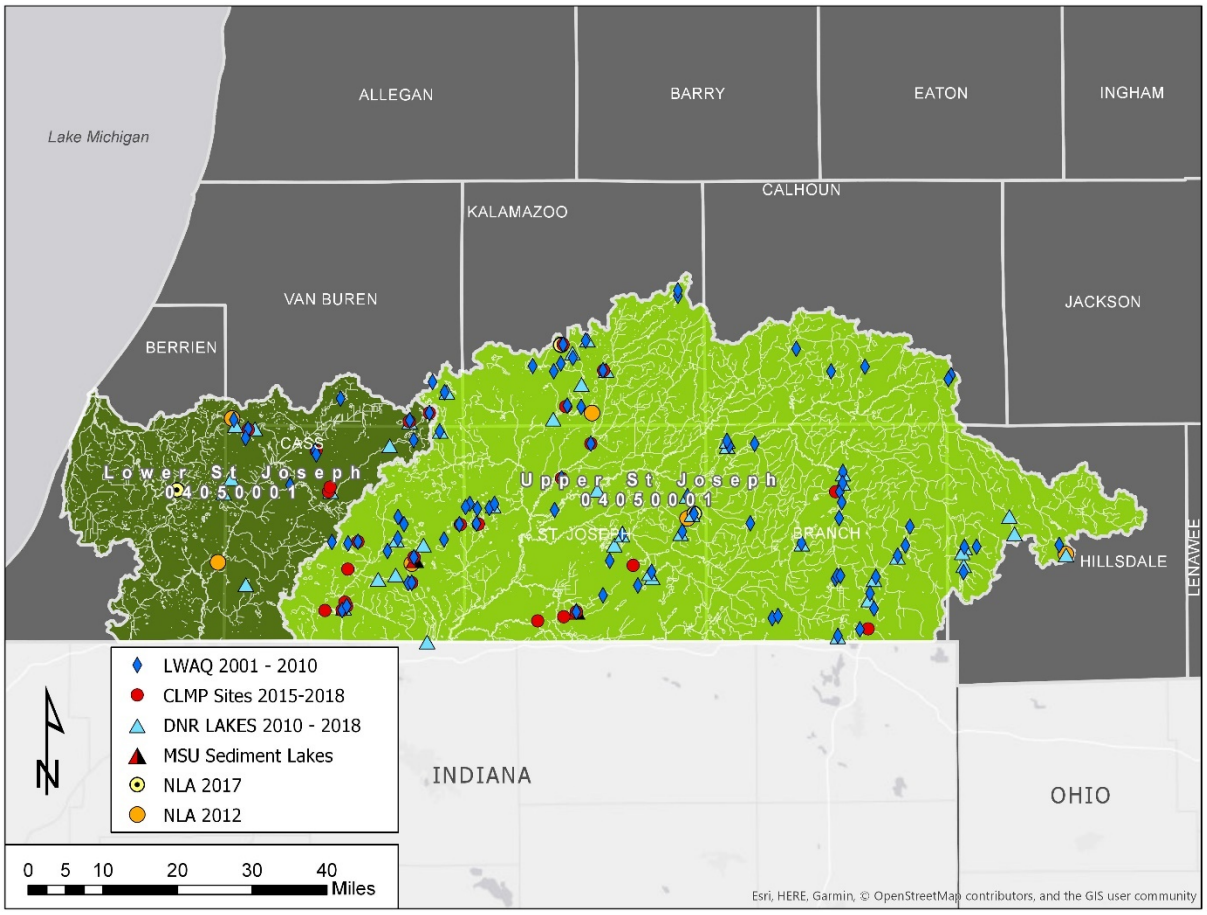

Figure 7. Lake monitoring efforts in the SJW.

3.3 Contaminants

3.3.1 *Water Chemistry Monitoring Program (WCMP)*

EGLE WCMP collects water samples across the state for the purpose of assessing current conditions, determining if WQS are being met, measuring spatial and temporal trends, evaluating program effectiveness, and identifying emerging issues.

The SJW has 4 locations (Table 4) that were sampled as part of the fixed station tributary monitoring from 2000-2013. The fixed station sampling concluded in 2013. The SJW also has several locations that are sampled as part of the probabilistic (random) design project of the WCMP, which is ongoing (Figure 8). Location descriptions and STOrage and RETrieval (STORET) numbers for WCMP locations within the SJW are located in Table 4. Summarized data below is focused on data collected from 2005-2016 (Table 4, Figure 9, Figure 10, and Figure 11). A map showing the locations of the sampled locations is presented in Figure 8.

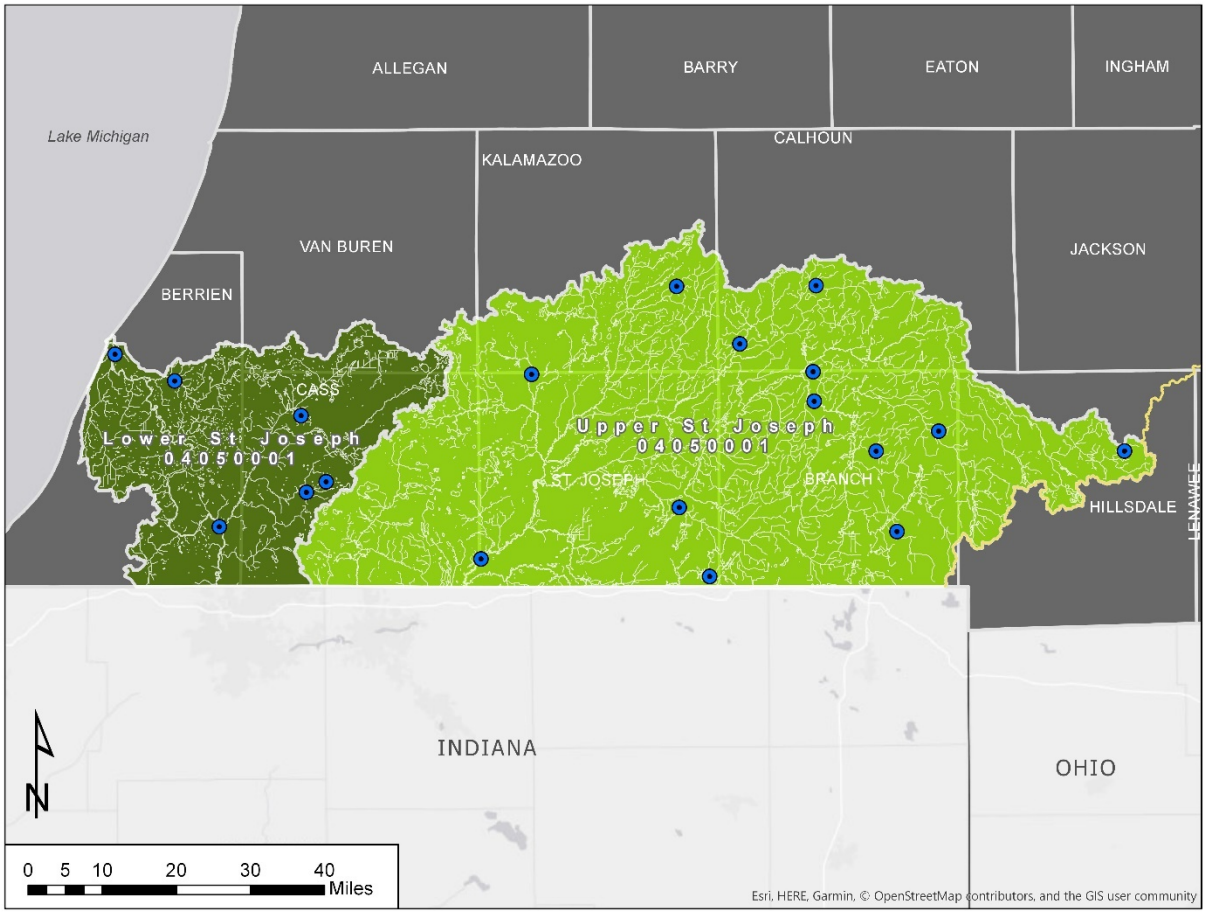

Figure 8. Probabilistic and fixed station sampling locations for the WCMP program in the SJW.

Table 4. WCMP location descriptions, STORET numbers, and types (Probabilistic/Fixed) in the SJW.

STORET	Prob/Fixed	River Name	Latitude	Longitude	Location/Township
110628	Fixed	St. Joseph River (Lower)	42.09642	-86.4712	Benton Twp
110745	Probabilistic	Saint Joseph River	41.84674	-86.2676	Niles Twp
110746	Probabilistic	Pipestone Creek	42.05786	-86.3547	Sodus Twp
120215	Fixed	Coldwater River	42.02848	-85.1066	Union Twp
120228	Probabilistic	Tallahassee Creek	41.83978	-84.9451	Algansee Twp
120229	Probabilistic	South Branch Hog Creek	41.98524	-84.8637	Quincy Twp
120247	Probabilistic	Trib to Cold Creek	41.9563	-84.9858	Coldwater Twp
120248	Probabilistic	Burnett Creek	42.07124	-85.1088	Union Twp
130357	Probabilistic	Pine Creek	42.1115	-85.2518	Athens Twp
130410	Probabilistic	Nottawa Creek	42.1956	-85.1031	Newton Twp
140110	Fixed	Pokagon Creek	41.91194	-86.0592	Lagrange Twp
140189	Probabilistic	Pokagon Creek	41.89671	-86.0977	Jefferson Twp
140198	Probabilistic	Unnamed Tributary to Dowagiac River	42.00768	-86.1081	Silver Creek Twp
300274	Probabilistic	Beebe Creek	41.9565	-84.5011	Adams
390610	Probabilistic	Johnson Drain	42.1945	-85.3752	Climax Twp
750273	Fixed	St. Joseph River (Upper)	41.80003	-85.7569	Mottville Twp
750285	Probabilistic	Prairie River	41.8747	-85.37	Burr Oak Twp
750331	Probabilistic	Fawn River	41.7746	-85.3107	Fawn River
750332	Probabilistic	Flowerfield Creek	42.06745	-85.6582	Flowerfield

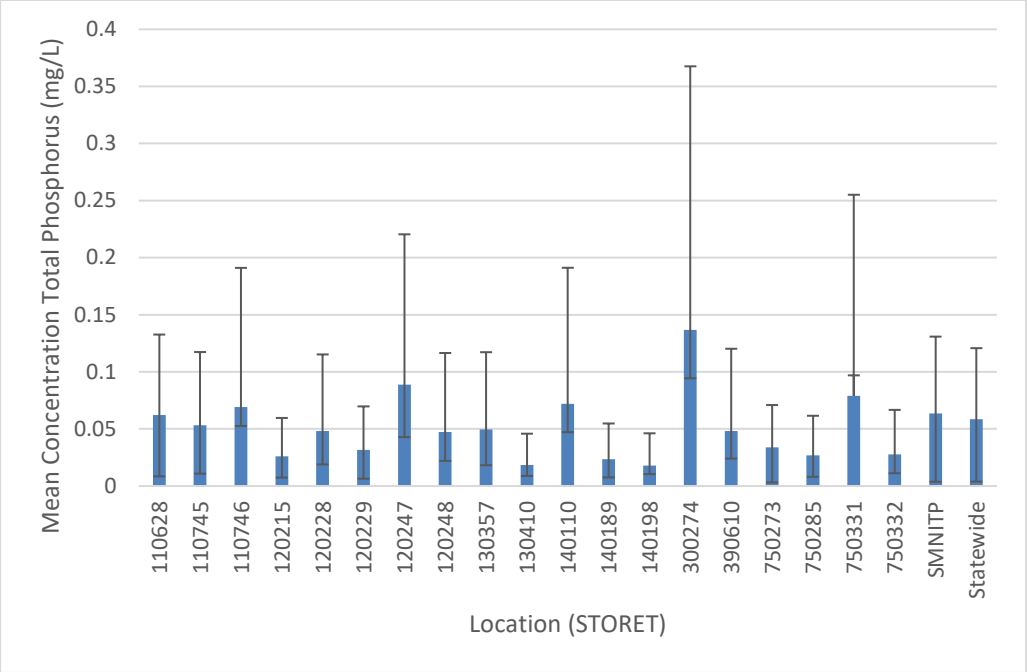

Figure 9. Mean total phosphorus concentrations (2005-2016) statewide, ecoregion, and for individual locations (Table 6) in the SJW. Values include 95 percent confidence interval.

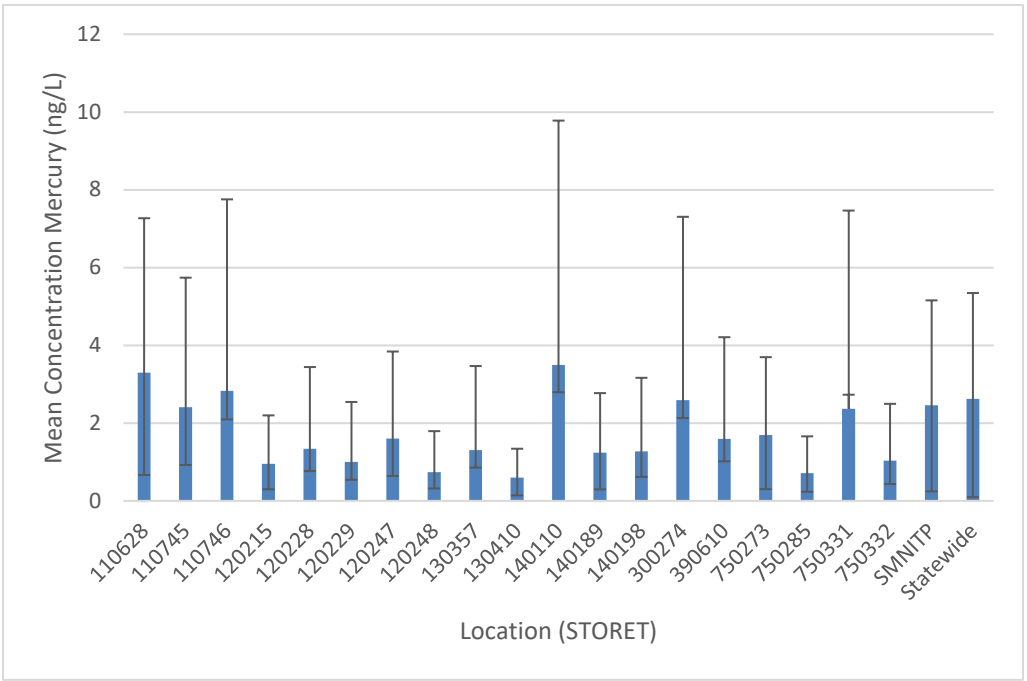

Figure 10. Mean concentration of mercury concentrations (2005-2016) statewide, ecoregion, and for individual locations (Table 6) in the SJW. Values include 95 percent confidence interval.

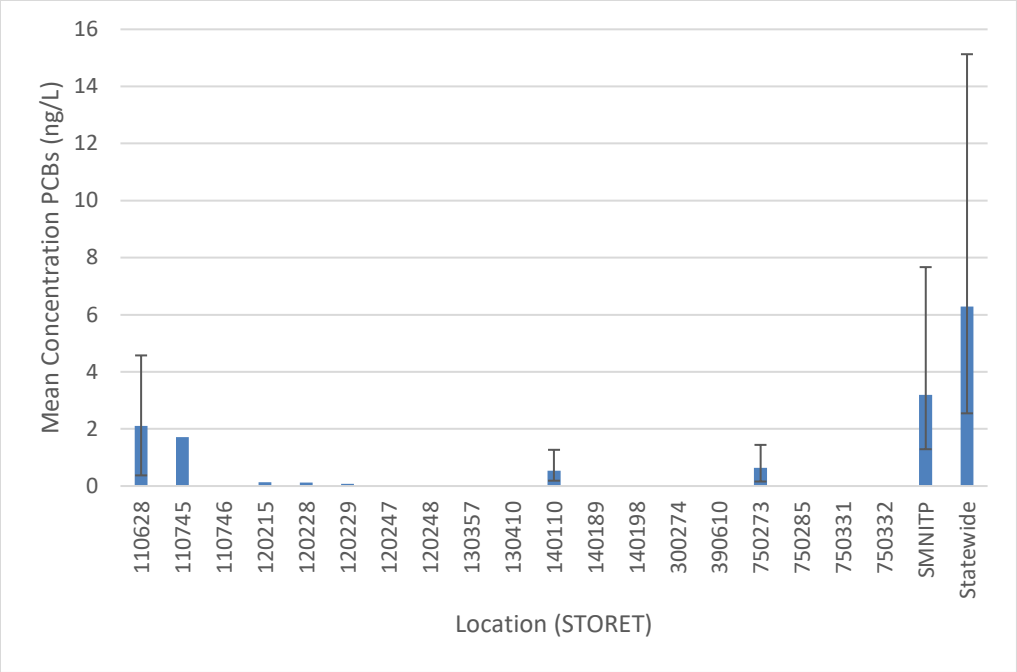

Figure 11. Mean concentration of PCBs (2005-2016) statewide, ecoregion, and for individual locations in the SJW. Values include 95 percent confidence interval.

Mean concentrations of total phosphorus at most sites in the SJW sampled from 2005-2016 are below the statewide average, although averages at some (110628, 110746, 120228, 140110, 300274, and 750331) are higher than the statewide average as well as the ecoregion average (Figure 9, Table 4).

Mean mercury values from 2005-2016 at the majority of WCMP sites in the SJW are lower than the statewide average. Six sites (Figure 10) are near or exceed the statewide average.

PCB concentration analysis was limited across the SJW sites (2005-2016) to only 3 locations (10628, 140110, and 750273) that had more than 1 sample collected (Figure 11, Table 4). Concentrations at all sites were below the statewide average.

Links to additional data and reports can be found on EGLE's Web site (EGLE, 2019c).

3.3.2 *Wildlife Contaminants*

EGLE monitors the productivity and contaminant levels in fish-eating (piscivorous) wildlife as an indicator of the health of the Great Lakes ecosystem. Herring gull eggs and bald eagle plasma/feathers are analyzed for persistent bioaccumulative contaminants of concern such as mercury, PCBs, and chlorinated pesticides. Reports can be found on EGLE's Web site (MDEQ, 2019c).

No monitored herring gull colonies or eagle nests are in the SJW. In 2017 it was noted that there were only 7 active eagle territories in the SJW, none of which have been monitored for contaminants.

3.3.3 *Fish Contaminant Monitoring Program (FCMP)*

Fish have been collected in the SJW as part of EGLE's FCMP. The FCMP program has been in existence since 1980 and allows for assessment of chemical contamination in fish from the state's surface waters.

Thirty-six locations have been sampled within the SJW as part of the FCMP program (Figure 12). Since 1986, 14 species of fish have been analyzed for several contaminants, including organo-pesticides, PCBs, mercury, and dioxins. More information and links to reports regarding the FCMP Program can be found on EGLE's Web site (EGLE, 2019a). Additionally, specific water body information can be found on the MDHHS's Web site (MDHHS, 2018).

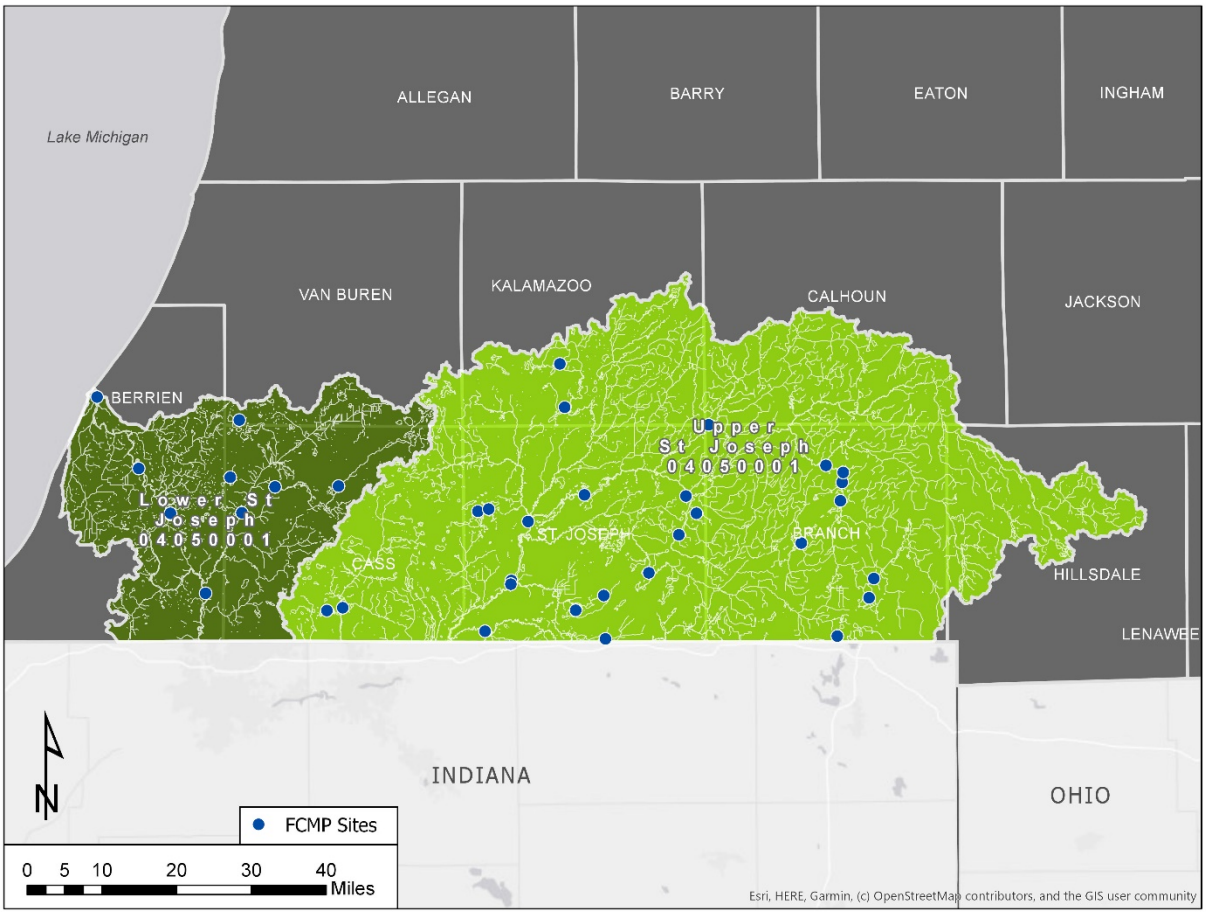

Figure 12. FCMP locations within the SJW.

When northern pike fillet data from the SJW are compared to average statewide concentrations, mercury levels (Figure 13) are slightly higher in the SJW than those in the lower peninsula of Michigan, but lower than concentrations found in the upper peninsula. Average PCB concentrations (Figure 14) found in carp from the SJW are lower than concentrations found in the lower peninsula of Michigan. Carp PCB data is not available from the upper peninsula.

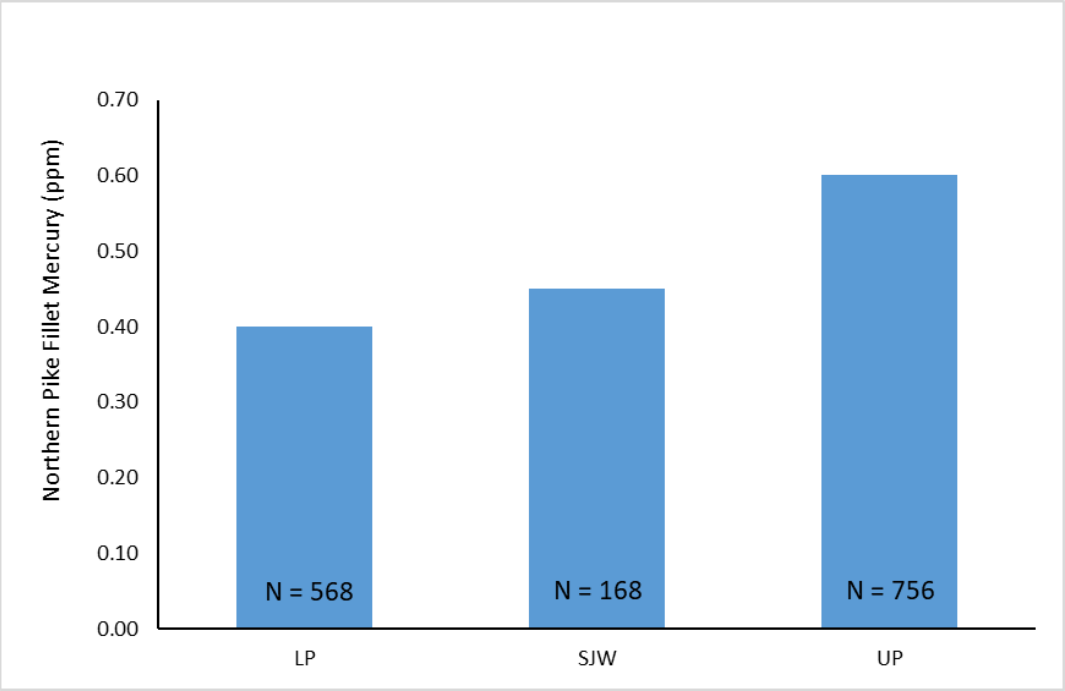

Figure 13. Mercury levels in Northern Pike in the SJW compared to levels found in the Lower Peninsula (LP) of Michigan and the Upper Peninsula (UP) of Michigan.

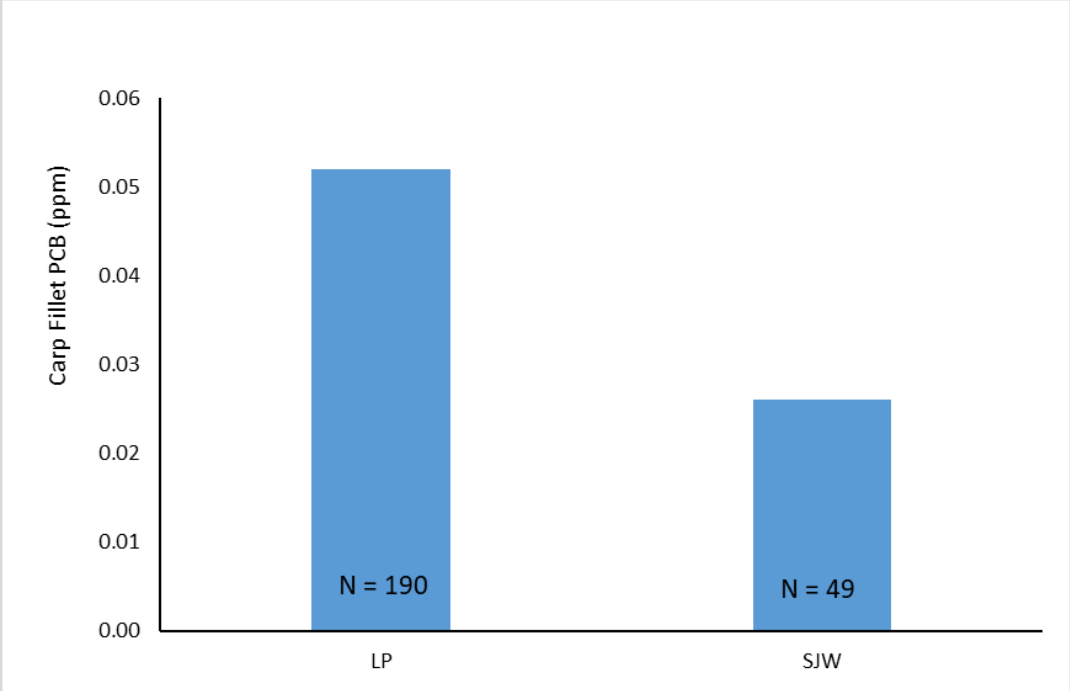

Figure 14. PCB levels in Common Carp in the SJW compared to levels found in the Lower Peninsula (LP) of Michigan and the Upper Peninsula (UP) of Michigan.

3.4 Freshwater Mussels

Native freshwater mussels (Unionidae) are an important component of aquatic ecosystems. They are long-lived (up to 50 years), generally sessile, filter feeders, and sensitive to contaminants. All of these traits make them a valuable indicator of water quality. Loss of species and historical community composition can be documented based on empty shells which can remain in a system for many years after death (Grabarkiewicz & Davis, 2008).

The Michigan Natural Features Inventory (MNFI) conducts various mussel surveys across Michigan and maintains a database of mussel species distribution based on surveys conducted and historical records. Species of concern found in the SJW and their current Michigan conservation status are presented in Table 5.

Table 5. Species and conservation status of native freshwater mussels (Unionidae) found in the SJW.

Common Name	Scientific Name	MI Conservation Status	Most Recent Observation
Elktoe	*Alasmidonta marginata*	Special Concern	**2016**
Slippershell	*Alasmidonta viridis*	Threatened	**2015**
Purple wartyback	*Cyclonaias tuberculata*	Threatened	**2006**
Snuffbox	*Epioblasma triquetra*	Endangered	**2001**
Eastern pondmussel	*Ligumia nasuta*	Endangered	--
Black sandshell	*Ligumia recta*	Endangered	**1930**
Threehorn wartyback	*Obliquaria reflexa*	Endangered	--
Round pigtoe	*Pleurobema sintoxia*	Special Concern	**2016**
Kidney shell	*Ptychobranchus fasciolaris*	Special Concern	**1927**
Lilliput	*Toxolasma parvum*	Endangered	**2009**
Deertoe	*Truncilla truncata*	Special Concern	**2004**
Rainbow	*Villosa iris*	Special Concern	**2016**
Paper pondshell	*Utterbackia imbecillis*	Special Concern	**2016**
Ellipse	*Venustaconcha ellipsiformis*	Special Concern	**2016**

Additional information and specifics regarding the surveys conducted by MNFI in the SJW can be found in several recent reports (Badra, 2010), (Badra, 2005), (Badra & Goforth, 2002).

4 SUMMARY

Based on recent data, overall water quality in the St. Joseph River watershed appears to be rather good. The 2015-2016 benthic invertebrate component of the watershed survey found all but 1 site (Table 2) supported the other indigenous aquatic life and wildlife designated use component of R 323.1100(1)(e) of the Michigan WQS using Procedure 51. For benthic invertebrates, nearly half (12 of the 30) sites scored Excellent; 12 scored in the upper half of the Acceptable range; and only 3 were in the lower Acceptable range. One site was scored as Poor. In addition, stream habitat was Excellent at 10 locations, 16 scored as Good, and only 4 fell in the Marginal scoring range. Eleven trend sites (Table 2) were resampled using Procedure 51 during 2015-2016, all but 2 locations scoring within 3 points of the previous sampling effort (2010-2011), which is within typical margins of variation.

Sites that scored poorly were typically noted as being directly adjacent to agricultural land or serving as a maintained drain. These sites typically have issues with excess nutrient expression, lack of tree canopy (higher temps/excessive sunlight), channelization, and sedimentation from runoff. These issues would be expected in a watershed where well over half of the land use is agricultural (Figure 3). Phosphorus levels were also found to be over the statewide average at several locations around the SJW (Figure 9).

FCMP sampling shows mercury levels to be slightly higher than the lower peninsula average, but lower than the upper peninsula average. Fish levels of PCBs are shown to be lower than the comparable average found in the lower peninsula.

Freshwater mussels of special concern are commonly found in the SJW. Future monitoring efforts as well as proposed projects within the watershed should pay particular attention to the location of these species.

5 FUTURE MONITORING NEEDS/RECOMMENDATIONS

- Status and trend monitoring will continue in the next round of sampling in 2020 and 2021.
- Requests for targeted monitoring will be solicited prior to the 2020 and 2021 watershed surveys. The lead biologist should consult with NPDES; NPS; FCMP; Area of Concern; and MDNR, Fisheries Division, staff to identify possible monitoring needs. Specifically, the 3 locations submitted for sampling during 2016 by the MDNR (5L, 6L, 7L) should be discussed for revisiting during 2021.
- Follow-up monitoring of any completed NPS projects should be considered and subsequent success stories should be completed.
- Because the SJW is considered a particularly vulnerable watershed, AIS monitoring should continue with the purpose of tracking currently established AIS and identifying undocumented species.
- Due to the significant number of threatened and endangered species present in the SJW, additional mussel surveys should be considered during future sampling events.

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Appendix A

1 MACROINVERTEBRATE DATA

TAXA	Fawn River Drain Featherstone Rd. 9/1/2015 1U	South Branch Hog Creek D/S Girard Road 7/16/2015 2U	Sand Creek Sterling Rd. 7/15/2015 3U	Fawn River Dickinson Rd. 9/1/2015 4U
PLATYHELMINTHES (flatworms)				
Turbellaria	68			
ANNELIDA (segmented worms)				
Hirudinea (leeches)	4			
Oligochaeta (worms)	30	1	1	5
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	10	68	42	4
Decapoda (crayfish)	1	2	1	
Isopoda (sowbugs)	23			
Arachnoidea				
Hydracarina	18	2	11	15
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae			3	
Baetidae	1	6	4	130
Caenidae			2	1
Ephemeridae		2		1
Heptageniidae		17	2	11
Isonychiidae				1
Siphlonuridae		8	11	15
Tricorythidae			7	32
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	5	
Gomphidae			2	1
Zygoptera (damselflies)				
Calopterygidae	1		2	
Coenagrionidae	1			7
Plecoptera (stoneflies)				
Perlidae		15	1	
Pteronarcyidae		1		
Hemiptera (true bugs)				
Belostomatidae	1			
Corixidae	1		3	1
Gerridae	1	1		1
Mesoveliidae	1		1	
Notonectidae	1			
Saldidae				2
Veliidae	1	1	1	1
Megaloptera				
Sialidae (alder flies)		1		
Trichoptera (caddisflies)				
Brachycentridae		1	10	5
Helicopsychidae		2		
Hydropsychidae	8	89	55	5
Hydroptilidae	3			
Lepidostomatidae		1		
Leptoceridae			29	4
Limnephilidae			1	
Philopotamidae				1
Phryganeidae		1		
Polycentropodidae			1	
Uenoidae				1
Lepidoptera (moths)				
Pyralidae				1
Coleoptera (beetles)				
Dytiscidae (total)	1			
Gyrinidae (adults)				1
Haliplidae (adults)	1			
Elmidae		34	5	2
Psephenidae (larvae)		5		
Diptera (flies)				
Ceratopogonidae	4	1		1
Chironomidae	78	21	33	18
Culicidae		1		
Dixidae	1		1	1
Simuliidae	64	5	43	88
Tabanidae	1	3		
Tipulidae		1		
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		1	1	9
Lymnaeidae	1		1	
Physidae		5	1	3
Planorbidae	2			1
Pleuroceridae				4
Pelecypoda (bivalves)				
Corbiculidae				1
Pisidiidae	8	1	2	1
TOTAL INDIVIDUALS	336	298	282	375

METRIC	Fawn River Drain Featherstone Rd. 9/1/2015 1U Value	Score	South Branch Hog Creek D/S Girard Road 7/16/2015 2U Value	Score	Sand Creek Sterling Rd. 7/15/2015 3U Value	Score	Fawn River Dickinson Rd. 9/1/2015 4U Value	Score
TOTAL NUMBER OF TAXA	29	1	30	1	30	1	34	1
NUMBER OF MAYFLY TAXA	1	0	4	1	6	1	7	1
NUMBER OF CADDISFLY TAXA	2	0	5	1	5	1	5	1
NUMBER OF STONEFLY TAXA	0	-1	2	1	1	1	0	-1
PERCENT MAYFLY COMPOSITION	0.30	-1	11.07	0	10.28	0	50.93	1
PERCENT CADDISFLY COMPOSITION	3.27	-1	31.54	1	34.04	1	4.27	0
PERCENT DOMINANT TAXON	23.21	0	29.87	0	19.50	1	34.67	0
PERCENT ISOPOD, SNAIL, LEECH	8.93	0	2.01	1	1.06	1	4.53	0
PERCENT SURFACE AIR BREATHERS	2.38	1	1.01	1	1.77	1	1.60	1
TOTAL SCORE		-1		7		8		4

TAXA	Swan Creek Burr Oak Rd 7/16/2015 5U	Prairie River Main St. 9/2/2015 6U	Sauk River Race St. 7/16/2015 7U	Bear Creek Longnecker Road 8/6/2015 8U
PLATYHELMINTHES (flatworms)				
Turbellaria		4		
ANNELIDA (segmented worms)				
Hirudinea (leeches)				1
Oligochaeta (worms)	7	3	52	7
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	14	5	35	71
Decapoda (crayfish)	3	1		4
Isopoda (sowbugs)			2	
Arachnoidea				
Hydracarina	7	26		12
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae	1			
Baetidae	24	126	35	11
Caenidae	8		1	14
Ephemeridae	1		1	1
Heptageniidae	7	1	22	24
Isonychiidae		1		
Siphlonuridae	4		4	
Tricorythidae	12	1		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	2		1	
Gomphidae	1	1		1
Zygoptera (damselflies)				
Coenagrionidae		3		
Plecoptera (stoneflies)				
Perlidae	1		7	3
Hemiptera (true bugs)				
Corixidae	1	2		1
Gerridae		1		1
Mesoveliidae				1
Notonectidae		1		
Pleidae				11
Veliidae				12
Megaloptera				
Corydalidae (dobson flies)	1			
Sialidae (alder flies)				1
Trichoptera (caddisflies)				
Brachycentridae	13	1		12
Helicopsychidae			1	5
Hydropsychidae	30	11	87	17
Hydroptilidae	2			
Lepidostomatidae			1	
Leptoceridae	19	40	1	2
Limnephilidae			2	2
Philopotamidae			15	
Phryganeidae	1			
Polycentropodidae	3	9		
Uenoidae	1		2	
Coleoptera (beetles)				
Gyrinidae (adults)		1		
Haliplidae (adults)		1		
Elmidae	15	1	26	11
Diptera (flies)				
Ceratopogonidae			1	
Chironomidae	39	33	34	45
Culicidae				1
Simuliidae	43	109	8	1
Stratiomyidae	1			
Tipulidae	1			2
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1	2		1
Bithyniidae	1			
Lymnaeidae			3	3
Physidae	7	1	1	4
Planorbidae	1	2		
Viviparidae		1		
Corbiculidae	1	1		
Pisidiidae	5	1	1	2

METRIC	Swan Creek 7/16/2015 5U Value	Score	Prairie River 9/2/2015 6U Value	Score	Sauk River 7/16/2015 7U Value	Score	Bear Creek 8/6/2015 8U Value	Score
TOTAL NUMBER OF TAXA	35	1	30	1	25	1	32	1
NUMBER OF MAYFLY TAXA	7	1	4	1	5	1	4	1
NUMBER OF CADDISFLY TAXA	7	1	4	0	7	1	5	1
NUMBER OF STONEFLY TAXA	1	1	0	-1	1	1	1	1
PERCENT MAYFLY COMPOSITION	20.43	1	32.66	1	18.31	1	16.56	0
PERCENT CADDISFLY COMPOSITION	24.73	0	15.44	0	31.69	1	12.58	0
PERCENT DOMINANT TAXON	15.41	1	31.90	0	25.29	0	23.51	0
PERCENT ISOPOD, SNAIL, LEECH	3.58	1	1.52	1	1.74	1	2.98	1
PERCENT SURFACE AIR BREATHERS	0.72	1	1.52	1	0.00	1	8.94	0
TOTAL SCORE		8		4		8		5
MACROINVERTEBRATE COMMUNITY RATING		Excellent		Acceptable		Excellent		Excellent

TAXA	Beebe Creek Dewey Rd. 7/15/2015 9U	Fawn River Haybridge Rd. 9/1/2015 10U	Unnamed Trib to Prairie River M66 9/2/2015 11U	Prairie River Middle Colon Rd. 9/2/2015 12U
PLATYHELMINTHES (flatworms)				
Turbellaria			1	2
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1		11	
Oligochaeta (worms)	1	2	21	3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	105	5		25
Decapoda (crayfish)	1			
Isopoda (sowbugs)			1	
Arachnoidea				
Hydracarina		21	38	15
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				1
Baetidae	2	147	76	73
Caenidae		6		
Heptageniidae		1		
Siphlonuridae	4	1		
Tricorythidae		23		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	1	1	1
Gomphidae		1		1
Zygoptera (damselflies)				
Coenagrionidae	1	25	35	1
Plecoptera (stoneflies)				
Perlidae	2			
Hemiptera (true bugs)				
Corixidae		5	4	
Gerridae	1	1		
Mesoveliidae			1	
Nepidae		1		
Pleidae		1		
Trichoptera (caddisflies)				
Brachycentridae		3		1
Hydropsychidae	47	1	1	27
Hydroptilidae			2	4
Leptoceridae		17		16
Limnephilidae	1			
Phryganeidae			1	
Polycentropodidae		2		3
Coleoptera (beetles)				
Dytiscidae (total)	1		1	
Haliplidae (adults)			4	
Elmidae	4	3		1
Gyrinidae (larvae)		1		1
Diptera (flies)				
Ceratopogonidae	1		6	
Chironomidae	34	29	68	21
Dixidae		4	1	
Simuliidae	142	45	7	95
Tipulidae				1
Gastropoda (snails)				
Ancylidae (limpets)	1	12		1
Hydrobiidae			2	
Physidae	10	11	7	4
Pleuroceridae		1		
Pelecypoda (bivalves)				
Corbiculidae				1
Pisidiidae	1		1	2
TOTAL INDIVIDUALS	363	376	302	315

METRIC	Dewey Rd. 7/15/2015 9U Value	Score	Haybridge Rd. 9/1/2015 10U Value	Score	M66 9/2/2015 11U Value	Score	Middle Colon Rd. 9/2/2015 12U Value	Score
TOTAL NUMBER OF TAXA	22	0	31	1	25	1	26	1
NUMBER OF MAYFLY TAXA	2	0	5	1	1	-1	2	0
NUMBER OF CADDISFLY TAXA	2	0	4	0	3	0	5	1
NUMBER OF STONEFLY TAXA	1	1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	1.65	-1	47.34	1	25.17	1	23.49	1
PERCENT CADDISFLY COMPOSITION	13.22	0	6.12	0	1.32	-1	16.19	0
PERCENT DOMINANT TAXON	39.12	-1	39.10	-1	25.17	0	30.16	0
PERCENT ISOPOD, SNAIL, LEECH	3.86	1	6.91	0	9.27	0	1.90	1
PERCENT SURFACE AIR BREATHERS	0.55	1	2.93	1	4.97	1	0.95	1
TOTAL SCORE		1		2		0		4
MACROINVERTEBRATE COMMUNITY RATING		Acceptable		Acceptable		Acceptable		Acceptable

TAXA	Sand Creek Bean Rd. 7/15/2015 13U	Spring Creek Muskrat Lake Road 8/7/2015 14U	Unnamed Trib to Prairie River Prairie River Rd. 8/6/2015 15U	Spring Creek Johnson Road 9/3/2015 16U
PLATYHELMINTHES (flatworms)				
Turbellaria		26		2
ANNELIDA (segmented worms)				
Hirudinea (leeches)	3	1	7	
Oligochaeta (worms)	5	2	13	3
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	50	21	2	190
Decapoda (crayfish)	2	1		1
Isopoda (sowbugs)	4	59		
Arachnoidea				
Hydracarina		52	8	10
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae				1
Baetidae	14	50	19	28
Caenidae	21			4
Heptageniidae	7	1		4
Isonychiidae	1			
Siphlonuridae	8	10		
Tricorythidae	2			1
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	5	1	1	1
Gomphidae	1			1
Zygoptera (damselflies)				
Calopterygidae	11	16		35
Coenagrionidae	2	1		1
Plecoptera (stoneflies)				
Perlidae	1			
Hemiptera (true bugs)				
Corixidae	11	1	3	2
Gerridae		1		1
Mesoveliidae		2		1
Pleidae				2
Veliidae	1			
Megaloptera				
Sialidae (alder flies)		1		
Neuroptera (spongilla flies)				
Sisyridae	1			
Trichoptera (caddisflies)				
Brachycentridae	3	3		16
Hydropsychidae	26	22	2	9
Hydroptilidae		4		3
Leptoceridae	12	1		5
Limnephilidae		1	1	
Molannidae	1			
Philopotamidae	2			
Polycentropodidae	5			2
Lepidoptera (moths)				
Pyralidae	1			
Coleoptera (beetles)				
Gyrinidae (adults)				3
Hydrophilidae (total)			1	
Elmidae	3		1	1
Gyrinidae (larvae)				1
Diptera (flies)				
Ceratopogonidae	1		1	
Chironomidae	27	44	160	46
Dixidae	3			1
Simuliidae	67	33	15	
Tabanidae			1	
Tipulidae	1			
Gastropoda (snails)				
Bithyniidae	1			
Lymnaeidae			1	
Planorbidae			2	1
Pelecypoda (bivalves)				
Pisidiidae	1	1	1	1
Unionidae (mussels)	1			
TOTAL INDIVIDUALS	305	356	262	378

METRIC	Sand Creek 7/15/2015 Value	Score	Spring Creek 8/7/2015 Value	Score	ıamed Trib to Prairie R 8/6/2015 Value	Score	Spring Creek 9/3/2015 Value	Score
TOTAL NUMBER OF TAXA	35	1	26	1	20	1	30	1
NUMBER OF MAYFLY TAXA	6	1	3	0	1	0	5	1
NUMBER OF CADDISFLY TAXA	6	1	6	1	2	0	5	1
NUMBER OF STONEFLY TAXA	1	1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	17.38	0	17.13	0	7.25	0	10.05	0
PERCENT CADDISFLY COMPOSITION	16.07	0	8.99	0	1.15	-1	9.26	0
PERCENT DOMINANT TAXON	21.97	0	16.57	1	61.07	-1	50.26	-1
PERCENT ISOPOD, SNAIL, LEECH	2.62	1	16.85	-1	11.07	-1	0.53	1
PERCENT SURFACE AIR BREATHERS	3.93	1	1.12	1	3.05	1	2.38	1
TOTAL SCORE		6		2		-2		3
MACROINVERTEBRATE COMMUNITY RATING		Excellent		Acceptable		Acceptable		Acceptable

TAXA	Unnamed Tributary to Portage River 36th Avenue 9/3/2015 17U	Rocky River Memory Isle Park 9/2/2015 18U	Blackwell Drain Girard Road 9/15/2015 19U	Nottawa Creek Correll Road 9/15/2015 20U
PLATYHELMINTHES (flatworms)				
Turbellaria	2	1	2	1
ANNELIDA (segmented worms)				
Hirudinea (leeches)	1	1	1	
Oligochaeta (worms)	3	2	22	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	7	41		39
Decapoda (crayfish)		1		2
Isopoda (sowbugs)		4	5	12
Arachnoidea				
Hydracarina	3	7	14	33
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae		2		
Baetidae	70	156	3	32
Caenidae		3		5
Ephemeridae				1
Heptageniidae	3	13		10
Siphlonuridae	1			1
Tricorythidae	16	1		3
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1		2	
Gomphidae		1		
Zygoptera (damselflies)				
Calopterygidae	33		45	1
Coenagrionidae	1	3	5	42
Plecoptera (stoneflies)				
Perlidae		1		
Hemiptera (true bugs)				
Corixidae	1	2		4
Gerridae	4		1	1
Mesoveliidae	2	1	1	
Notonectidae				1
Pleidae				1
Veliidae	1			
Megaloptera				
Corydalidae (dobson flies)		1		
Sialidae (alder flies)				4
Trichoptera (caddisflies)				
Brachycentridae		2		9
Helicopsychidae	6	6		3
Hydropsychidae	17	7	125	10
Hydroptilidae	4			3
Leptoceridae	31	6	3	15
Limnephilidae		1	4	
Molannidae	1			1
Philopotamidae	1			
Phryganeidae	1			
Polycentropodidae	4		1	3
Uenoidae		1		1
Lepidoptera (moths)				
Pyralidae				3
Coleoptera (beetles)				
Dytiscidae (total)	1			
Gyrinidae (adults)				1
Haliplidae (adults)	1	1		1
Elmidae	1	3	7	2
Gyrinidae (larvae)				1
Diptera (flies)				
Ceratopogonidae			2	
Chironomidae	33	53	75	47
Culicidae	3			
Simuliidae	95	11	3	8
Tabanidae	2		1	1
Tipulidae			8	
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	1	2	1	5
Hydrobiidae		1		
Physidae	6	5	1	2
Planorbidae	2	1	3	
Pleuroceridae				3
Viviparidae	1			8
Pelecypoda (bivalves)				
Corbiculidae		1		1
Pisidiidae		2	3	6
TOTAL INDIVIDUALS	360	344	338	328

METRIC	Unnamed Tributary to Portage River 36th Avenue 9/3/2015 17U Value	Score	Rocky River Memory Isle Park 9/2/2015 18U Value	Score	Blackwell Drain Girard Road 9/15/2015 19U Value	Score	Nottawa Creek Correll Road 9/15/2015 20U Value	Score
TOTAL NUMBER OF TAXA	35	1	34	1	25	1	40	1
NUMBER OF MAYFLY TAXA	4	1	5	1	1	0	6	1
NUMBER OF CADDISFLY TAXA	8	1	6	1	4	0	8	1
NUMBER OF STONEFLY TAXA	0	-1	1	1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	25.00	1	50.87	1	0.89	-1	15.85	0
PERCENT CADDISFLY COMPOSITION	18.06	0	6.69	0	39.35	1	13.72	0
PERCENT DOMINANT TAXON	26.39	0	45.35	-1	36.98	0	14.33	1
PERCENT ISOPOD, SNAIL, LEECH	3.06	1	4.07	0	3.25	1	9.15	0
PERCENT SURFACE AIR BREATHERS	3.61	1	1.16	1	0.59	1	2.74	1
TOTAL SCORE		5		5		2		4
MACROINVERTEBRATE COMMUNITY RATING		Excellent		Excellent		Acceptable		Acceptable

TAXA	Hog Creek Girard Road 9/15/2015 21U	St. Joseph River Stowell Road 9/15/2015 22U	St. Joseph River M-66 at 28140 Talon Drive 9/25/2015 23U	Pipestone Creek Wildwood Dr 9/22/2016 1L
PLATYHELMINTHES (flatworms)				
Turbellaria	1			
ANNELIDA (segmented worms)				
Oligochaeta (worms)	9	1	2	4
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	68	3	22	4
Decapoda (crayfish)	1			2
Isopoda (sowbugs)	1		4	
Arachnoidea				
Hydracarina		3	4	15
Insecta				
Ephemeroptera (mayflies)				
Baetiscidae		1	1	
Baetidae	4	58	37	38
Caenidae	5	2		
Ephemeridae		2		
Heptageniidae	16	14	13	4
Isonychiidae		5	1	
Potamanthidae		3	8	
Siphlonuridae	1	1		
Tricorythidae	1	20	17	
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1			3
Gomphidae	1	3	1	
Zygoptera (damselflies)				
Calopterygidae	11	1	12	4
Coenagrionidae	1	7	40	
Plecoptera (stoneflies)				
Perlidae	1	1		
Pteronarcyidae	1	1	1	
Hemiptera (true bugs)				
Belostomatidae		1		
Corixidae	13		9	
Gerridae		1	3	1
Mesoveliidae	1	1		
Megaloptera				
Corydalidae (dobson flies)	1			
Trichoptera (caddisflies)				
Brachycentridae	1	6	1	
Glossosomatidae		1		
Helicopsychidae	2			
Hydropsychidae	15	17	33	82
Hydroptilidae			1	
Leptoceridae		38	30	
Limnephilidae	1		1	
Philopotamidae		2	3	
Polycentropodidae	1	3	4	
Uenoidae	1		1	
Lepidoptera (moths)				
Pyralidae		1	1	
Coleoptera (beetles)				
Dytiscidae (total)		1		
Gyrinidae (adults)		1	1	
Elmidae	12	10	7	11
Psephenidae (larvae)	1		1	
Diptera (flies)				
Chironomidae	123	45	34	32
Culicidae		1		
Dixidae		1		
Simuliidae	4	30	13	52
Tabanidae	2			
Tipulidae				1
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)	12			1
Lymnaeidae	2			
Physidae				1
Pleuroceridae			4	
Viviparidae	1			
Pelecypoda (bivalves)				
Corbiculidae	1	1	1	
Dreissenidae		7	1	
Pisidiidae	13		1	1
Unionidae (mussels)		1	1	
TOTAL INDIVIDUALS	330	295	314	256

METRIC	Hog Creek Girard Road 9/15/2015 21U Value	Score	St. Joseph River Stowell Road 9/15/2015 22U Value	Score	St. Joseph River -66 at 28140 Talon Dri 9/25/2015 23U Value	Score	Pipestone Creek Wildwood Dr 9/22/2016 1L Value	Score
TOTAL NUMBER OF TAXA	35	1	37	1	35	1	17	0
NUMBER OF MAYFLY TAXA	5	1	9	1	6	1	2	0
NUMBER OF CADDISFLY TAXA	6	1	6	1	8	1	1	-1
NUMBER OF STONEFLY TAXA	2	1	2	1	1	1	0	-1
PERCENT MAYFLY COMPOSITION	8.18	0	35.93	1	24.52	1	16.41	0
PERCENT CADDISFLY COMPOSITION	6.36	0	22.71	0	23.57	0	32.03	1
PERCENT DOMINANT TAXON	37.27	-1	19.66	1	12.74	1	32.03	0
PERCENT ISOPOD, SNAIL, LEECH	4.85	0	0.00	1	2.55	1	0.78	1
PERCENT SURFACE AIR BREATHERS	4.24	1	2.03	1	4.14	1	0.39	1
TOTAL SCORE		4		8		8		1
MACROINVERTEBRATE COMMUNITY RATING		Acceptable		Excellent		Excellent		Acceptable

TAXA	Brandywine Creek US-12 8/29/2016 2L	Dowagiac River Atwood Road 9/23/2016 3L	Hickory Creek Upstream Snow Road 9/22/2016 4L	Old Bitty Creek Red Bud Tr 8/29/2016 5L
PLATYHELMINTHES (flatworms)				
Turbellaria			3	4
ANNELIDA (segmented worms)				
Hirudinea (leeches)		1	3	
Oligochaeta (worms)	1	14	17	1
ARTHROPODA				
Crustacea				
Amphipoda (scuds)	52	21	34	87
Decapoda (crayfish)		1		
Isopoda (sowbugs)	1		115	58
Arachnoidea				
Hydracarina	5	27	5	6
Insecta				
Ephemeroptera (mayflies)				
Baetidae	64	18		15
Caenidae			4	
Heptageniidae		8		
Odonata				
Anisoptera (dragonflies)				
Aeshnidae	1	2		
Zygoptera (damselflies)				
Calopterygidae	1	26	3	
Coenagrionidae	6	5	15	
Hemiptera (true bugs)				
Belostomatidae	1	3	2	
Corixidae	1	29	90	
Gerridae	1	1		8
Mesoveliidae	5	4		6
Nepidae	1	3	1	
Notonectidae	1			1
Pleidae	2		1	
Megaloptera				
Corydalidae (dobson flies)		1		
Sialidae (alder flies)				1
Trichoptera (caddisflies)				
Brachycentridae	11	2		
Hydropsychidae	30	22	1	31
Hydroptilidae			8	1
Leptoceridae	3	3	1	
Limnephilidae	1	3		9
Phryganeidae	1	1	2	1
Coleoptera (beetles)				
Dytiscidae (total)	1	2		
Haliplidae (adults)	1	2	2	
Elmidae	1	12	2	1
Diptera (flies)				
Chironomidae	37	37	24	4
Culicidae			3	
Ptychopteridae	1			
Simuliidae	39	12		34
Stratiomyidae		5		2
Tabanidae			1	1
Tipulidae				3
MOLLUSCA				
Gastropoda (snails)				
Ancylidae (limpets)		4	1	
Hydrobiidae				1
Physidae	2		64	1
Planorbidae	2		9	
Pelecypoda (bivalves)				
Pisidiidae	1	3	1	
TOTAL INDIVIDUALS	274	272	412	276

METRIC	Brandywine Creek US-12 8/29/2016 2L Value	Score	Dowagiac River Atwood Road 9/23/2016 3L Value	Score	Hickory Creek Upstream Snow Road 9/22/2016 4L Value	Score	Old Bitty Creek Red Bud Tr 8/29/2016 5L Value	Score
TOTAL NUMBER OF TAXA	29	1	29	1	26	1	22	0
NUMBER OF MAYFLY TAXA	1	-1	2	0	1	-1	1	0
NUMBER OF CADDISFLY TAXA	5	1	5	1	4	0	4	0
NUMBER OF STONEFLY TAXA	0	-1	0	-1	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	23.36	1	9.56	0	0.97	-1	5.43	0
PERCENT CADDISFLY COMPOSITION	16.79	0	11.40	0	2.91	-1	15.22	0
PERCENT DOMINANT TAXON	23.36	0	13.60	1	27.91	0	31.52	0
PERCENT ISOPOD, SNAIL, LEECH	1.82	1	1.84	1	46.60	-1	21.74	-1
PERCENT SURFACE AIR BREATHERS	5.47	1	18.01	0	24.03	-1	6.16	1
TOTAL SCORE		3		3		-5		-1
MACROINVERTEBRATE COMMUNITY RATING		Acceptable		Acceptable		Poor		Acceptable

TAXA	Prairie River Bowers Rd 8/31/2016 6L	Prairie River Orland Rd 8/31/2016 7L	S
ANNELIDA (segmented worms)			
Hirudinea (leeches)	1		
Oligochaeta (worms)	17	3	
ARTHROPODA			
Crustacea			
Amphipoda (scuds)	79	64	
Decapoda (crayfish)	1	1	
Isopoda (sowbugs)		2	
Arachnoidea			
Hydracarina	3	1	
Insecta			
Ephemeroptera (mayflies)			
Baetidae	53	8	
Heptageniidae	4	42	
Isonychiidae		1	
Odonata			
Anisoptera (dragonflies)			
Aeshnidae	4	1	
Gomphidae		1	
Zygoptera (damselflies)			
Calopterygidae	6	8	
Coenagrionidae	7		
Hemiptera (true bugs)			
Belostomatidae	1		
Corixidae	20	13	
Gerridae		1	
Notonectidae		1	
Veliidae		1	
Megaloptera			
Corydalidae (dobson flies)		1	
Trichoptera (caddisflies)			
Brachycentridae	3	8	
Helicopsychidae	9	18	
Hydropsychidae	15	63	
Hydroptilidae	9	3	
Leptoceridae	2	7	
Limnephilidae	1		
Molannidae		1	
Coleoptera (beetles)			
Dytiscidae (total)	1		
Haliplidae (adults)	6		
Elmidae	11	20	
Diptera (flies)			
Ceratopogonidae	1		
Chironomidae	42	26	
Culicidae	1		
Dixidae	1		
Simuliidae	3	22	
Tabanidae	1		
Tipulidae	1	1	
MOLLUSCA			
Gastropoda (snails)			
Ancylidae (limpets)	3	2	
Lymnaeidae		1	
Physidae	36	4	
Planorbidae	3	2	
Pelecypoda (bivalves)			
Pisidiidae	14	1	
TOTAL INDIVIDUALS	359	328	

METRIC	Prairie River Bowers Rd 8/31/2016 6L Value	Score	Prairie River Orland Rd 8/31/2016 7L Value	Score
TOTAL NUMBER OF TAXA	32	1	31	1
NUMBER OF MAYFLY TAXA	2	0	3	0
NUMBER OF CADDISFLY TAXA	6	1	6	1
NUMBER OF STONEFLY TAXA	0	-1	0	-1
PERCENT MAYFLY COMPOSITION	15.88	0	15.55	0
PERCENT CADDISFLY COMPOSITION	10.86	0	30.49	1
PERCENT DOMINANT TAXON	22.01	0	19.51	1
PERCENT ISOPOD, SNAIL, LEECH	11.98	-1	3.35	1
PERCENT SURFACE AIR BREATHERS	8.08	0	4.88	1
TOTAL SCORE		0		5
MACROINVERTEBRATE COMMUNITY RATING		Acceptable		Excellent

2 HABITAT DATA

	U1	U2	U3	U4	
	Fawn River Drain	**South Branch Hog Creek**	**Sand Creek**	**Fawn River**	
	Featherstone Rd.	**D/S Girard Road**	**Sterling Rd.**	**Dickinson Rd.**	
	9/1/2015	**7/16/2015**	**7/15/2015**	**9/1/2015**	
	GLIDE/POOL	**RIFFLE/RUN**	**GLIDE/POOL**	**GLIDE/POOL**	
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	5	19	13	7	
Embeddedness (20)*		18			
Velocity/Depth Regime (20)*		16			
Pool Substrate Characterization (20)**	11		15	19	
Pool Variability (20)**	9		17	12	
Channel Morphology					
Sediment Deposition (20)	14	19	15	5	
Flow Status - Maint. Flow Volume (10)	10	10	9	10	
Flow Status - Flashiness (10)	9	8	10	10	
Channel Alteration (20)	10	20	11	20	
Frequency of Riffles/Bends (20)*		18			
Channel Sinuosity (20)**	0		1	17	
Riparian and Bank Structure					
Bank Stability (L) (10)	9	9	8	9	
Bank Stability (R) (10)	8	9	8	9	
Vegetative Protection (L) (10)	9	6	8	9	
Vegetative Protection (R) (10)	7	9	8	9	
Riparian Vegetation Zone Width (L) (10)	4	8	5	10	
Riparian Vegetation Zone Width (R) (10)	4	4	9	10	
TOTAL SCORE (200):	109	173	137	156	
HABITAT RATING:	**GOOD**	**EXCELLENT**	**GOOD**	**EXCELLENT**	
Date:	9/1/2015	7/16/2015	7/15/2015	9/1/2015	
Weather:	Sunny	Partly Cloudy	Sunny	Sunny	
Air Temperature: °F	85	65	80	65	
Water Temperature: °F	73	68	74	66	
Ave. Stream Width: Feet	6.56	40.234	24.928	63.413	
Ave. Stream Depth: Feet	0.619	1.209	1.067	1.546	
Surface Velocity: Feet/Second					
Estimated Flow: Cubic Feet/Second					
Stream Modifications:	Dredged	None	Dredged	None	
Nuisance Plants (Y/N):	N	N	N	N	
STORET No.:	750337	120250	300295	750338	
County Code:	75	12	30	75	
TRS:	07S11W23	05S06W23	05S04W28	08S11W03	
Latitude (dd):	41.85342	42.02926	42.01466	41.80961	
Longitude (dd):	-85.55999	-84.97127	-84.77151	-85.57858	
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	
USGS Basin Code:	4050001	4050001	4050001	4050001	
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

	4U	5U	6U	7U	
	Swan Creek	**Prairie River**	**Sauk River**	**Bear Creek**	
	Burr Oak Rd	**Main St.**	**Race St.**	**Longnecker Road**	
	7/16/2015	**9/2/2015**	**7/16/2015**	**8/6/2015**	
	GLIDE/POOL	**GLIDE/POOL**	**RIFFLE/RUN**	**RIFFLE/RUN**	
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	10	13	19	12	
Embeddedness (20)*			19	13	
Velocity/Depth Regime (20)*			18	15	
Pool Substrate Characterization (20)**	13	15			
Pool Variability (20)**	15	15			
Channel Morphology					
Sediment Deposition (20)	10	15	17	11	
Flow Status - Maint. Flow Volume (10)	8	10	10	7	
Flow Status - Flashiness (10)	5	10	4	7	
Channel Alteration (20)	19	15	20	20	
Frequency of Riffles/Bends (20)*			20	11	
Channel Sinuosity (20)**	16	14			
Riparian and Bank Structure					
Bank Stability (L) (10)	7	10	6	7	
Bank Stability (R) (10)	7	10	6	7	
Vegetative Protection (L) (10)	7	5	7	8	
Vegetative Protection (R) (10)	7	5	7	8	
Riparian Vegetation Zone Width (L) (10)	8	2	6	10	
Riparian Vegetation Zone Width (R) (10)	8	2	6	10	
TOTAL SCORE (200):	140	141	165	146	
HABITAT RATING:	**GOOD**	**GOOD**	**EXCELLENT**	**GOOD**	
Date:	7/16/2015	9/2/2015	7/16/2015	8/6/2015	
Weather:	Cloudy	Sunny	Partly Cloudy	Sunny	
Air Temperature: °F	65	75	58	75	
Water Temperature: °F	70	66	65	72	
Ave. Stream Width: Feet	28.54	48.1067	41.765	27.989	
Ave. Stream Depth: Feet	2.06	0.89435	0.0676	0.5772	
Surface Velocity: Feet/Second					
Estimated Flow: Cubic Feet/Second					
Stream Modifications:	None	None	None	None	
Nuisance Plants (Y/N):	N	N	N	N	
STORET No.:	120003	750339	120251	750319	
County Code:	12	75	12	75	
TRS:	07S08W03	07S09W23	06S06W21	05S09W04	
Latitude (dd):	41.89612	41.84874	41.93562	42.05772	
Longitude (dd):	-85.22038	-85.31545	-85.00986	-85.35625	
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	
USGS Basin Code:	4050001	4050001	4050001	4050001	
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

	9U	10U	11U	12U	
	Beebe Creek	**Fawn River**	**Unnamed Trib to Prairie River**	**Prairie River**	
	Dewey Rd.	**Haybridge Rd.**	**M66**	**Middle Colon Rd.**	
	7/15/2015	**9/1/2015**	**9/2/2015**	**9/2/2015**	
	RIFFLE/RUN	**GLIDE/POOL**	**GLIDE/POOL**	**GLIDE/POOL**	
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	10	10	1	18	
Embeddedness (20)*	15				
Velocity/Depth Regime (20)*	11				
Pool Substrate Characterization (20)**		16	8	18	
Pool Variability (20)**		15	3	19	
Channel Morphology					
Sediment Deposition (20)	16	10	3	15	
Flow Status - Maint. Flow Volume (10)	9	10	9	9	
Flow Status - Flashiness (10)	9	9	3	3	
Channel Alteration (20)	9	20	11	17	
Frequency of Riffles/Bends (20)*	10				
Channel Sinuosity (20)**		20	1	16	
Riparian and Bank Structure					
Bank Stability (L) (10)	5	10	4	6	
Bank Stability (R) (10)	8	7	4	8	
Vegetative Protection (L) (10)	1	10	5	2	
Vegetative Protection (R) (10)	5	8	5	10	
Riparian Vegetation Zone Width (L) (10)	1	10	5	0	
Riparian Vegetation Zone Width (R) (10)	1	10	5	10	
TOTAL SCORE (200):	110	165	67	151	
HABITAT RATING:	**GOOD**	**EXCELLENT**	**MARGINAL**	**GOOD**	
Date:	7/15/2015	9/1/2015	9/2/2015	9/2/2015	
Weather:	Sunny	Sunny	Sunny	Sunny	
Air Temperature: °F	68	80	85	80	
Water Temperature: °F	64	63	72	66	
Ave. Stream Width: Feet	7.653	54.12	11.48	35.533	
Ave. Stream Depth: Feet	0.892	2.715	0.80469	1.41915	
Surface Velocity: Feet/Second					
Estimated Flow: Cubic Feet/Second					
Stream Modifications:	Dredged	None	Dredged	None	
Nuisance Plants (Y/N):	N	N	N	N	
STORET No.:	300296	750340	750341	750342	
County Code:	30	75	75	75	
TRS:	06S02W04	07S11W27	06S09W30	07S09W30	
Latitude (dd):	41.934592	41.82478	41.91297	41.85460615	
Longitude (dd):	-84.518353	-85.58104	-85.40957	-85.33094954	
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	
USGS Basin Code:	4050001	4050001	4050001	4050001	
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

	13U	14U	15U	16U	
	Sand Creek	Spring Creek	Unnamed Trib to Prairie River	Spring Creek	
	Bean Rd.	Muskrat Lake Road	Prairie River Rd.	Johnson Road	
	7/15/2015	8/7/2015	8/6/2015	9/3/2015	
	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL	GLIDE/POOL	
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	10	18	6	5	
Embeddedness (20)*					
Velocity/Depth Regime (20)*					
Pool Substrate Characterization (20)**	15	14	8	13	
Pool Variability (20)**	16	15	5	5	
Channel Morphology					
Sediment Deposition (20)	19	15	16	5	
Flow Status - Maint. Flow Volume (10)	10	9	8	10	
Flow Status - Flashiness (10)	10	9	8	10	
Channel Alteration (20)	20	20	5	20	
Frequency of Riffles/Bends (20)*					
Channel Sinuosity (20)**	19	19	1	11	
Riparian and Bank Structure					
Bank Stability (L) (10)	9	10	8	10	
Bank Stability (R) (10)	9	10	8	10	
Vegetative Protection (L) (10)	9	10	7	10	
Vegetative Protection (R) (10)	8	10	7	10	
Riparian Vegetation Zone Width (L) (10)	9	10	3	10	
Riparian Vegetation Zone Width (R) (10)	8	10	3	10	
TOTAL SCORE (200):	171	179	93	139	
HABITAT RATING:	**EXCELLENT**	**EXCELLENT**	**MARGINAL**	**GOOD**	
Date:	7/15/2015	8/7/2015	8/6/2015	9/3/2015	
Weather:	Sunny	Sunny	Sunny	Sunny	
Air Temperature: °F	80	70	72	85	
Water Temperature: °F	78	62	65	74	
Ave. Stream Width: Feet	17.1653	15.744	5.576	28.536	
Ave. Stream Depth: Feet	1.41259	0.56197	0.76096	2.276	
Surface Velocity: Feet/Second					
Estimated Flow: Cubic Feet/Second					
Stream Modifications:	None	None	Dredged	None	
Nuisance Plants (Y/N):	N	N	N	N	
STORET No.:	120252	750275	120253	750324	
County Code:	30	75	12	75	
TRS:	06W04W13	05S11W04	07S08W15	05S12W13	
Latitude (dd):	41.95588	42.06419	41.85931	42.03811	
Longitude (dd):	-84.728149	-85.60689	-85.23348	-85.64919	
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	
USGS Basin Code:	4050001	4050001	4050001	4050001	
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

	17U	18U	19U	20U	
	Unnamed Tributary to Portage River	**Rocky River**	**Blackwell Drain**	**Nottawa Creek**	
	36th Avenue	**Memory Isle Park**	**Girard Road**	**Correll Road**	
	9/3/2015	**9/2/2015**	**9/15/2015**	**9/15/2015**	
	GLIDE/POOL	**GLIDE/POOL**	**RIFFLE/RUN**	**GLIDE/POOL**	
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	18	10	10	13	
Embeddedness (20)*			15		
Velocity/Depth Regime (20)*			14		
Pool Substrate Characterization (20)**	18	15		16	
Pool Variability (20)**	19	10		11	
Channel Morphology					
Sediment Deposition (20)	16	10	10	8	
Flow Status - Maint. Flow Volume (10)	10	10	6	9	
Flow Status - Flashiness (10)	10	9	1	6	
Channel Alteration (20)	19	15	15	13	
Frequency of Riffles/Bends (20)*			15		
Channel Sinuosity (20)**	20	18		11	
Riparian and Bank Structure					
Bank Stability (L) (10)	10	9	2	7	
Bank Stability (R) (10)	10	9	3	7	
Vegetative Protection (L) (10)	8	8	7	8	
Vegetative Protection (R) (10)	8	1	7	6	
Riparian Vegetation Zone Width (L) (10)	6	6	7	5	
Riparian Vegetation Zone Width (R) (10)	8	2	5	5	
TOTAL SCORE (200):	180	132	117	125	
HABITAT RATING:	**EXCELLENT**	**GOOD**	**GOOD**	**GOOD**	
Date:	9/3/2015	9/2/2015	9/15/2015	9/15/2015	
Weather:	80	Sunny	Sunny	Sunny	
Air Temperature: °F	72	85	74	85	
Water Temperature: °F	72	76	60.5	66	
Ave. Stream Width: Feet	10.933	77.627	6.997	94.03	
Ave. Stream Depth: Feet	0.903	0.848	0.651	2.27	
Surface Velocity: Feet/Second					
Estimated Flow: Cubic Feet/Second					
Stream Modifications:	None	Canopy Removal	Dredged	None	
Nuisance Plants (Y/N):	N	N	N	N	
STORET No.:	390607	750280	120245	750327	
County Code:	39	75	12	75	
TRS:	03S09W19	06S11W18	05S08W24	05S09W14	
Latitude (dd):	42.19779	41.945093	42.02827	42.04024	
Longitude (dd):	-85.41293	-85.637014	-85.19361	-85.33234	
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	
Stream Type:	Warmwater	Warmwater	Warmwater	Warmwater	
USGS Basin Code:	4050001	4050001	4050001	4050001	
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

	21U	22U	23U	1L	
	Hog Creek	St. Joseph River	St. Joseph River	Pipestone Creek	
	Girard Road	Stowell Road	M-66 at 28140 Talon Drive	Wildwood Dr	
	9/15/2015	9/15/2015	9/25/2015	9/22/2016	
	RIFFLE/RUN	RIFFLE/RUN	GLIDE/POOL	RIFFLE/RUN	
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	14	17	17	15	
Embeddedness (20)*	15	15		11	
Velocity/Depth Regime (20)*	15	18		14	
Pool Substrate Characterization (20)**			15		
Pool Variability (20)**			10		
Channel Morphology					
Sediment Deposition (20)	16	15	13	10	
Flow Status - Maint. Flow Volume (10)	9	9	10	9	
Flow Status - Flashiness (10)	2	3	9	2	
Channel Alteration (20)	20	20	20	20	
Frequency of Riffles/Bends (20)*	6	16		18	
Channel Sinuosity (20)**			18		
Riparian and Bank Structure					
Bank Stability (L) (10)	6	7	8	5	
Bank Stability (R) (10)	7	9	8	5	
Vegetative Protection (L) (10)	8	7	8	2	
Vegetative Protection (R) (10)	8	9	8	2	
Riparian Vegetation Zone Width (L) (10)	8	7	6	2	
Riparian Vegetation Zone Width (R) (10)	8	10	6	3	
TOTAL SCORE (200):	142	162	156	118	
HABITAT RATING:	**GOOD**	**EXCELLENT**	**EXCELLENT**	**GOOD**	
Date:	9/15/2015	9/15/2015	9/25/2015	9/22/2016	
Weather:	Partly Cloudy	Sunny	Sunny	Cloudy	
Air Temperature: °F	72	80	75	82	
Water Temperature: °F	60.4	70.2	70	68	
Ave. Stream Width: Feet	37.449	113.05	329.64	26.896	
Ave. Stream Depth: Feet	1.034	2.06	1.404	1.176	
Surface Velocity: Feet/Second				2	
Estimated Flow: Cubic Feet/Second				51	
Stream Modifications:	None	None	None	None	
Nuisance Plants (Y/N):	N	N	N	N	
STORET No.:	120242	750001	750326	110804	
County Code:	12	75	75	11	
TRS:	05S06W18	06S09W01	05S10W25	55S18W03	
Latitude (dd):	42.02921	41.97248	42.00758	42.060079	
Longitude (dd):	-85.04859	-85.30265	-85.41126	-86.396446	
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	
Stream Type:	Warmwater	Warmwater	Warmwater		
USGS Basin Code:	4050001	4050001	4050001	4050001	
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

	2L	3L	4L	5L	
	Brandywine Creek	**Dowagiac River**	**Hickory Creek**	**Old Bitty Creek**	
	US-12	**Atwood Road**	**Upstream Snow Road**	**Red Bud Tr**	
	8/29/2016	**9/23/2016**	**9/22/2016**	**8/29/2016**	
	GLIDE/POOL	**GLIDE/POOL**	**GLIDE/POOL**	**RIFFLE/RUN**	
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	14	8	1	8	
Embeddedness (20)*				16	
Velocity/Depth Regime (20)*				19	
Pool Substrate Characterization (20)**	17	8	11		
Pool Variability (20)**	15	14	11		
Channel Morphology					
Sediment Deposition (20)	19	18	6	11	
Flow Status - Maint. Flow Volume (10)	10	10	7	8	
Flow Status - Flashiness (10)	10	1	9	0	
Channel Alteration (20)	20	20	0	19	
Frequency of Riffles/Bends (20)*				16	
Channel Sinuosity (20)**	16	17	0		
Riparian and Bank Structure					
Bank Stability (L) (10)	10	8	9	4	
Bank Stability (R) (10)	10	6	9	1	
Vegetative Protection (L) (10)	9	9	9	7	
Vegetative Protection (R) (10)	9	6	9	0	
Riparian Vegetation Zone Width (L) (10)	9	9	1	3	
Riparian Vegetation Zone Width (R) (10)	9	6	1	0	
TOTAL SCORE (200):	177	140	83	112	
HABITAT RATING:	**EXCELLENT**	**GOOD**	**MARGINAL**	**GOOD**	
Date:	8/29/2016	9/23/2016	9/22/2016	8/29/2016	
Weather:	Sunny	Cloudy	Sunny	Partly Cloudy	
Air Temperature: °F	80	75	85	85	
Water Temperature: °F	65	64	64	65	
Ave. Stream Width: Feet	12.79	28.86	14.76	7.98	
Ave. Stream Depth: Feet	2.06	2.31	2.199	0.413	
Surface Velocity: Feet/Second	1	1	0	1	
Estimated Flow: Cubic Feet/Second	25	85	16	3	
Stream Modifications:	None	None	Dredged	Bank Stabilization	
Nuisance Plants (Y/N):	N	N	N	N	
STORET No.:	140111	140168	110732	110805	
County Code:	14	14	11	11	
TRS:	08S16W06	05S15W09	06S19W25	07S18W23	
Latitude (dd):	41.79694	42.04965	41.92741	41.8565	
Longitude (dd):	-86.21472	-86.06914	-86.4704	-86.36527	
Ecoregion:	SMNITP	SMNITP	SMNITP	SMNITP	
Stream Type:	Coldwater	Coldwater	Coldwater		
USGS Basin Code:	4050001	4050001	4050001	4050001	
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

	6L	7L			
	Prairie River	**Prairie River**			
	Bowers Rd	**Orland Rd**			
	8/31/2016	**8/31/2016**			
	GLIDE/POOL	**RIFFLE/RUN**			
HABITAT METRIC					
Substrate and Instream Cover					
Epifaunal Substrate/ Avail Cover (20)	8	16			
Embeddedness (20)*		19			
Velocity/Depth Regime (20)*		15			
Pool Substrate Characterization (20)**	11				
Pool Variability (20)**	6				
Channel Morphology					
Sediment Deposition (20)	5	20			
Flow Status - Maint. Flow Volume (10)	9	9			
Flow Status - Flashiness (10)	1	9			
Channel Alteration (20)	15	20			
Frequency of Riffles/Bends (20)*		17			
Channel Sinuosity (20)**	5				
Riparian and Bank Structure					
Bank Stability (L) (10)	5	9			
Bank Stability (R) (10)	5	9			
Vegetative Protection (L) (10)	6	2			
Vegetative Protection (R) (10)	6	3			
Riparian Vegetation Zone Width (L) (10)	4	2			
Riparian Vegetation Zone Width (R) (10)	7	3			
TOTAL SCORE (200):	93	153			
HABITAT RATING:	**MARGINAL**	**GOOD**			
Date:	8/31/2016	8/31/2016			
Weather:	Partly Cloudy	Cloudy			
Air Temperature: °F	75	75			
Water Temperature: °F	69	68			
Ave. Stream Width: Feet	31.816	21.43			
Ave. Stream Depth: Feet	0.711	0.3			
Surface Velocity: Feet/Second	2	1			
Estimated Flow: Cubic Feet/Second	39	27			
Stream Modifications:	anopy Removal/Dredg	None			
Nuisance Plants (Y/N):	N	N			
STORET No.:	130324	120254			
County Code:	12	12			
TRS:	08S07W03	07S08W25			
Latitude (dd):	41.80182	41.8391			
Longitude (dd):	-85.11642	-85.19303			
Ecoregion:	SMNITP	SMNITP			
Stream Type:	Warmwater				
USGS Basin Code:	4050001	4050001			
* Applies only to Riffle/Run stream Surveys	** Applies only to Glide/Pool stream Surveys				
Note: Individual metrics may better describe conditions directly affecting the biological community while the Habitat Rating describes the general riverine environment at the site(s).					

Appendix B

Lake Name	County	Program	Year Sampled
Barton	Kalamazoo	CLMP	2018
Birch (Fallon)	Cass	CLMP	2018
Birch (Temple)	Cass	CLMP	2015
Cedar	Van Buren	CLMP	2018
Christiana	Cass	CLMP	2018
Corey	St. Joseph	CLMP	2018
Diamond	Cass	CLMP	2018
Eagle	Cass	CLMP	2018
Fishers	St. Joseph	CLMP	2018
Grass	St. Joseph	CLMP	2018
Gravel	Van Buren	CLMP	2018
Harwood	Cass	CLMP	2016
Huyck	Branch	CLMP	2016
Indian	Kalamazoo	CLMP	2018
Juno	Cass	CLMP	2018
Kelsey (Big)	Cass	CLMP	2018
Kelsey (Little)	Cass	CLMP	2018
Klinger	St. Joseph	CLMP	2018
Magician	Cass	CLMP	2018
Painter	Cass	CLMP	2018
Perrin	St. Joseph	CLMP	2018
Portage	St. Joseph	CLMP	2018
Puterbaugh	Cass	CLMP	2018
Randall	Branch	CLMP	2015
Shavehead	Cass	CLMP	2018
Twin (Big-North)	Cass	CLMP	2016
Wahbememe	St. Joseph	CLMP	2018
West	Kalamazoo	CLMP	2017
Long	Hillsdale	DNR	2018
Long	Kalamazoo	DNR	2018
Lime Lakes	Cass	DNR	2017
Donnell Lake	Cass	DNR	2017
Bunker	Cass	DNR	2017
S Sand Lake	Hillsdale	DNR	2017
N Sand Lake	Hillsdale	DNR	2017
Hemlock Lake	Hillsdale	DNR	2017
Carpenter Lake	Hillsdale	DNR	2017
Sunset Lake	Kalamazoo	DNR	2017
Painter	Cass	DNR	2017

Lake Name	County	Program	Year Sampled
Juno (Christiana) Lakes	Cass	DNR	2017
Fish Lake	St Joseph	DNR	2017
Magician Lake	Cass	DNR	2017
Day Lake	Cass	DNR	2016
Curtis Lake	Cass	DNR	2016
Chain Lake	Cass	DNR	2016
Oliverda (Clayton, Kirby) Lake	Branch	DNR	2016
Kenyon Lake	Branch	DNR	2016
Fourth (Foot, Bass) Lake	Hillsdale	DNR	2016
Gravel Lake	Hillsdale	DNR	2016
Hemlock Lake	Cass	DNR	2016
Pleasant Lake	St Joseph	DNR	2015
Coldwater Lake	Branch	DNR	2015
Indian Lake	Cass	DNR	2015
Little Crooked Lake	Cass	DNR	2015
Lake Lavine	Branch	DNR	2015
Indiana Lake	Cass	DNR	2014
Lake Templine	Branch	DNR	2013
Howard Lake	Kalamazoo	DNR	2012
Morrison Lake	Branch	DNR	2012
Craig Lake	Branch	DNR	2012
Sand Lake	St Joseph	DNR	2012
Cary Lake	Branch	DNR	2012
Indian Lake	Kalamazoo	DNR	2011
Kelsey Lake	Cass	DNR	2011
Sturgeon Lake	St Joseph	DNR	2011
Palmer Lake	St Joseph	DNR	2011
East Long Lake	Branch	DNR	2011
Archer Lake	Branch	DNR	2011
Long Lake (Colon Twp)	St Joseph	DNR	2011
Bankson Lake	Van Buren	DNR	2011
Barron Lake	Cass	DNR	2010
Austin Lake	Kalamazoo	DNR	2010
Sturgis Impoundment	St Joseph	DNR	2010
Prairie River Lake	St Joseph	DNR	2010
Gull Lake	Kalamazoo	MSU Sediment	1999 and 2005
Paw Paw Lake	Berrien	MSU Sediment	2001 and 2007
Birch Lake	Cass	MSU Sediment	2003
Bird Lake	Hillsdale	MSU Sediment	2009
Klinger Lake	St. Joseph	MSU Sediment	2009

Lake Name	County	Program	Year Sampled
Cora Lake	Van Buren	MSU Sediment	2009
Round Lake	Van Buren	NLA	2012
Palmer Lake	St. Joseph	NLA	2012 and 2017
West Lake	Kalamazoo	NLA	2012 and 2017
Fourth Lake	Hillsdale	NLA	2012
Pond Near Birch Lake	Cass	NLA	2012
Pond Near Mud Lake	Kalamazoo	NLA	2012
Dowagiac Impoundment	Cass	NLA	2012
Coldwater Lake	Branch	LWQA	2010
Randall Lake	Branch	LWQA	2011
Marble Lake	Branch	LWQA	2005
Marble Lake	Branch	LWQA	2005
Rose Lake	Branch	LWQA	2010
Rose Lake	Branch	LWQA	2010
Rose Lake	Branch	LWQA	2010
Coldwater Lake	Branch	LWQA	2010
Gilead Lake	Branch	LWQA	2009
Gilead Lake	Branch	LWQA	2009
Lake Lavine	Branch	LWQA	2009
Matteson Lake	Branch	LWQA	2005
Union Lake	Branch	LWQA	2005
Archer Lake	Branch	LWQA	2010
Cary Lake	Branch	LWQA	2005
Craig Lake	Branch	LWQA	2010
North Lake	Branch	LWQA	2010
South Lake	Branch	LWQA	2005
Morrison Lake	Branch	LWQA	2010
Silver Lake	Branch	LWQA	2005
East Long Lake	Branch	LWQA	2010
Oliverda Lake	Branch	LWQA	2010
Kenyon Lake	Branch	LWQA	2005
Nottawa Lake	Calhoun	LWQA	2005
Lee Lake	Calhoun	LWQA	2005
Warners Lake	Calhoun	LWQA	2005
Homer Lake	Calhoun	LWQA	2005
Homer Lake	Calhoun	LWQA	2005
Diamond Lake	Cass	LWQA	2001
Diamond Lake	Cass	LWQA	2001
Fish Lake	Cass	LWQA	2006
Hemlock Lake	Cass	LWQA	2005

Lake Name	County	Program	Year Sampled
Christiana Lake	Cass	LWQA	2006
Donnell Lake	Cass	LWQA	2006
Juno Lake	Cass	LWQA	2006
Belas Lake	Cass	LWQA	2001
Birch Lake	Cass	LWQA	2006
Harwood Lake	Cass	LWQA	2005
Magician Lake	Cass	LWQA	2006
Mill Pond	Cass	LWQA	2005
Paradise Lake	Cass	LWQA	2006
Baldwins Lake	Cass	LWQA	2001
Stone Lake	Cass	LWQA	2001
North Twin Lake	Cass	LWQA	2006
Shavehead Lake	Cass	LWQA	2006
Shavehead Lake	Cass	LWQA	2006
Kirk Lake	Cass	LWQA	2001
Dewey Lake	Cass	LWQA	2006
Driskels Lake	Cass	LWQA	2005
South Twin Lake	Cass	LWQA	2001
Long Lake	Hillsdale	LWQA	2005
Hemlock Lake	Hillsdale	LWQA	2009
Baw Beese Lake	Hillsdale	LWQA	2005
Round Lake	Hillsdale	LWQA	2005
Austin Lake	Kalamazoo	LWQA	2005
Barton Lake	Kalamazoo	LWQA	2009
Indian Lake	Kalamazoo	LWQA	2010
Long Lake	Kalamazoo	LWQA	2010
Barton Lake	Kalamazoo	LWQA	2009
Sugarloaf Lake	Kalamazoo	LWQA	2009
Portage Lake	Kalamazoo	LWQA	2005
Portage Lake	Kalamazoo	LWQA	2005
West Lake	Kalamazoo	LWQA	2010
Hogset Lake	Kalamazoo	LWQA	2005
Gourdneck Lake	Kalamazoo	LWQA	2009
Long Lake	St. Joseph	LWQA	2009
Palmer Lake	St. Joseph	LWQA	2010
Klinger Lake	St. Joseph	LWQA	2005
Fishers Lake	St. Joseph	LWQA	2010
Corey Lake	St. Joseph	LWQA	2010
Pleasant Lake	St. Joseph	LWQA	2010
Pleasant Lake	St. Joseph	LWQA	2010

Lake Name	County	Program	Year Sampled
Big Fish Lake	St. Joseph	LWQA	2010
Long Lake	St. Joseph	LWQA	2010
Long Lake	St. Joseph	LWQA	2010
Crotch (Omena)	St. Joseph	LWQA	2010
Sand Lake	St. Joseph	LWQA	2005
Sturgeon Lake	St. Joseph	LWQA	2005
Thompson Lake	St. Joseph	LWQA	2009
Three Rivers Impoundment	St. Joseph	LWQA	2010
Clear Lake	St. Joseph	LWQA	2010
Portage Lake	St. Joseph	LWQA	2005
Prairie River Lake	St. Joseph	LWQA	2010
Bankson Lake	Van Buren	LWQA	2009
Lake of the Woods	Van Buren	LWQA	2006
Cedar Lake	Van Buren	LWQA	2001
Round Lake	Van Buren	LWQA	2006
Gravel Lake	Van Buren	LWQA	2001
Huzzy Lake	Van Buren	LWQA	2005
Corey Lake	Van Buren	LWQA	2010