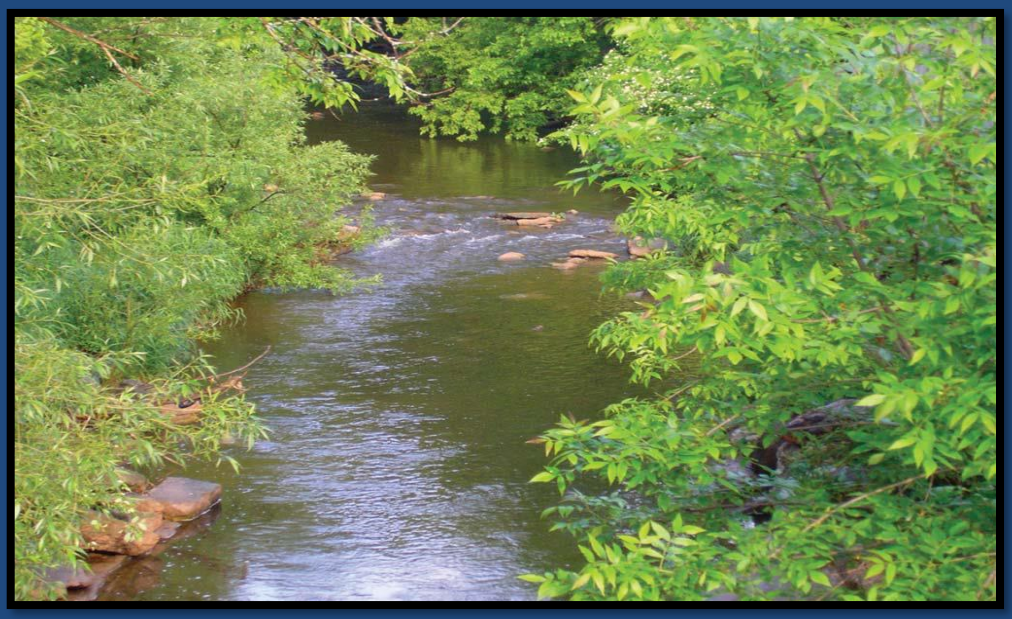
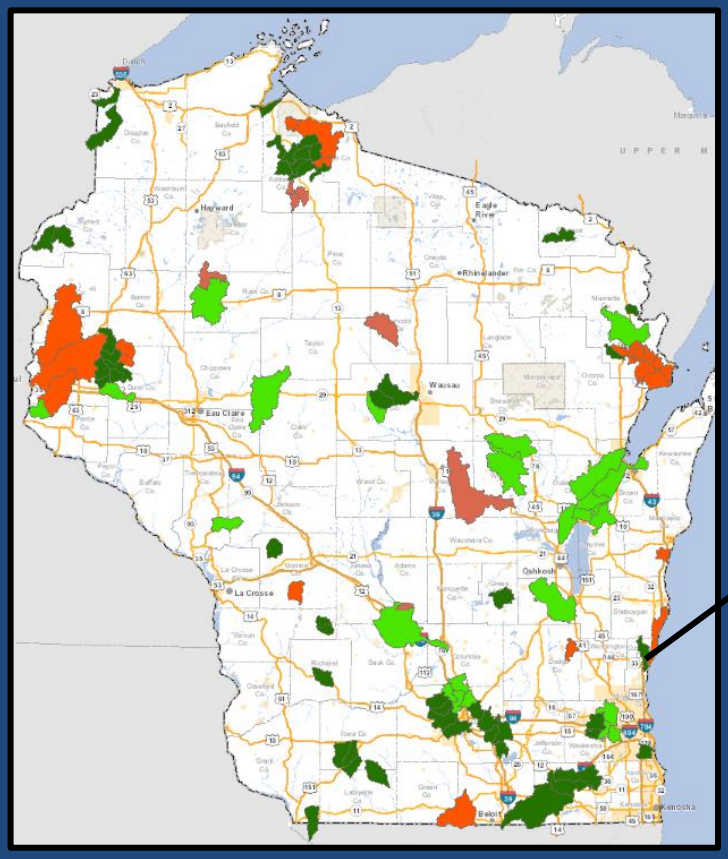


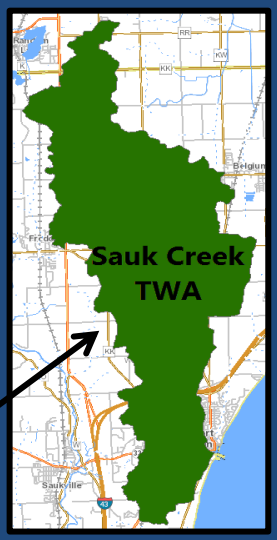
Sauk Creek, Photo by Vic Pappas, DNR

Watershed Report created by the Bureau of Water Quality in support of the Clean Water Act.

Sauk Creek Targeted Watershed Assessment Water Quality Management Plan 2017

Sauk Creek (SH01)
HUC: 040301011204
Monitored 2014





WISCONSIN DEPT. OF NATURAL RESOURCES

EGAD # 3200-2017-07
Water Quality Bureau,
Wisconsin DNR

Table of Contents

Wisconsin Water Quality Monitoring and Planning

This Water Quality Management Plan was created under the state's Water Quality Management Planning and Water Resources Monitoring Programs. The plan reflects Water Quality Bureau and Water Resources Monitoring Strategy 2015-2020 goals and priorities and fulfills Areawide Water Quality Management Planning milestones under the Clean Water Act, Section 208. Condition information and resource management recommendations support and guide program priorities for the plan area.

This plan is hereby approved by the Wisconsin DNR Water Quality Program and is a formal update to the Sheboygan Areawide Water Quality Management Plan and Wisconsin's Statewide Areawide Water Quality Management Plan. This plan will be forwarded to USEPA for certification as a formal plan update.

Water Quality Field Supervisor — Date 2/6/18

Greg Searle, Water Quality Bureau Field Operations Director — Date 2/6/18

Timothy Asplund, Water Quality Bureau Monitoring Section Chief — Date 2/6/18

Basin/Watershed Partners

- Ozaukee County

Report Acknowledgements

- Craig Helker, Primary Author and Investigator, Eastern District, Wisconsin DNR
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- Lisa Helmuth, Program Coordinator, Water Quality Bureau, Wisconsin DNR

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List of Abbreviations

BMP: **Best Management Practice**. A practice that is determined effective and practicable (including technological, economic, and institutional considerations) in preventing or reducing pollution generated from nonpoint sources to a level compatible with water quality goals.

DNR: **Department of Natural Resources.** Wisconsin Department of Natural Resources is an agency of the State of Wisconsin created to preserve, protect, manage, and maintain natural resources.

FIBI: **Fish Index of biological integrity (Fish IBI).** An Index of Biological Integrity (IBI) is a scientific tool used to identify and classify water pollution problems. An IBI associates anthropogenic influences on a water body with biological activity in the water and is formulated using data developed from biosurveys. In Wisconsin, Fish IBIs are created for each type of natural community in the state's stream system.

HUC: **Hydrologic Unit Code.** A code or sequence of numbers that identify one of a number of nested and interlocked hydrologic catchments delineated by a consortium of agencies including USGS, USFS, and Wisconsin DNR.

mIBI: **Macroinvertebrate Index of biological integrity.** In Wisconsin, the mIBI, or macroinvertebrate Index of biological integrity, was developed specifically to assess Wisconsin's macroinvertebrate community (see also Fish IBI).

Natural Community. A system of categorizing waterbodies based on their inherent physical, hydrologic, and biological assemblages. Both Streams and Lakes are categorized using an array of "natural community" types.

Monitoring Seq. No. Monitoring Sequence Number refers to a unique identification code generated by the Surface Water Integrated Monitoring System (SWIMS), which holds much of the state's water quality monitoring data.

SWIMS ID. Surface Water Integrated Monitoring System (SWIMS) Identification Code is the unique monitoring station identification number for the location where monitoring data was gathered.

TWA: **Targeted Watershed Assessment.** A statewide study design a rotating watershed approach to gathering of baseline monitoring data with specialized targeted assessments for unique and site specific concerns, such as effectiveness monitoring of management actions.

WATERS ID: The Waterbody Assessment, Tracking and Electronic Reporting System Identification Code (WATERS ID) is a unique numerical sequence number assigned by the WATERS system, also known as "Assessment Unit ID code".

WBIC: **Water Body Identification Code.** WDNR's unique identification codes assigned to water features in the state. The lines and information allow the user to execute spatial and tabular queries about the data, make maps, and perform flow analysis and network traces.

WQM: Water Quality Management. The process of reviewing the condition of water, assessing data against condition thresholds, writing up results and making recommendations for management actions.

Watershed Discussion & Management Recommendations

Watershed Goals

The overall goal of this plan is to improve and protect water quality in the basin. This Targeted Watershed Assessment monitoring project provided substantial data to analyze current conditions and to make recommendations for future management actions in the area. This plan is designed to present monitoring study results, identify issues or concerns in the area found during the project and to make recommendations to improve or protect water quality consistent with Clean Water Act guidelines and state water quality standards.

Watershed Overview

The Sauk Creek Watershed is the southernmost watershed in the Sheboygan River Basin. Most of the watershed is located in Ozaukee County, with a small northern portion located in Sheboygan County. This watershed includes the sub watersheds of Sauk Creek and Sucker Creek, plus areas discharging directly to Lake Michigan. Sauk Creek enters Lake Michigan in the City of Port Washington, while Sucker Creek (also known as Sucker Brook) enters the Lake north of the City of Port Washington. This document focuses on Sauk Creek. The watersheds are primarily agricultural, but urbanization is proceeding.

Figure 1: Sauk Creek TWA.

Population, Land Use, Site Characteristics

The entire City of Port Washington and portions of the Villages of Cedar Grove, Belgium and Fredonia are located within this watershed. Based on the Southeastern Wisconsin Regional Planning Commission's (SEWRPC's) 2000 land use data, over three quarters (78%) of the total area in the Sauk and Sucker Creeks watershed is devoted to agriculture and other open lands. Transportation, communication, and utilities make up six percent of the watershed's area. Residential areas and wetlands each comprise about five percent of the total area, and another three percent is woodlands. Recreational, governmental / institutional, industrial, and commercial uses and surface water each cover less than one percent of the Sauk and Sucker Creeks watershed.

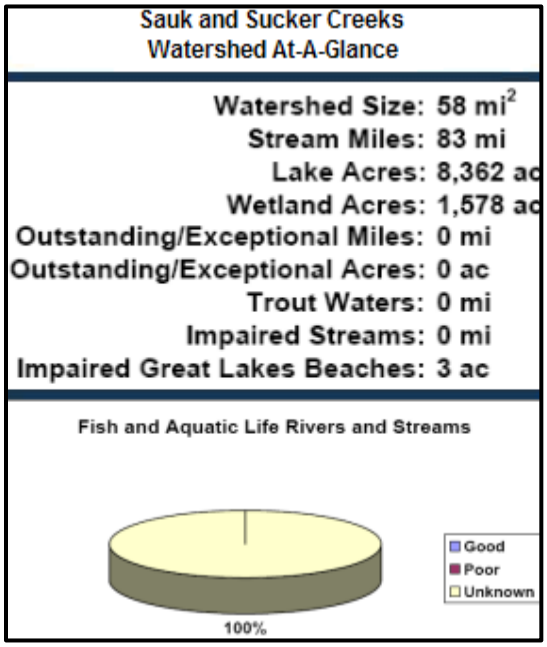


Figure 2: Watershed details

Hydrology

The hydrologic cycle describes the various ways water is exchanged from one form or location to another. In Wisconsin, precipitation, in the form of rain, snow, and everything in-between, falls onto the earth's surface. It either soaks into the ground or flows across the land. The water that soaks into the ground recharges the groundwater table, or flows laterally through the ground into a lake or stream. Water generally moves more quickly in coarse sand, sometimes as much as several feet per day. When precipitation infiltrates the more sandy soils in this watershed, the water quickly moves vertically through the soils into the shallow Sand and Gravel Aquifer.

This watershed includes the subwatersheds of Sauk Creek and Sucker Creek, plus areas discharging directly to Lake Michigan (see Map 1). All streams ultimately reach Lake Michigan. There are three lakes within the watershed: Ludowissi Lake, Grasser Lake, and an unnamed lake (an abandoned quarry) located in Harrington Beach State Park. The only active dam is a small dam on this quarry lake. There was also the remnant of an old dam on Spring Creek (a tributary to Sauk Creek) in Port Washington, although that dam has subsequently been removed by Ozaukee County. Stream channelization has caused some degradation of water quality and habitat in the watershed. Also, impervious surfaces (such as roads, roofs, and parking lots) are increasing as urbanization proceeds. Impervious surfaces increase stormwater runoff, contributing to problems with erosion, water pollution, and flooding. The loss of about 60% of the original wetlands in the watershed has also had negative consequences.

Study Summary

In 2014, the aquatic biological communities of Sauk Creek and associated tributaries were surveyed utilizing established survey methods, and compared with results from historical surveys.

Sauk Creek is impaired for Total Phosphorus, being listed in 2012. This study suggests the surveyed Unnamed Tributaries are also impaired for Phosphorus, and are contributing to Sauk Creek's impairment. These Tributaries should be assessed further, and listed if meeting criteria. Furthermore, land practices associated with reducing phosphorus loading to streams should continue to be advocated for and placed adjacent to Sauk Creek, Sucker Creek, and their tributaries.

Management Recommendations

- Identify the sources of phosphorus in the watershed and prioritize management activities.
- Identify potential partners and stakeholders to participate in an overall awareness and behavioral change program in the watersheds that will result in reduced erosion and phosphorus inputs.
- Pursue local runoff management and river/stream grants to reduce phosphorous inputs into local resources.

Ecological, Aquatic Resources

Trout Waters

While there are no officially listed trout waters within the Sauk Creek Watershed, the lower portions of Sauk Creek do have populations of stocked Rainbow and Brown Trout. And recent studies by WDNR have confirmed naturally reproducing Rainbow Trout.

Impaired Waters

Every two years, Section 303(d) of the Clean Water Act requires states to publish a list of all waters that do not meet water quality standards. The list, also known as the Impaired Waters List, is updated to reflect waters that are newly added or removed based on new information. Impaired waters in this watershed are impaired for historical discharges and runoff issues (Table 1).

Numerous locations along Lake Michigan have been listed as impaired due to high E. coli counts. Beaches in the watershed under recreational restrictions due to elevated E. coli counts include: Cedar Beach, County Road D Boat Launch Beach, Upper Lake Park Beach, Amsterdam Beach, Lions Den Gorge National Preserve (South Beach), and Harrington State Park (South Beach).

Table 1: List of impaired waters in Sauk and Sucker Creeks Watershed (SH01).

Waterbody Name	WBIC	Start Mile	End Mile	Pollutant	Impairment	Sources	303(d) Status
Lions Den Gorge National Preserve South Beach, Lake Michigan	20	0	0.38	E. coli	Recreational Restrictions - Pathogens	NA	Water Delisted
Harrington State Park (S. Beach), Lake Michigan	20	0	0.16	E. coli	Recreational Restrictions - Pathogens	NA	Water Delisted
Upper Lake Park Beach, Lake Michigan	20	0	0.77	E. coli	Recreational Restrictions - Pathogens	NA	Water Delisted
Amsterdam Beach, Lake Michigan	20	0	0.33	E. coli	Recreational Restrictions - Pathogens	NA	Water Delisted
County Road D Boat Launch Beach, Lake Michigan	20	0	0.37	E. coli	Recreational Restrictions - Pathogens	NA	Water Delisted
Cedar Beach, Lake Michigan	20	0	0.7	E. coli	Recreational Restrictions - Pathogens	NA	Water Delisted
Lake Michigan Shoreline	20	0	103.38	Mercury	Contaminated Fish Tissue	Contaminated Sediments	303d Listed
Lake Michigan Shoreline	20	0	103.38	PCBs	Contaminated Fish Tissue	Contaminated Sediments	303d Listed
Sauk Creek	49500	0	15.9	Total Phosphorus	Water Quality Use Restrictions	Non-Point Source (Rural or Urban)	303d Listed
Sucker Creek	50100	0	10.19	Total Phosphorus	Degraded Biological Community	NA	303d Listed

Fish Consumption

Wisconsin's fish consumption advisory is based on the work of public health, water quality, and fisheries experts from eight Great Lakes states. Based on the best available scientific evidence, these scientists determined how much fish is safe to eat over a lifetime based on the amount of contaminants found in the fish and how those contaminants affect human health. Advisories are based on concentrations of contaminants, along with angler habits, fishing regulations, and other factors.

In 2001, Wisconsin adopted a statewide general fish consumption advisory that applies to all (non-Great Lakes) waters of the state based on statewide distribution of mercury in fish and species differences in mercury concentrations. The statewide general advisory eliminated the need for many of the pre-2001 advisories because the equivalent of more stringent advice now applied through the general advisory. In addition to the statewide general advisory, some waters still require more stringent advice or exceptions to the general advisory. Exceptions to the general advice apply to some species of fish from specific waters where higher concentrations of mercury, PCBs, or other chemicals require advice more stringent than the general advisory. More information about the specific consumption advisory can be found in

the publication: Choose wisely: a health guide for eating fish in Wisconsin [PUB-FH-824], which is found online at http://dnr.wi.gov/topic/fishing/consumption/index.html.

AIS Species

Lake Michigan hosts a variety of Aquatic Invasive Species, including the following: Eurasian Water Milfoil, Fishhook Waterfleas, Spiny Waterfleas, Zebra Mussels, Rainbow Smelt, and Round Goby. In addition, Rusty Crayfish are common in Sauk Creek. It should be noted that there are invasive plant species that exist in wetland and riparian areas along Sauk and Sucker Creek, including Japanese knotweed, purple loosestrife, garlic mustard, glossy buckthorn, and reed canary grass.

State Natural and Wildlife Areas

An amendment to the regional natural areas and critical species habitat protection and management plan for Southeastern Wisconsin was completed by SEWRPC in 2010. The plan seeks to identify and protect what remains of the landscape of the region as it existed pre-European settlement. The plan also seeks to identify and protect other areas found to be vital to the maintenance of endangered, threatened, and rare plant and animal species. Both plan objectives foster biodiversity in the Region. Under the plan, natural areas are defined as tracts of land or water so little modified by human activity, or which have sufficiently recovered from the effects of such activity, that they contain intact native plant and animal communities believed to be representative of the pre-European-settlement landscape.

Critical species habitats are defined as additional tracts of land or water which support endangered, threatened, or rare plant or animal species. Eight natural areas, totaling 446 acres were identified in the Sauk Creek watershed. Two natural areas, totaling 199 acres, are protected within the watershed under public ownership; five natural areas, totaling 232 acres within the watershed, are under unprotected private ownership; and one natural area, totaling 15 acres, is protected within the watershed under partial private, partial public, and partial private conservation ownership. The eight natural areas were identified, ranked according to their quality, and classified into one of the following three categories:

1. NA-1 Areas: native biotic communities of statewide significance that contain excellent examples of nearly complete and relatively undisturbed plant and animal communities that are believed to closely resemble those present during pre-European settlement times.

2. NA-2 Areas: native biotic communities that are judged to be of lower than NA-1 significance, perhaps on a county or regional basis. These areas are probably so designated because of evidence of a limited amount of human disturbance. They may also be of a high biotic quality, but of less than the minimum size necessary for an NA-1 ranking. In the future, some NA-2 sites may become of higher significance because of recovery from past disturbance, because of a sudden substantial decrease in the acreage of a once-common type, or after a more detailed inventory.

3. NA-3 Areas: native biotic communities substantially altered by human activities, but yet of local natural area significance. These sites often contain excellent wildlife habitat and also provide refuge for a large number of native plant species that no longer exist in the surrounding region because of land use activities. Specifically, the classification of an area into one of the foregoing categories is based upon consideration of the diversity of plant and animal species and community types present; the expected structure and integrity of the native plant or animal community; the extent of disturbance from human activities, such as logging, grazing, water-

level changes, and pollution; the commonness of the plant and animal communities present; any unique natural features within the area; and the size of the area.

There were no natural areas within the Sauk or Sucker Creek watersheds that were ranked NA-1; one natural area was ranked NA-2; and seven natural areas were ranked NA-3. The total of 446 acres included within designated natural areas represents about 1 percent of the watershed. Four critical species habitat sites, totaling 472 acres, were identified within the Sauk and Sucker Creek watershed. Two of these sites, totaling 408 acres, are under public ownership, and two sites, totaling 64 acres, are under private ownership.

Monitoring Project Discussion

Purpose of Project

In 2014, the aquatic biological communities of the Sauk Creek sub-watershed (HUC 12) within the larger Sauk-Sucker Creek Watershed were surveyed and assessed required under Section 305(b) of the Clean Water Act. And, if problems were to be found, determine the listing eligibility of the waterbody for placement onto the 303(d) list under the Clean Water Act. And finally, as a result of the overall assessment of Sauk Creek and tributaries, make recommendations to be used as a planning guide.

Site Selection and Study Design

The watershed study within the Sauk Creek sub-watershed utilized historical survey locations studied by DNR biologists in 2010 and in preceding years. The sites selected represent good special coverage of the sub-watershed, capture stream habitat (natural vs. ditched) and contributing land area (urban vs. agriculture vs. mixed woodland-agriculture).

At each sampling location, a single fish and qualitative fish habitat survey was completed; with the fish community assessed using either a backpack or towed electro shocker. At each same stream segment, a single Total Phosphorus water quality grab sample was taken, and later sampled for aquatic macroinvertebrates. Additionally, one location, representing the lowest portion of the sub-watershed, was sampled monthly five additional times for Total Phosphorus.

Table 2: List of monitoring stations in the 2014 Sauk Creek TWA.

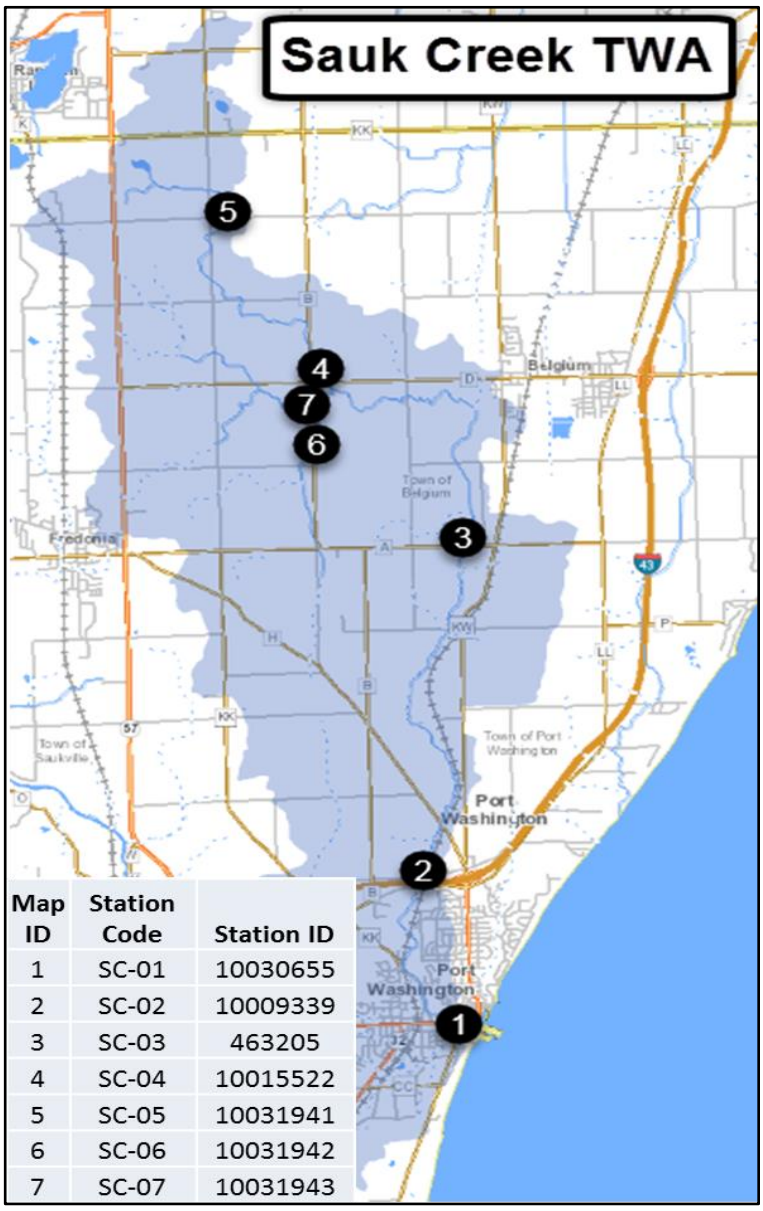
Station ID	Station Code	Station Name	WBIC	Water Body Name
10030655	SC-01	Sauk Creek - South Wisconsin Street	49500	Sauk Creek
10009339	SC-02	Sauk Creek Upstream Of Mink Ranch Road	49500	Sauk Creek
463205	SC-03	Sauk Creek at Cth A Near Fredonia WI	49500	Sauk Creek
10015522	SC-04	Unnamed Tributary to Sauk Creek - Upstream Of Cth D	49700	Unnamed
10031941	SC-05	Unnamed Tributary to Sauk Creek - Upstream of Jay Road	49700	Unnamed
10031942	SC-06	Unnamed Tributary to Sauk Creek - Upstream of CTHY B	49900	Unnamed
10031943	SC-07	Sauk Creek - Upstream of CTHY B	49500	Sauk Creek

Methods, Equipment and Quality Assurance

All sampling activities followed accepted WDNR sampling protocols. For fish community assessments, a single backpack shocker or towed electroshocker was used of a set distance of 35 times mean stream width, or 100 meters if the stream was less than three meters in width. The collected fish were then identified and counted. At each fish sampling location, a qualitative habitat survey was also conducted. Aquatic macroinvertebrates were collected from a riffle within the fish sampling site using a kick-net. The collected macroinvertebrates were then sent to UW-Stevens Point aquatic Entomology Lab for identification and indexing.

Project Results

Seven monitoring stations were sampled during the 2014 field season in Sauk Creek and tributaries . Based on fish surveys (Table 3) in the watershed, the modeled natural communities at each of the seven monitoring stations were able to be verified (Table 4). Sauk Creek has a cool-warm natural community at 6 of the seven monitoring stations. Fish surveyed at Station ID 10030655 indicate a cool-cold transition headwater natural community, not the modeled natural community of cool-warm transition headwater.



Map ID	Station Code	Station ID
1	SC-01	10030655
2	SC-02	10009339
3	SC-03	463205
4	SC-04	10015522
5	SC-05	10031941
6	SC-06	10031942
7	SC-07	10031943

Figure 3: Map of the 7 monitoring stations in the Sauk Creek TWA.

Table 3: Sampled number and fish species at 7 monitoring stations in the 2014 Sauk Creek TWA.

Fish	Station Code						
	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7
Black Bullhead	6						
Bluegill	1				2		
Bluntnose Minnow							
Breek Stickleback		9	30	2	4	7	82
Brown Trout	2						
Central Mudminnow			19	15	2	128	21
Central Stoneroller	9	92	2	56			2
Creek Chub	21	171	1	43	3		1
Common Shiner				3			
Fathead Minnow	1		4	1	2	4	7
Golden Shiner							
Green Sunfish	3						
Johnny Darter	3	136		60		3	39
Largemouth Bass	2	3		1			2
Longnose Dace	5						
Mottled Sculpin	113	167		51	1		6
Pearl Dace				4			
Pumkinseed Sunfish	1						
Pumkinseed/Bluegill Hybrid							
Rainbow Trout	71	3					
Round Goby							
Southern Redbelly Dace		15		1			
Western Blacknose Dace	27	232		15			
White Sucker	6	43	4	33	6		1

Table 4: Modelled and verified or changed natural community at 7 monitoring stations in the Sauk Creeks TWA.

Station Name	Station Code	SWIMS Station ID	Modeled Natural Community	Verified Natural Community
Sauk Creek upstream of S. Wisconsin Avenue	SC-01	10030655	Cool-Warm Headwater	Cool-Cold Headwater
Sauk Creek upstream of Mink Ranch Road	SC-02	10009339	Cool-Warm Headwater	Cool-Warm Headwater
Sauk Creek upstream of CTH A	SC-03	463205	Cool-Warm Headwater	Cool-Warm Headwater
Unnamed Tributary to Sauk Creek upstream of CTH D	SC-04	10015522	Cool-Warm Headwater	Cool-Warm Headwater
Unnamed Tributary to Sauk Creek upstream of Jay Road	SC-05	10031941	Cool-Warm Headwater	Cool-Warm Headwater
Unnamed Tributary to Sauk Creek upstream of CTH B	SC-06	10031942	Cool-Warm Headwater	Cool-Warm Headwater
Sauk Creek upstream of CTH B	SC-07	10031943	Cool-Warm Headwater	Cool-Warm Headwater

Water chemistry and biological parameters were taken at all seven monitoring stations. Six total phosphorus samples were taken at SC-1 (SWIMS Station ID; 10030655) throughout the growing season (May – October) and one phosphorus grab sample was taken at the other 6 monitoring stations (Table 5). Dissolved oxygen was taken once at each of the monitoring stations during 2014and ranged from 0.83mg/L (SC-6) to 11.6mg/L (SC-1) (Table 4).

The Hilsenhoff's Biotic Index ranged Poor with a score 7.527 (SC-2) to Very Good with a score of 4.497 (SC-1) (Table 5). The Macroinvertebrate IBI (MIBI) score ranged from 0.8386 (Poor) to 7.142 (Good). The Fish IBI (FIBI) score ranged from Poor with a score of 30 (SC-6) to Excellent with a score of 100 (SC-4 and SC-7) (Table 5).

Table 5: Water chemistry and biology at 7 stations in the 2014 Sauk TWA.

Parameter	Station Code						
	SC-1	SC-2	SC-3	SC-4	SC-5	SC-6	SC-7
TP (mg/L)	0.104, 0.399 0.121, 0.172 0.339, 0.0831	0.328	0.432	0.262	0.214	0.61	0.366
DO (mg/L)	11.6	10.08	5.26	8.56	6.89	0.83	5.97
Hilsenhoff's Biotic Index (Score)	Very Good (4.497)	Fair (5.996)	Poor (7.527)	Good (5.45)	Fairly Poor (7.392)	Fairly Poor (7.36)	Fairly Poor (6.58)
Macroinvertebrate IBI (Score)	Fair (2.934)	Fair (2.942)	Poor (1.874)	Poor (2.98)	Poor (0.8386)	Poor (2.07)	Good (7.142)
Appropriate Fish Index of Biotic Integrity* (Score)	Excellent (90)[1]	Excellent (70)[1]	Fair (30)[1]	Excellent (100)[2]	Good (70)[2]	Poor (30)[2]	Excellent (100)[2]
* Appropriate Fish Index is either Cool-Water[1] or Small Stream[2]							

Discussion

River/Stream Health

Sauk Creek is classified as a cool-warm transitional headwater, and is confirmed as such by comparing the biological community with its modeled ranking – with the exception of the portion of Sauk Creek from the mouth at Lake Michigan upstream approximately 0.3 miles. This stream portion (SC-1) has a fish community that better reflects cold-cool transitional headwater communities. This section scores as excellent for fish, and has a fair macroinvertebrate community. And comparing sampling conducted in 2010 with 2014, shows a trend of improvement in the macroinvertebrate community. Total Phosphorus at this location was measured six times during the growing season, and all readings were above 0.075 mg/L, indicating impaired conditions.

The next assessed stream portion is 2.4 miles upstream at Mink Ranch Road (SC-2). This section has an excellent fishery, with Rainbow Trout (stocked) and sculpin present. However, compared with the 2002

and 2010 information, there is a slightly increasing trend in the macroinvertebrate community HBI score, representing a positive trending organic load. The Total Phosphorus reading was 0.328 mg/L.

Sauk Creek at County Highway A (SC-3) is the last location where the Cool Water Index of Biotic Integrity is utilized for comparing fish communities, and in this location, the fishery is considered Fair. From 2002 to 2014, this site shows the most in declining overall water quality. Both fish and macroinvertebrate scores trend over this time in a negative direction. The Total Phosphorus reading was 0.432 mg/L.

Sauk Creek at County Highway B (SC-7) has seen a positive trend in both its macroinvertebrate community and fish community, trending from poor to fairly poor (macroinvertebrates), and from good to excellent for its fish community. The Total Phosphorus reading was 0.366 mg/L.

The Unnamed Tributary to Sauk Creek at County Highway D (SC-4), like Sauk Creek at County Highway B, has a fish community that is more properly scored with the Small Stream IBI. The fish community here scores as excellent, and has a good macroinvertebrate community. The Total Phosphorus reading was 0.262 mg/L.

The Unnamed Tributary at Jay Road (SC-5) is very near the headwaters at Ludowissi Lake, and despite the heavy surrounding agriculture and its channelized nature, scores as good for its fishery. The Total Phosphorus reading at this site was 0.214 mg/L.

The Unnamed Tributary at County Highway B (SC-6) showed, in 2014, the only poor fish community in the assessment. This is a decline from its fair ranking in 2010. Filamentous algae growth in the assessed section was significant. Additionally, readings of DO were very low at this location. The Total Phosphorus reading was 0.61 mg/L, the highest reading of the study.

Watershed Condition

The majority of the streams within the Sauk and Sucker Creek watersheds have natural community classifications of cool-warm transition headwaters. There are a few smaller streams that are classified as macroinvertebrate streams or have no classification, and the lower portion of Sauk Creek in the City of Port Washington could be classified as cool-cold transition headwater. Overall, the water quality of Sauk Creek could be considered as good to poor. Fish and macroinvertebrate communities rated excellent to poor in both the lower and upstream reaches, with ratings varying at each site, depending upon the index used. In some cases, excellent fish community sites co-exist with macroinvertebrate sites rated as poor (Table 5).

Across the sub-watershed, it is stream habitat, especially within the headwater areas that is a limiting factor. Stream channelization, along with associated sedimentation from runoff and bank erosion, are limiting factors that negatively impair fish and macroinvertebrate populations. Heavy growth of filamentous algae on the stream bottom, which was especially apparent at site SC-6, also degrades the habitat and water quality. Water chemistry monitoring was done in 2014 at the monitored sites, and showed elevated concentrations of Total Phosphorus that exceed Wisconsin's water quality standard for all sample locations. Dissolved oxygen levels did not appear to be a problem in either stream when sampling was done, with the exception of SC-6. This tributary to Sauk Creek had very low readings during the fish community sampling event.

Other streams within the wider Sauk-Sucker Creek Watershed were not sampled in 2014. Ozaukee County has done extensive work within the Watershed to improve fish passage, including work on Mineral Springs Creek, and Sucker Creek.

Lake Health

There are three lakes within the Sauk and Sucker Creek Watershed, although none were assessed during 2014. Ludowissi Lake is in the headwaters of Sauk Creek with a surface area of 11 acres and a maximum depth of 25 feet. Recent satellite data from Ludowissi Lake suggest the lake is supporting its fish and aquatic life designated use.

Grasser Lake is located within Sheboygan County, is 10.7 acres in size, and has a maximum depth of 33 feet. The third lake is an unnamed lake located within Harrington Beach State Park. This "lake" is actually an abandoned quarry that flooded many years ago. It is 23 acres in size and has a maximum depth of 47 feet. Little is known regarding the latter two lakes because of limited monitoring.

Port Washington Harbor is the first manmade harbor on Lake Michigan, constructed in the 1870s. In addition to providing safe haven for vessels, the harbor received shipments of coal since the Port Washington Power Plant was constructed in the 1930s. Sauk Creek discharges to the harbor.

Since that time, a recreational marina was constructed in the harbor. Two channel slips also provide dock space for recreational and charter boats. The cooling water discharge for the ***We Energies*** Power Plant, recently converted to natural gas in place of coal, discharges to the harbor. The City of Port Washington Sewage Treatment plant outfall also discharges to the harbor. The harbor was last dredged by the US Army COE in 2004. However, there are no known sediment contamination issues in this harbor.

Management Actions

Management Priorities

- Identify areas throughout the watershed where stream habitat can be restored. Seek funds and programs to support these efforts.
- Identify the primary sources of phosphorus in the watershed and pursue local runoff management and river/stream grants to reduce phosphorous inputs into local resources.
- Identify potential partners and stakeholders to participate in an overall awareness and behavioral change program in the watershed that will result in reduced erosion and phosphorus inputs.

Restoration Goals

- Reduce nutrient loadings to the Watershed.
- Expand aquatic life passage within the Watershed.
- Expand and improve existing wetlands.

Monitoring and Assessment Recommendations

- The DNR should update its databases to reflect updated natural community confirmation data or recommendations for changes to reflect current fish assemblages in the watershed.
- DNR should conduct a follow-up site visit should be made to Mineral Springs Creek (49600**),** a tributary of Sauk Creek, in order to confirm that this source of contamination has been removed and that remediation has taken place.
- DNR should continue to work with partners to gather ambient data on sediment, biology and phosphorus to monitor the effectiveness of best management practices as they are implemented throughout the watershed for the restoration of Sauk and Sucker Creeks.
- Citizen-Based Stream Monitors should be recruited to assist with on-going Watershed monitoring for phosphorus and other key parameters.

- Sauk and Sucker Creeks Watershed should continue to be considered as a high priority for runoff and urban NPS grants and river grants based on the total phosphorus impairments and related urbanization issues.

Management Recommendations for DNR

- A map of invasive species should be made for all sites throughout the watershed through updating information based on monitoring data.
- Water quality biologists should continue to assist Ozaukee County in identifying drain tile connections from septic systems and milk-house wastes to surface waters in the Sauk and Sucker Creeks Watershed and facilitate the corrections.
- A permit compliance inventory should be conducted by reviewing wastewater and stormwater discharges in the Sauk and Sucker Creeks Watershed; DNR could work with SEWRPC on this project.
- The Department and partners should facilitate and provide incentives for increased management by private landowners, organizations, businesses, municipalities and agencies to monitor and control the invasion by non-native species in the Sauk and Sucker Creeks Watershed.
- Water quality biologists should continue working with the communities, Ozaukee Land Conservation Department, agricultural community and others to improve the water quality by decreasing sediment runoff, nutrient loads, and stormwater runoff to Sauk & Sucker Creeks.
- The Department should work with local entities to inventory and improve construction site erosion and stormwater management ordinances that minimize runoff from agricultural and developed areas.
- Fisheries and water quality staff should continue to work with external partners on habitat improvement projects on Sauk and Sucker Creeks.
- The Department should assist Ozaukee County Land Conservation Department in obtaining stream bank buffers along all of the streams in the county.
- Restoration and management of key wetlands, woodlands, and shorelands in the Sauk and Sucker Creeks Watershed should occur.
- DNR should assist local communities to minimize polluted runoff from agricultural areas in the Sauk and Sucker Creeks Watershed. As funding for farm conservation practices is limited, resources should be directed to the highest priority runoff areas first. Goals should include reducing soil erosion, controlling animal waste runoff, and meeting nutrient management requirements. DNR models or local models can be used to most effectively target highest priority locations.

Management Recommendations for External Partners

- DNR should work with local communities to expand public access and fishing opportunities within the Watershed.
- Where possible, innovative partnerships with nonprofits, schools, and UW Extension should be pursued to expand educational programs at the local, county and regional planning agency level.
- The City of Port Washington and the county should continue implementation of its stormwater program and provide updates on key milestones and performance goals if that data is available.

Appendix A: References

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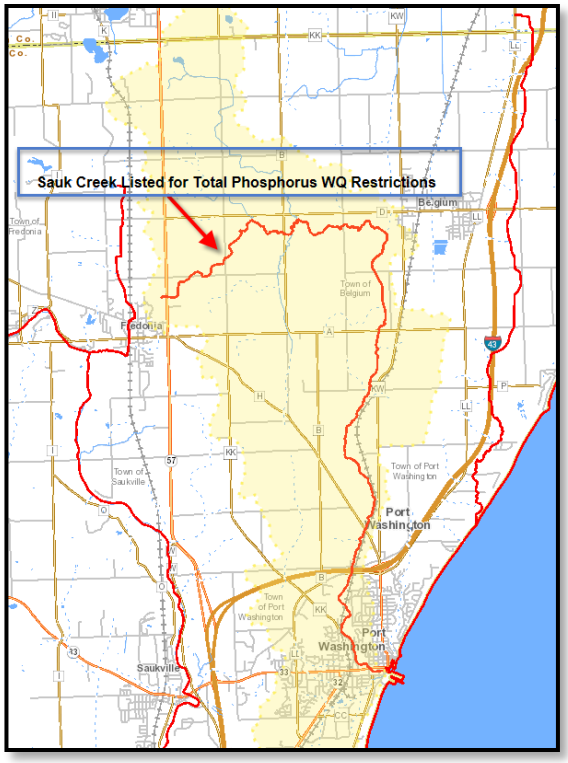
Appendix B: Stream Narratives

Sauk Creek

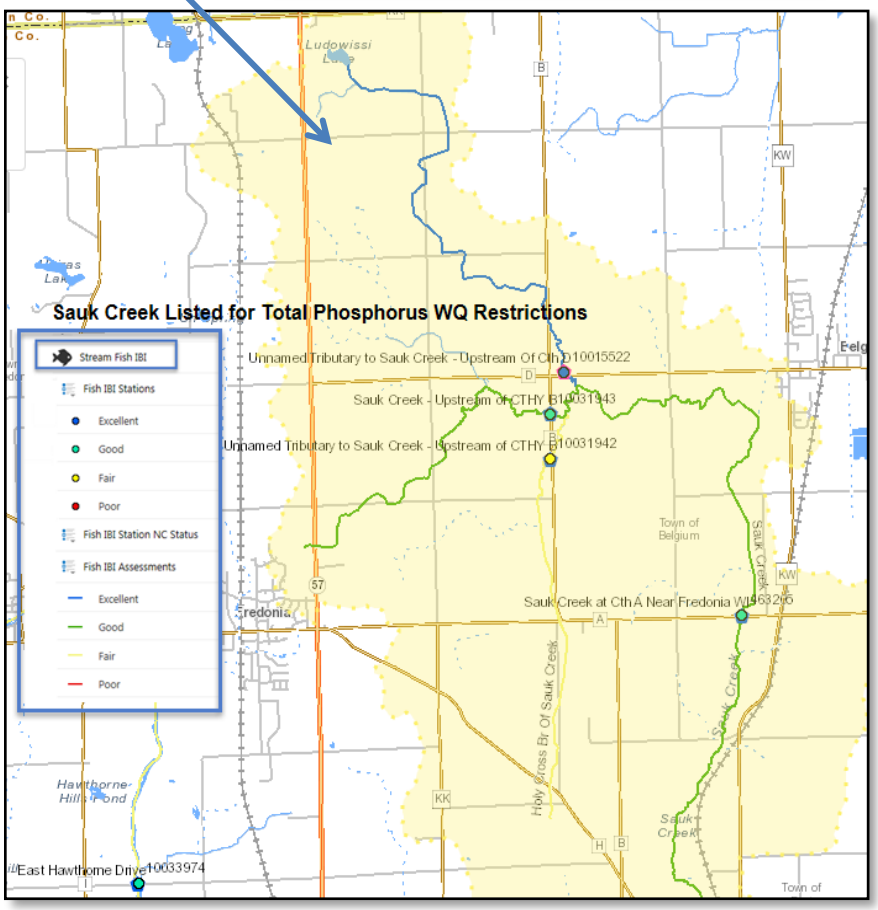
WBIC: 49500



Sauk Creek is the major waterway in this watershed and Ozaukee County (see figure at right). The stream flows south and enters Lake Michigan in Port Washington. Sauk Creek originates within Ozaukee County just north of Fredonia at T12N R21E Sec. 26, just west of STH 57. The convergence of three branches (Ludowissi Lake Branch, Hickory Grove Branch, and Holy Cross Branch) makes up the headwaters of Sauk Creek. The southwestern headwater and mainstem are listed as "impaired" for total phosphorus affecting water quality uses.

The Ludowissi Lake Branch of Sauk Creek originates from Ludowissi Lake and flows southerly 5.9 stream miles to the main branch of Sauk Creek. In the most recent assessment (2017/18), the Ludowissi Lake Branch fish IBI value indicates 'excellent' water quality and is meets fish and aquatic use uses (see map below).

The Hickory Grove Branch of Sauk Creek originates north of Hickory Grove Road and flows southerly 2.3 stream miles to a confluence with the main branch of Sauk Creek. The Holy Cross Branch of Sauk Creek originates south of Holy Cross and flows north 3.6 miles to a confluence with Sauk Creek. All three headwater branches are confluent with the main branch of Sauk Creek within a 1.5 mile reach just south of CTH D near CTH B.



Sauk Creek was listed for total phosphorus in 2012 (see right). The stream was again assessed in 2016 and 2018. Total phosphorus sample data overwhelmingly exceed WisCALM listing thresholds for the Fish and Aquatic Life use; however, available biological data (macroinvertebrate and fish data) do not indicate biological impairment, although macroinvertebrate values

were in the "fair" range). Based on the most updated information, no change in existing impaired waters listing is needed. (2017)

Sucker Creek
WBIC: 50100

Sucker Creek is the second largest stream in this watershed and originates in Sheboygan County just north of the Ozaukee County line. Sucker Creek flows south into Ozaukee County along the I-43 corridor past Lake Church, entering Lake Michigan north of the City of Port Washington. Sucker Creek is modeled as a Cool-Warm Headwater. Based on a 2010 fish survey using the intermittent IBI, the stream is considered "fair" for fish biology. However, the stream is listed as impaired for total phosphorus criteria exceedance. The 1999 survey found central stoneroller, shiners, dance, chub, sucker, stickleback, green sunfish, pumpkinseed, bluegill and johnny darter. Don Fago's exhaustive analysis of fish distribution in th4e 1980s found fourteen species of fish, primarily consisting of forage fish species, historically collected in Sauk Creek (Fago, Don. 1992). Trout and salmon from Lake Michigan are also found in the stream during their seasonal spawning runs (2001).

Sucker Creek was placed on the impaired waters list for total phosphorus in 2012. The 2016 assessment showed continued impairment by phosphorus; total phosphorus sample data exceed WisCALM listing criteria for the Fish and Aquatic Life use and biological impairment was observed (i.e. at least one macroinvertebrate or fish Index of Biotic Integrity (IBI) scored in the poor condition category). This water was also assessed for temperature and sample data did not exceed 2018 WisCALM listing criteria for the Fish and Aquatic Life use. Based on the most updated information (2011), no change in existing impaired waters listing is needed (2015, updated 2017).

Grasser Lake
WBIC: 45600

This is a small, moderately deep lake in the end moraine of the south central portion of the county. It has a surface area of 10.7 acres and has a maximum depth of 33 feet. Historically, the lake's water has been clear; the bottom consisting primarily of muck with some gravel. Largemouth bass, panfish and perch supply the main fishery. The lake is landlocked and develops a thermocline in midsummer at 11 feet. One acre of surrounding wetlands (non-wood) provides good habitat for mallards and teal. Water quality and clarity of this lake is excellent, and historical records indicate that this lake warrants high priority for acquisition of a public access to utilize recreational values. (2017)

Ludowissi Lake
WBIC: 49800

(Overview 02/01/2001 Ludowissi Lake is a small, moderately deep seepage lake contained within a terminal moraine of red glacial till. This lake is in the headwaters of Sauk Creek, the Ludowissi Lake Branch of Sauk Creek. It has a surface area of 11 acres and a maximum depth of 25 feet. Ludowissi Lake is supporting its fish and aquatic life designated use as indicated by recent satellite data.

Lake Michigan Upper Lake Park Beach

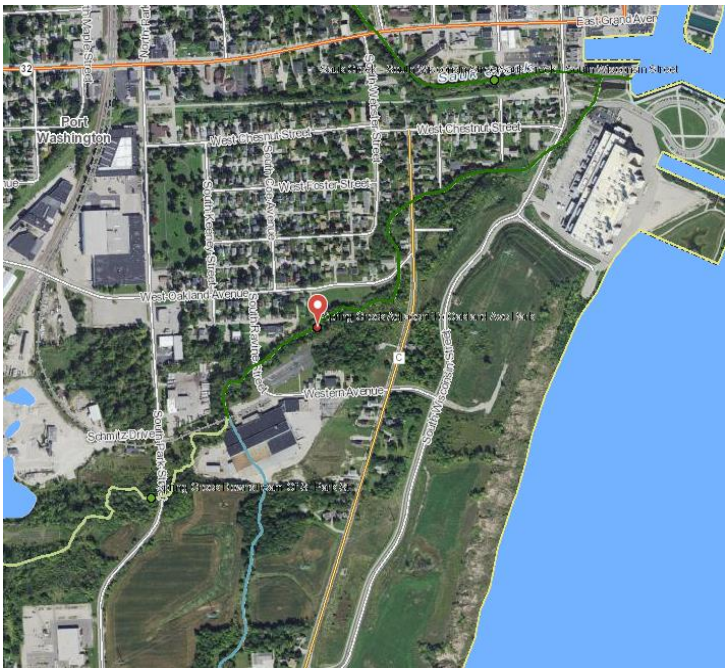
Upper Lake Park Beach on Lake Michigan was assessed for impairment based on E. coli and found to be meeting recreational use standards and in good condition. These assessments are important as bacterial pollution in coastal waters is caused by a combination of point and nonpoint sources of pollution. Although point sources of bacterial contamination (e.g., industry, wastewater treatment facilities) may be significant, nonpoint source pollution poses a tremendous threat to the integrity of

recreational water. Agricultural and urban runoff delivers a diverse mixture of chemical and biological contaminants and is discharged from countless undefined sites within a given watershed. Pollutants that accumulate in storm water as they are washed off impervious surfaces are then discharged into local waterways. With increasing urbanization of the nations' coastal areas, pollution of waterways by storm water is a growing concern.

Unnamed Tributary to Sauk Creek

WBIC: 49600

Just upstream of the confluence between Sauk Creek and the Port Washington Harbor on Lake Michigan, a small tributary known locally as Mineral Springs Creek (WBIC 49600) joins Sauk Creek through property owned by ***We Energies***. The stream is approximately 2.7 miles in length and drains areas to the south and southwest portions of Port Washington including the city industrial park. The outlet of the stream on the Wisconsin Electric Power Company property has been channelized and is lined with gabions to stabilize the stream banks. Although the culvert at the mouth of this creek is elevated, several feet above the elevation of Sauk Creek there have been informal reports of salmonids reaching upstream portions of the stream during past spawning runs. There is also a report of an old dam on the stream above the We Energies property.

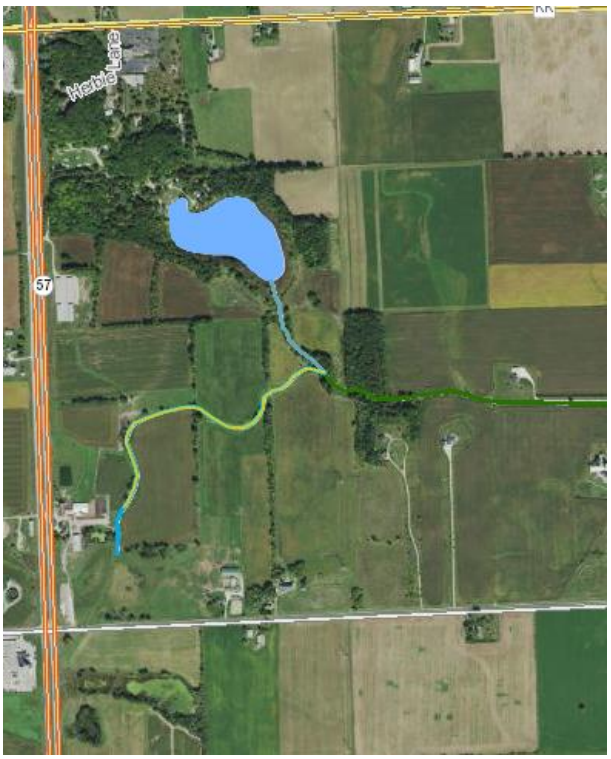


Fish and habitat assessments have been conducted over the years. The stream is modeled as a cool-warm headwater with known tolerant fish, indicating impacts from runoff and related issues. Trout and salmon from Lake Michigan are also found in the stream during their seasonal spawning runs and may provide some angling opportunities in pools although access is difficult due to steep stream banks.

Land use adjacent to the lower reaches of this stream is primarily industrial with a former Murphy (Spur) Gasoline Tank Farm is located adjacent to one of its branches. A water quality survey in 1982 identified potentially contaminated leachate from the site reaching the stream. A sediment sample was collected from the stream on June 25, 1998 in a depositional area just downstream from the former gas tank site (40 ft. upstream of S. Park St.). The concentrations of metals, PAHs, and PCBs are consistent with the concentrations observed in urban streams. A follow up site visit to Mineral Spring Creek (49600**)** a tributary of Sauk Creek, should be made to confirm that this source of contamination has been removed and that remediation has taken place.

Ludowissi Lake Branch To Sauk Creek

WBIC: 49700



The Ludowissi Lake Branch of Sauk Creek originates from Ludowissi Lake (T12N R21E Sec. 1) and flows southerly 5.5 stream miles to the main branch of Sauk Creek at T12N R22E Sec. 20. In 1994 a macroinvertebrate sample was collected from this branch just upstream of the confluence with the main branch south of CTH D. In the 1990s, the biotic index (HBI) rating indicated fair water quality at this site. A fish and habitat survey was conducted in 1999 upstream of CTH D. The fish community assessments and tolerance to pollution for each fish species has been analyzed as well as the HBI (Hilsenhoff Index of Biotic Integrity) and habitat rating scores (2001).

The very headwaters of Sauk Creek, in the Ludowissi branch, a large drain tile is located at Jay Road just east of STH 57. The water then flows north behind a barnyard and pasture then easterly to a confluence with the tributary from Ludowissi Lake. Cedar Valley Cheese is located at the southwest corner of Jay Road and STH 57 in Ozaukee County, discharges irrigated waste high in chlorides across Jay Road to the north, west of STH 57. In spring of 1998 water from the irrigated field was observed flowing from the drain tile under STH 57 (easterly direction) to a farm swale between the manure storage facility and barn, across the pasture to the headwaters of Sauk Creek. The water from the irrigated field was observed entering the headwaters of Sauk Creek (Ludowissi branch) at T12N R21E S1 NWSW (WDNR 1998). Chlorides are toxic to freshwater aquatic organisms (1999). In 1999 the large drain tile that the stream originates from discharged organic rich sludge to the stream. Corrective actions were taken in late 1999 to stop the source, flush the tile line, and remove sludge from the stream.

Macroinvertebrate samples were collected at two sites in 1999, one just below the stream reach with the sludge and another 1.2 river miles downstream from there at CTH D. The HBI index, which is a measure of the degree of organic pollution rated the water quality poor at the first site (HBI score 8.27) and the stream showed some improvement at the downstream site with a water quality rating of Fair (HBI score 6.06) upstream of CTH D. Diel (24 hour) dissolved oxygen concentrations were recorded for three days in late July 1999 from the same two stream reaches. The dissolved oxygen (DO) concentration recorded downstream of Jay Road below the drain tile and sludge shows very low DO concentrations at levels that are prohibitive of most aquatic life. The DO concentrations recovered to more normal levels within 1.2 miles downstream to Kay-K Road."

Hickory Grove Branch of Sauk Creek
WBIC: 50000

(Overview 02/01/2001) This branch of Sauk Creek has been unofficially called the Hickory Grove branch for descriptive purposes. The Hickory Grove Branch of Sauk Creek originates north of Hickory Grove Road and flows southerly 2.3 stream miles to a confluence with the main branch of Sauk Creek.
In December 1999 the water quality biologist observed a white liquid in the stream at Kay-K Road. The discharge was traced to a drain tile that was determined to be connected to a milk house. The connection has since been corrected and no longer discharges to the stream. A fish and habitat survey was conducted in 1999 upstream of CTH D.

Holy Cross Branch of Sauk Creek
WBIC: 49900

Holy Cross Branch of Sauk Creek was assessed during the 2018 listing cycle; new biological data (M-IBI scores were clearly below 2018 WisCALM listing thresholds for the Fish and Aquatic Life use indicating that the water is meeting its designated use and is not considered impaired.

Port Washington Harbor
WBIC: 32

The first manmade harbor on Lake Michigan at Port Washington was constructed in the 1870's. In addition to providing safe harbor for vessels, the harbor received shipments of coal since the Port Washington Power Plant was constructed in the 1930's. Sauk Creek discharges to the harbor. A recreational marina was constructed in the harbor and two channel slips also provide dock space for recreational and charter boats. The cooling water discharge for the We Energies power plant (which was recently converted to natural gas in place of coal) discharges to the harbor. The City of Port Washington Sewage Treatment plant outfall also discharges to the harbor. The harbor was dredged by the US Army COE in 2004. As of 2011, there were no known sediment contamination issues in this harbor (2011).

Appendix C: Monitored Waters

WBIC	NAME	STATION ID	NAME	EARLIEST DATE	LATEST DATE
20	Lake Michigan	10017752	Lake Michigan -- Port Washington	06/18/2009	09/21/2016
20	Lake Michigan	10012640	Lake Michigan - Harrington State Park North 46-003	05/19/2003	09/04/2016
46800	Unnamed	10004746	Unnamed Lake (T12 R23E S19)	09/08/2000	08/01/2015
49600	Unnamed	10044240	Unnamed Trib (WBIC=49600) to Sauk Cr Chestnut St and Wisconsin St	07/01/2015	07/01/2015
50100	Sucker Creek	10030656	Sucker Creek - Sucker Brook Lane	10/20/2009	01/01/2015
49500	Sauk Creek	10030655	Sauk Creek - South Wisconsin Street	10/20/2009	01/01/2015
49700	Unnamed	10015522	Unnamed Tributary to Sauk Creek - Upstream Of Cth D	11/04/2010	11/07/2014
49500	Sauk Creek	10009339	Sauk Creek Upstream Of Mink Ranch Road	11/07/2002	11/07/2014
49500	Sauk Creek	463205	Sauk Creek at Cth A Near Fredonia WI	10/07/1997	11/07/2014
49500	Sauk Creek	10031943	Sauk Creek - Upstream of CTHY B	11/04/2010	11/07/2014
49900	Unnamed	10031942	Unnamed Tributary to Sauk Creek - Upstream of CTHY B	11/04/2010	11/07/2014
49700	Unnamed	10031941	Unnamed Tributary to Sauk Creek - Upstream of Jay Road	11/04/2010	11/07/2014
49800	Ludowissi Lake	10004747	Ludowissi Lake	09/08/2000	09/23/2014
45600	Grasser Lake	10005795	Grasser Lake	09/08/2000	09/23/2014
3000496	Unnamed	10037503	Unnamed stream (3000496) US hales trail	08/21/2013	11/12/2013
50100	Sucker Creek	463071	Sucker Creek US Cedar Beach Rd	05/12/1980	11/12/2013
50100	Sucker Creek	10031617	Sucker Creek at High Point Beach Rd	07/16/2010	09/16/2011
50100	Sucker Creek	10031615	Sucker Creek at Pebble Beach Rd	07/16/2010	09/16/2011
WBIC	NAME	STATION ID	NAME	EARLIEST DATE	LATEST DATE

50100	Sucker Creek	10031616	Sucker Creek at CTH D	07/16/2010	08/15/2011
50100	Sucker Creek	10031777	Sucker Creek - 10 meters upstream of Sandy Beach Road	11/09/2010	11/09/2010
50100	Sucker Creek	10031946	Sucker Creek - Upstream of Silver Beach Road	11/09/2010	11/09/2010
49700	Unnamed	463067	Sauk Creek at Cth D (Bi Survey)	05/15/1980	07/22/2009
20	Lake Michigan	463209	Lake Michigan - Harrington Beach State Park Beach	08/07/2001	05/22/2006
49700	Unnamed	10015784	Unnamed Trib To Sauk Creek - Local Name - Ludowissi Lake Branch downstream Of Jay Road And Mueller Farm	11/16/1999	11/16/1999
NA	NULL	463052	Sauk Creek Tributary Of - Murphy Oil Corp.	03/08/1977	11/09/1999
49600	Unnamed	463148	Sauk Creek Unnamed Tributary To - Spring Creek; Middle Branch To Sauk Cr	06/25/1998	11/09/1999
49800	Ludowissi Lake	463149	Ludowissi Lake - Br Of Sauk Creek	06/21/1999	10/26/1999
50100	Sucker Creek	10008224	Sucker Creek - Sucker Creek	10/20/1999	10/20/1999
49500	Sauk Creek	10008217	Sauk Creek - Sauk Creek Fredonia Branch	10/20/1999	10/20/1999
49500	Sauk Creek	10015749	Sauk Creek - Holy Cross Branch Sauk Creekupstream Of Cth B	10/20/1999	10/20/1999
49500	Sauk Creek	463116	Sauk Creek - 1.1 Mi Upstream Six Mi Rd	04/25/1994	10/20/1999

Appendix D: Watershed Report[i]

Waterbody Name	Start Mile	Mile or Acres	Current Use	Attainable Use	Supporting Attainable Use	Designated Use	Impairments	Sources	Assessment	Impaired Water Status
Lake Michigan Shoreline	0	103.38	WWSF	WWSF	Supporting	Default FAL	NA	NA	Monitored	303d Listed
Cedar Beach, Lake Michigan	0	0.7	FAL	FAL	Not Assessed	Default FAL	NA	NA	Monitored	Water Delisted (Recreational use)
County Road D Boat Launch Beach, Lake Michigan	0	0.37	FAL	FAL	Not Assessed	Default FAL	NA	NA	Monitored	Water Delisted (Recreational use)
Harrington State Park (S. Beach), Lake Michigan	0	0.38	FAL	FAL	Not Assessed	Default FAL	NA	NA	Monitored	Water Delisted (Recreational use)
Upper Lake Park Beach, Lake Michigan	0	0.77	FAL	FAL	Not Assessed	Default FAL	NA	NA	Monitored	Water Delisted (Recreational use)
Lion's Den Gorge National Preserve South Beach, Lake Michigan	0	0.38	FAL	FAL	Not Assessed	Default FAL	NA	NA	Monitored	Water Delisted (Recreational use)
Amsterdam Beach, Lake Michigan	0	0.33	FAL	FAL	Not Assessed	Default FAL	NA	NA	Monitored	Water Delisted (Recreational use)
Harrington State Park Beach North, Lake Michigan	0	0.16	FAL	FAL	Not Assessed	Default FAL	NA	NA	Monitored	NA
Port Washington Harbor	0	24.73	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA

Waterbody Name	Start Mile	Mile or Acres	Current Use	Attainable Use	Supporting Attainable Use	Designated Use	Impairments	Sources	Assessment	Impaired Water Status
Grasser Lake	0	9.45	Small	FAL	Supporting	Default FAL	NA	NA	Monitored	NA
Sauk Creek	0	15.9	FAL	WWSF	Not Supporting	Default FAL	Water Quality Use Restrictions (TP)	Non-Point Source	Monitored	303d Listed
Ludowissi L Br To Sauk Creek	0	4.81	FAL	FAL	Fully Supporting	Default FAL	NA	NA	Monitored	NA
Ludowissi Lake	0	10.79	Deep Seepage	FAL	Supporting	Default FAL	NA	NA	Monitored	NA
Holy Cross Br Of Sauk Creek	0	3.69	FAL	FAL	Fully Supporting	Default FAL	NA	NA	Monitored	NA
Hickory Grove Br. Of Sauk Creek	0	2.57	FAL	FAL	Not Assessed	Default FAL	NA	NA	No Assessment	NA
Sucker Creek	0	10.19	FAL	WWSF	Not Supporting	Default FAL	Degraded Biological Community(TP)	NA	Monitored	303d Listed

[i] The watershed assessment table reflects the condition of waters in the study area watershed. This table data is stored in the Water Assessment Tracking and Electronic Reporting System (WATERS) and is updated on an ongoing basis via monitoring data and assessment calculations. The following definitions apply:

- Current Use – current condition of water based on monitoring data.
- Attainable Use – "ecological potential" of water based on water type, natural community, lack of human-induced disturbances.
- Supporting Attainable Use – decision on whether the water's current condition is supporting its designated use under "water quality standards".
- Designated Use – the water's classified use under NR102, Wisconsin Water Quality Standards, for Fish and Aquatic Life.
- Impairments – documented impacts on water condition due to pollution sources or changes in hydro-geomorphological changes.
- Assessment – field indicates what type of data or information supports the decisions in the table (current, attainable, and supporting attainable).
- Impaired Water Status – This column indicates the status of the impaired water for TMDL development. `