

North Branch Manitowoc River Watershed

Nonpoint Source Pollution

Assessment Report

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November 1997

I. INTRODUCTION

As recommended in the *Manitowoc River Basin Water Quality Management Plan (1997)*, Northeast Region Watershed Management Staff at the Department of Natural Resources monitored streams in the North Branch Manitowoc River watershed - MA04 (Figures 1 and 2) in 1996 to evaluate the extent of nonpoint source pollution impacts on water quality. This information, along with existing watershed data, was used to rank the priority of the watershed streams for potential selection in the Wisconsin Nonpoint Source Pollution Abatement (Priority Watershed) Program.

II. METHODS AND PROCEDURES

Described below is monitoring that was conducted in the North Branch Manitowoc River watershed to evaluate the extent of nonpoint source pollution impacts on the water resources and the process used to rank the priority of the watershed streams for selection as a possible priority watershed project.

Stream habitat conditions were evaluated in the summer and recorded on the Stream Habitat Evaluation Form (Ball, 1982). This rates the quality and quantity of habitat available in the stream for aquatic life.

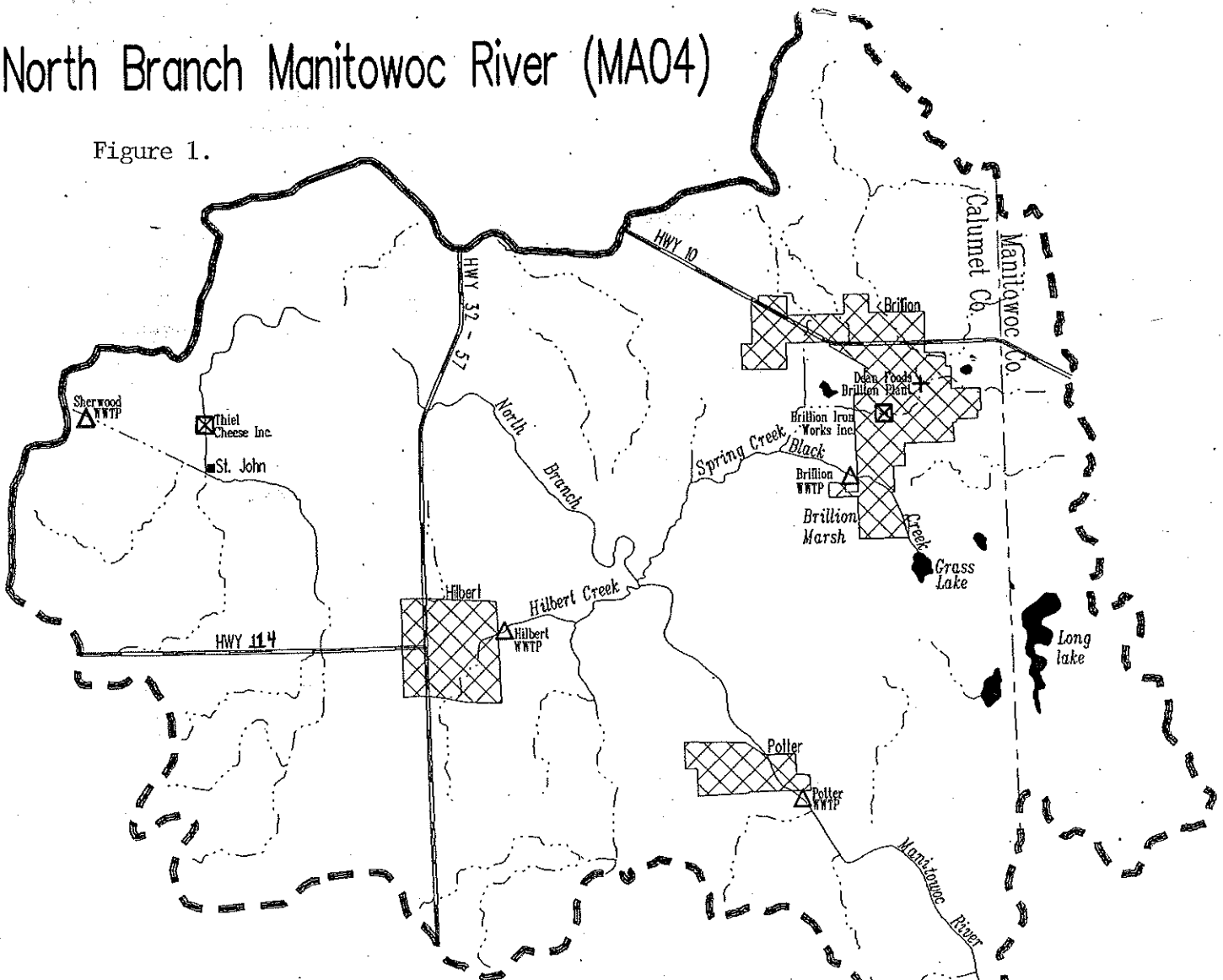
Aquatic macroinvertebrates were collected in spring and fall and sent to UW-Stevens Point for sorting and identification. Sample results were evaluated using the Hilsenhoff Biotic Index (HBI) which provides a relative measure of organic loading to the streams (Hilsenhoff, 1987). Artificial substrate samplers were used in the North Branch Manitowoc River, while the standard kicknet method was used in Spring Creek.

Water chemistry samples were collected and preserved following the "Sample Handling and Preservation Handbook" protocol (1988). All samples were chilled on ice and sent to the State Lab of Hygiene for analysis. Samples were analyzed for total and dissolved phosphorus, suspended solids, nitrate-nitrogen, ammonia, and biochemical oxygen demand. Stream flow was also collected, when possible, at the same time the chemistry samples were taken. Field parameters included dissolved oxygen, temperature, pH, and specific conductivity. Monthly samples were collected at Riverview Road on the North Branch Manitowoc River and during three runoff events at Hilbert Road on Hilbert Creek.

Continuous dissolved oxygen and temperature meter (Hydrolab DataSonde 3 Multiprobe Loggers) was placed in the North Branch Manitowoc River for several days in May 1996 in addition to grab samples at several other locations in the watershed. Wisconsin Administrative Code NR 102 establishes dissolved oxygen water quality standards in order to maintain favorable aquatic life. For warm water streams, the standard is 5 mg/l.

North Branch Manitowoc River (MA04)

Figure 1.



	Community
	River Basin Boundary
	Watershed Boundary
	River
	State, Federal, Interstate Highways
	County Boundary

Municipal Wastewater Treatment Plant

Discharge to:

- Groundwater
- Surface Waters
- Groundwater and Surface Waters

Industrial

Discharge to:

- Groundwater
- Surface Waters
- Groundwater and Surface Waters

0 1 2 Miles

0 1 2 3 Kilometers

DNR LWD water Supply Program 12/95

Fish communities were sampled in Spring Creek at two locations in August 1996 using a backpack stream shocker. Fish were identified in the field and released.

Using criteria defined in the Department of Natural Resources Planner's Guidance (1991), existing and new water quality information was applied to such things as water chemistry, macroinvertebrates, vegetation, and physical habitat so the watershed could be prioritized for selection as a priority watershed project. Based on impacts on the water resources from nonpoint sources of pollution, each major tributary stream as well as the overall watershed is given a high, medium, or low priority ranking.

III. RESULTS AND DISCUSSION

Following is a discussion of monitoring results and the resulting priority ranking for each of the major watershed streams.

North Branch Manitowoc River

The North Branch Manitowoc River flows 20 miles before its confluence with the South Branch where it forms the Manitowoc River. The river flows through the Brillion Marsh State Wildlife Area. The clay soils and the extensive cultivated fields in the watershed contribute to the turbid water. Stream flows are extremely variable.

Dissolved oxygen and temperature monitoring conducted at CTH PP from May 21 to 31, 1996, showed okay oxygen levels (range 4.6 to 11.7 mg/l) with only three hours of levels below the standard of 5 mg/l. Water temperature ranged between 11.3 and 22.5°C (52.3 and 72.5°F) (Figure 3).

Figure 3: North Branch Manitowoc River Dissolved Oxygen and Temperature

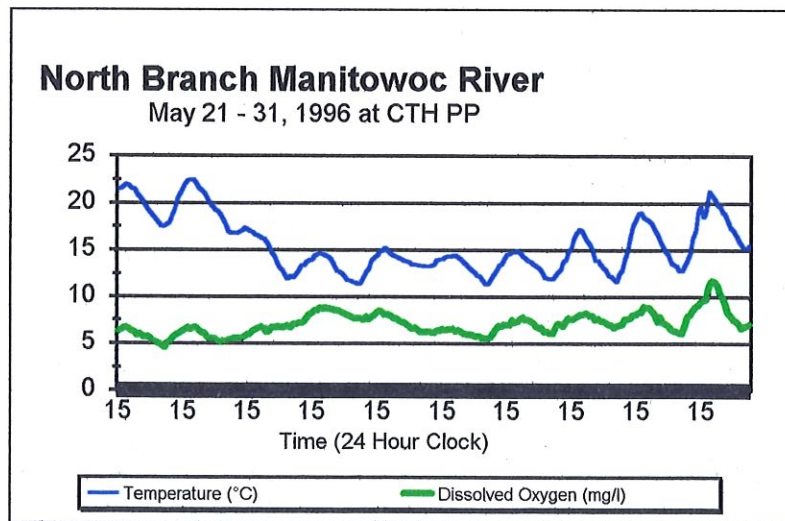
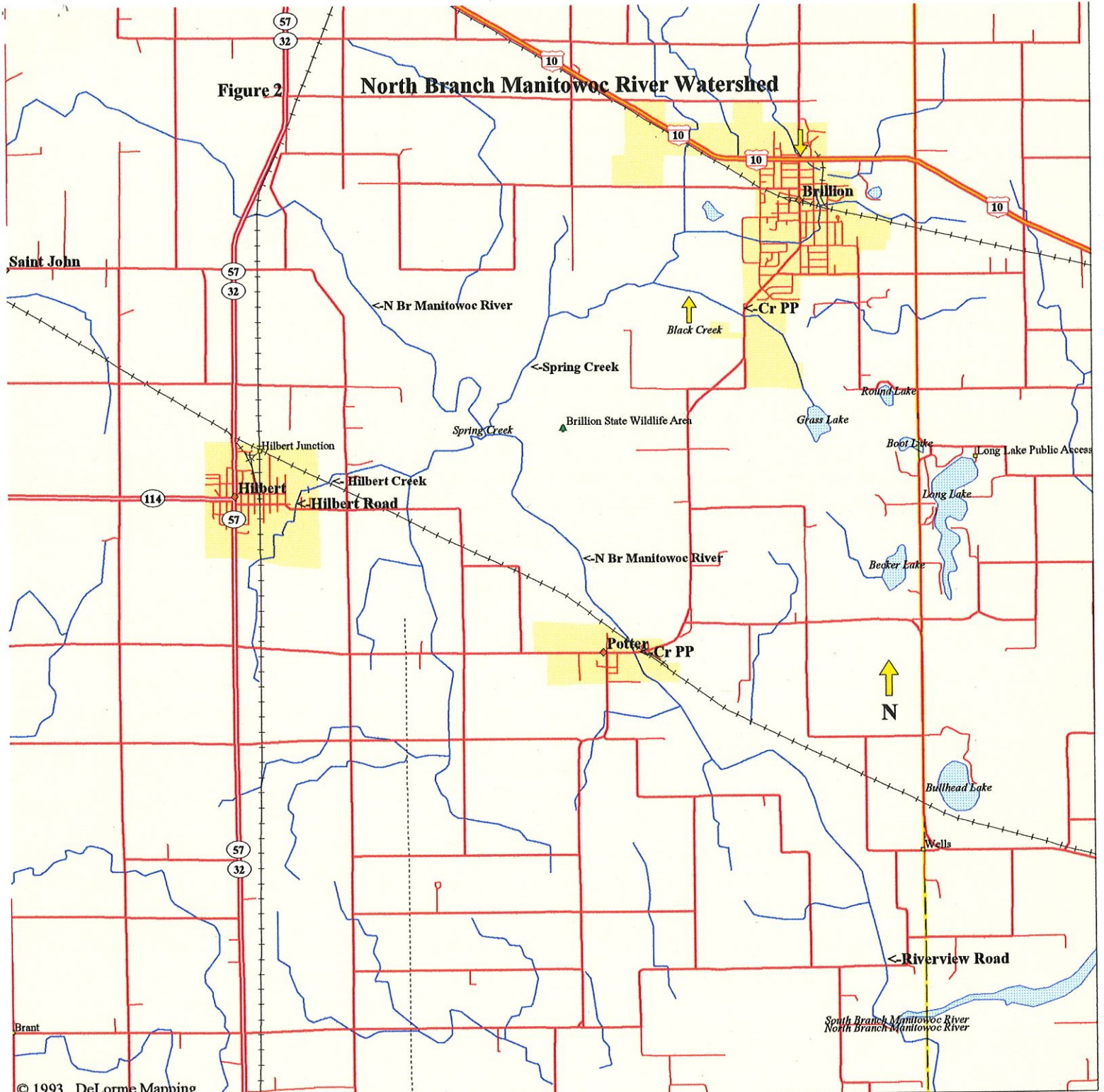


Figure 2

North Branch Manitowoc River Watershed



© 1993 DeLorme Mapping

LEGEND

- State Route
- Geo Feature
- ◆ Town, Small City
- ▲ Park
- County Boundary
- Population Center
- Street, Road
- Major Street/Road
- State Route
- US Highway
- +++ Railroad
- River
- Intermittent River
- Utility (powerline)

Scale 1:75,000 (at center)

1 Miles

2 KM

Mag 13.00
Wed Nov 12 13:53:30 1997

Macroinvertebrate samples at Riverview Road received a HBI value of 9.02 in spring and 8.72 in fall which rates this section of the North Branch Manitowoc River as very poor water quality with severe organic pollution present. Severe organic pollution is limiting the abundance and diversity of macroinvertebrates in the river.

Monthly water chemistry samples were collected on the North Branch Manitowoc River at Riverview Road in 1996 as part of the basin assessment trend stream monitoring (Robaidek, 1997). Total and dissolved phosphorus, ammonia, nitrate-nitrogen, biochemical oxygen demand, and suspended solids levels were all unusually high. Ammonia concentrations peaked at 1.52 mg/l, total phosphorus at 1.06 mg/l, dissolved phosphorus at 0.315 mg/l, nitrate-nitrogen at 5.6 mg/l, suspended solids at 385 mg/l, and biochemical oxygen demand at 32.2 mg/l. Water temperature peaked in July at 24.3°C (76°F). Dissolved oxygen levels were below the 5 mg/l standard in June and August.

Aquatic life habitat is limited in the North Branch Manitowoc River because of the variable stream flow, turbid water, muck covered substrate, and high nutrient concentrations with less than desirable oxygen levels.

Nonpoint sources of pollution are a controllable impact to the water resources of the North Branch Manitowoc River, however, the extensive wetland complex impacts are not. Therefore, the North Branch Manitowoc River received a medium priority rating.

Spring Creek

The headwaters of Spring Creek downstream to the city limits of Brillion at STH 10 are significantly impacted by controllable agricultural nonpoint source runoff. Cattle have access to the creek. Runoff from barnyards, feedlots, and manure stacks enter the creek. In some locations, buffers are minimal to none. Monitoring conducted in Spring Creek between the headwaters and STH 10 found water temperature in summer to average 19°C (66°F). Average dissolved oxygen was only 5.5 mg/l. Habitat evaluations rated this section of Spring Creek as fair aquatic life habitat. Stream flows are intermittent and the substrate is mostly soft sediment with rubble and gravel present. Duck weed and filamentous algae are common.

As Spring Creek flows through the city of Brillion, it receives storm sewer runoff and effluent from both Brillion Iron Works, Inc. and Dean Foods Brillion Plant. Dissolved oxygen measurements taken at several locations in Spring Creek between STH 10 and Glenview Ave., where Spring Creek enter the Brillion Marsh Wildlife Area, found summer dissolved oxygen at a relatively low average concentration of 5.1 mg/l. Average water temperature was 22°C (72°F).

Water chemistry samples collected during spring snowmelt and two rain runoff events show significantly elevated levels of ammonia (mean 0.74 mg/l), total phosphorus (mean 1.05 mg/l), dissolved phosphorus (mean 0.80), and nitrate-nitrogen (mean 2.81 mg/l) (Table 1). Since the samples were collected at CTH PP after the creek travels through several miles of agricultural land and the city of Brillion, these nutrients could be coming from rural or urban nonpoint sources or from point source discharges.

Table 1: Spring Creek Water Chemistry Samples

Date	Field Temperature (°C)	Field Dissolved Oxygen (mg/l)	Biochemical Oxygen Demand (mg/l)	Ammonia (mg/l)	Nitrate + Nitrite (mg/l)	Total Phosphorus (mg/l)	Dissolved Phosphorus (mg/l)	Suspended Solids (mg/l)
3/14/96	----	----	5.6	1.43*	1.38	0.49*	0.342*	9.0
4/16/96	4.7	13.2	4.9	0.693*	1.39	1.10*	0.845*	16.0
6/20/96	21.1	6.8	4.3	0.092	5.65*	1.56*	1.20*	19.0

* elevated concentration

Fish surveys were conducted at two locations in August, 1996 in Brillion. The first site was upstream of Brillion Iron Works at St. Francis Street and the second site was below Brillion Iron Works at E. Water Street. Both survey sites were approximately 50 feet long. At the upstream site, 188 fish were captured and identified. Brook stickleback were the most abundant species present followed by creek chub, blacknose dace, fathead minnow, central mudminnow, and white sucker. At the downstream site, 82 fish were captured. Creek chub were the most abundant followed by white sucker, brook stickleback, fathead minnow, common shiner, blacknose dace, and central mudminnow (Table 2). Although the number of fish caught was greater in the upstream site, all species collected are tolerant to environmental degradation and severe environmental conditions. This indicates that adverse conditions are limiting the number and type of fish species present in the stream.

Table 2: Spring Creek Fish Survey Results

Species	Number Caught		Tolerance
	E. Water Street	St. Francis Street	
Creek Chub	32	41	Tolerant Forage
White Sucker	29	4	Tolerant
Brook Stickleback	12	87	Coolwater Tolerant
Fathead Minnow	3	20	Tolerant Forage
Common Shiner	3	---	Intermediate Tolerant
Blacknose Dace	2	30	Tolerant Forage
Central Mudminnow	1	6	Tolerant Forage

A macroinvertebrate sample collected in spring at CTH PP received a Hilsenhoff Biotic Index value of 6.19 indicating fair water quality with fairly significant organic pollution present. The order Diptera was the most abundant order present with the family Chironomidae making up 75 percent of the entire sample. The lack of a diverse population and the presence of only tolerant organisms indicate significant pollution problems.

Habitat evaluations rated the section of stream within the city limits as fair aquatic life habitat. Where flows decrease, much of the rubble and gravel substrate is covered by silt and muck. Deep pools and riffles are rare. Macrophytes and filamentous algae are common. Because of the size and flow of Spring Creek, it does not have the potential to support a higher use classification than it already supports (warm water forage fish communities); although with the reduction of sediment and nutrient loading, it does have the potential to support more abundant and diverse biological populations.

No evaluation was made in Spring Creek from the Brillion Marsh downstream to the confluence of the North Branch Manitowoc River.

Spring Creek is significantly impacted by controllable agricultural nonpoint source runoff. It also receives storm sewer runoff and effluent from point sources in the city of Brillion. The high nutrient concentrations and presence of only tolerant fish and macroinvertebrate species indicates significant pollution problems. Therefore, Spring Creek received a high priority rating.

Black Creek

Black Creek is a 2-mile-long intermittent tributary to Spring Creek. It originates from the outlet of Grass Lake and is classified as limited aquatic life communities. The stream corridor is mostly wetlands. The City of Brillion discharges to Black Creek. Habitat and aquatic life is severely limited in this stream because of the small stream size, low flows, and soft silt covered substrate. Poned water at the golf course had low dissolved oxygen levels (2 mg/l) in August. It is unknown what the effects of the golf course are on the water quality of Black Creek.

Nonpoint sources of pollution does seem to impact the water resources of Black Creek; however, the naturally low stream flows and poor habitat limits the stream from reaching a higher use classification then the limited aquatic life classification it currently supports. Thus, Black Creek received a medium priority rating.

Unnamed Stream (Hilbert Tributary)

The unnamed tributary stream to the North Branch Manitowoc River (which is locally known as Hilbert Tributary) is a small intermittent stream near the community of Hilbert. It is classified as limited forage fish community. The Hilbert Wastewater Treatment Plant (WWTP) discharges to it.

An evaluation of this tributary was conducted in 1987 to determine the effects from the Hilbert WWTP discharge (Baumgartner, 1987). At that time, it was determined that the outfall from the Hilbert WWTP does impact the Hilbert Tributary to the North Branch Manitowoc River, but not significantly. All parameters monitored were within acceptable ranges.

Water chemistry samples collected on a tributary (T19N, R20E, S5, SESW) to the Hilbert Tributary in 1996 at Hilbert Road during runoff events, show elevated concentrations of ammonia, nitrate-nitrite, total phosphorus, and dissolved phosphorus (Table 3). These high levels are likely from agricultural nonpoint source runoff in the watershed since the monitoring location could not catch the WWTP discharge.

Table 3: Hilbert Tributary Water Chemistry Samples

Date	Field Temperature (°C)	Field Dissolved Oxygen (mg/l)	Biochemical Oxygen Demand (mg/l)	Ammonia (mg/l)	Nitrate+ Nitrite (mg/l)	Total Phosphorus (mg/l)	Dissolved Phosphorus (mg/l)	Suspended Solids (mg/l)
3/14/96	----	----	4.1	1.12*	1.57	0.410*	0.294*	ND
4/16/96	5.0	13.7	1.7	0.061	0.627	0.127*	0.073*	ND
6/20/96	20.9	4.0	<3	ND	5.91*	0.277*	0.250*	ND

ND - No detect

* elevated concentration

Aquatic life habitat is severely limited. Low stream flows, silted substrate and the previously ditched channel leaves only intermittent habitat during runoff events. Spring spawning runs from the North Branch Manitowoc River probably occur, but little if any recruitment is likely. Nonpoint source pollution significantly impacts Hilbert Tributary, thus it received a high priority rating.

IV. CONCLUSIONS

The North Branch Manitowoc River and Black Creek received medium priority ranking because nonpoint sources of pollution are impacting the water resources, but other factors are also limiting the streams from meeting their full potential. Spring Creek and Hilbert Tributary ranked high priority. Nonpoint sources of pollution limits the abundance and diversity of aquatic communities in these watershed streams by destroying available habitat and degrading water quality. The high level of sediment and nutrient loading impact the stream themselves and ultimately the North Branch Manitowoc River and the Brillion Marsh. Applying the priority watershed ranking procedures outlined in the Planner's Guidance, overall the *North Branch Manitowoc River watershed* ranked **high** priority for streams for potential selection in the Nonpoint Source Priority Watershed Program.

V. REFERENCES

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