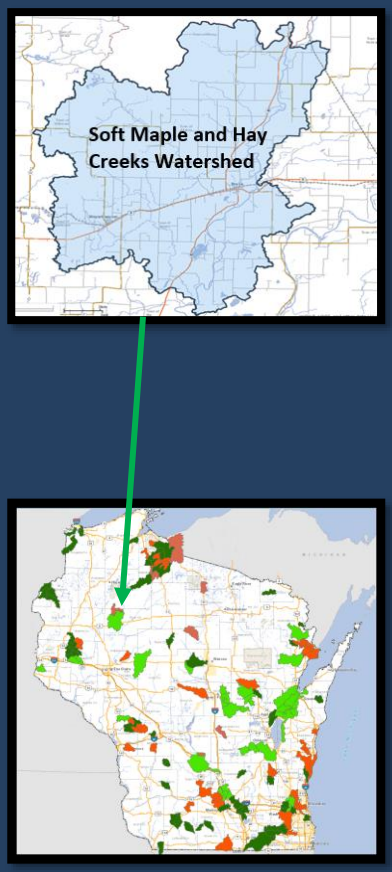
Soft Maple and Hay Creek Targeted Watershed Assessment: A Water Quality Plan to Protect Wisconsin Watersheds 2020

A Clean Water Act Water Quality Monitoring Report by the Bureau of Water Quality

Soft Maple and Hay Creeks (UC17)
HUC12: 0705000107, Monitored in 2015



Devil's Creek downstream of CTH O, 2015.
Photo by Jon Kleist, North District Water Quality Biologist, DNR.

Becky Creek upstream of STH 40, 2015.
Photo by Jon Kleist, North District Water Quality Biologist, DNR

WISCONSIN DEPT. OF NATURAL RESOURCES

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Water Quality Bureau
Wisconsin DNR

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Targeted Watershed Assessment Summary

The Wisconsin Department of Natural Resources surface water monitoring strategy includes targeting HUC 12 watersheds for a more intensive suite of monitoring activities including biological, chemical and physical data collections on the major streams within the watershed. This Targeted Watershed Assessment (TWA) approach allows us to assess baseline conditions across a larger geographic area versus a single stream or river. The Soft Maple and Hay Creek TWA was different in that it was intended to evaluate agricultural best management practices (BMP) in a HUC 10 watershed. For simplicity we will still use the term TWA.

This watershed was previously a Priority Watershed Project which was a cooperative effort to assess and address nonpoint pollution sources between the Wisconsin Department of Natural Resources (WDNR) and the Wisconsin Department of Agriculture Trade and Consumer Protection (DATCP) and Local Land Conservation Departments (LCDs) throughout the state.

The Rusk County Land Conservation Department administered the watershed project at the local level over an 11-year period, from 1996 through 2007. The project goal was to reduce nonpoint source impacts to waterways by working with landowners to install agricultural BMPs throughout the watershed. Rusk County LCD staff reported to the WDNR the name of property owners, site location, and types of BMPs implemented.

A total of 68 BMPs were reportedly installed by 35 different property owners. There were 19 named practices installed in 10 sub-watersheds with named waterways (Table 1). The Big Soft Maple and Devils Creek sub-watersheds had the most BMPs installed, with 26 and 13 practices respectively. Nutrient management and streambank shore protection-riprap were the most common BMP practices, with 12 and 8 installations respectively (Table 1, Figure 3).

The primary purpose of this TWA project was to collect biological, physical, and chemical parameters to characterize the Soft Maple Hay Creek Watershed and its tributaries and compare the current conditions of the waterways to the historical water quality data collected prior to the implementation of the priority watershed project. Much of these pre-data were collected in in the early 1990's as part of the watershed appraisal process.

Fish surveys were used to determine the correct natural community of watershed streams. Fish surveys, macroinvertebrate samples, quantitative and qualitative habitat evaluations, and nutrient sampling were used to gather water quality information of the waterways in the watershed.

A total of 15 fish surveys were conducted on 7 named waterways (Table 8). These waterways included; Devils Creek, Alder Creek, Becky Creek, Clear Creek, Big Soft Maple Creek, Little Soft Maple Creek and Hay Creek. There were 26 species of fish captured in the surveys. Fifty-eight percent of the fish species captured in the surveys were tolerant species (Figure 10).

Stream and riparian habitat quality were assessed at 13 fish survey stations based on DNR Wadeable Stream Quantitative Fish Habitat Rating guidance (Simonson et al, 1994, and at 2 sites with the Wadeable Stream Qualitative Fish Habitat Rating Guidance (Table 10). The quantitative habitat rankings ranged from fair to good for the 13 sites surveyed. The Devils Creek site at STH 40 was the only fair score. The other sites all were rated good. Due to time limitations qualitative habitat surveys were done at the US site on the Big Soft Maple Creek and at the Haymeadow Creek site. Both scores were rated excellent

Macroinvertebrate samples were collected at 10 sites in 2015 during this project period. The samples were generally collected at the DS survey site. Two streams, Becky and Little Soft Maple, had a second sample collected at the headwater sites. A mid reach macroinvertebrate sample was collected at Devils Creek at CTH O as part of another project and is included with this study. The MIBI scores ranged from 5.5 – 9.7 (Table 11). All sites were rated good or excellent in the 2015 study. HIBI scores ranged from 1.9 - 4.3, again in the good to excellent range.

Thirteen of the survey sites were sampled for Total Phosphorus, Ammonia as N, Nitrate+Nitrite, Total Nitrogen and Total Suspended Solids 1x each between June and September 2019. Field Measurements of dissolved oxygen, temperature, specific conductance, pH and transparency were recorded at each sampling event. These data are reported in Table 12. Total phosphorus values were observed above the state standard in NR 102 WI Adm. Code of 0.075mg/L in Becky, Devils, Little Soft Maple, and Big Soft Maple Creeks.

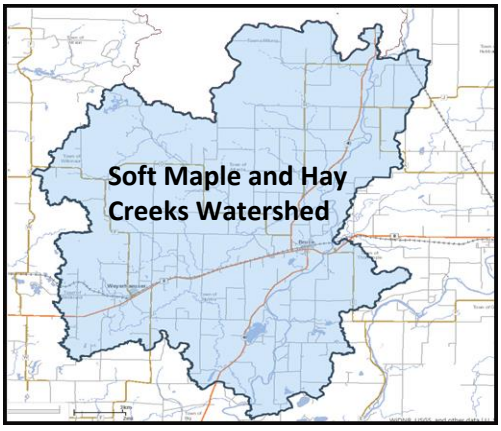

Figure 1. Soft Maple Hay Creek Watershed Near Ladysmith, Wisconsin

The Soft Maple Hay Creek watershed has high quality waters with good aquatic habitat which are currently supporting diverse biological communities. There are streams with elevated water chemistry nutrient values that are influenced by watershed land use. However, the undeveloped nature and large wetland component of the watershed are likely buffering any impacts to the aquatic biota.

Water Quality Monitoring and Planning

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

This WQM Plan is approved by the Wisconsin DNR and is a formal update to the Upper Chippewa River Basin Plan and Wisconsin's statewide Areawide Water Quality Management Plan (AWQM Plan). This plan will be forwarded to USEPA for certification as a formal update to Wisconsin's AWQM Plan.

_____ _____
Jon Kleist, North District Water Quality Biologist Date

_____ _____
Tom Aartila, Northern District Water Quality Field Supervisor Date

_____ _____
Greg Searle, Water Quality Field Operations Director Date

_____ _____
Timothy Asplund, Water Quality Monitoring Section Chief Date

Basin/Watershed Partners

- Rusk Creek County Land and Water Conservation Department

Report Acknowledgements

- Jon Kleist, Primary Author and Investigator, North District, Wisconsin DNR
- Lisa Kosmond Helmuth, Program Coordinator, Water Quality Bureau, Wisconsin DNR

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Abbreviations

AEL: Aquatic Entomology Laboratory at UW – Stevens Point: the primary laboratory for analysis of macroinvertebrate taxonomy in the State of Wisconsin.

BMP: **Best Management Practice**. A land management practice used to prevent or reduce nonpoint source pollution such as runoff, total suspended solids, or excess nutrients.

DATCP: Wisconsin Department of Agriculture, Trade and Consumer Protection – the state agency in partnership with DNR responsible for a variety of land and water related programs.

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

DS: Downstream

END: Endangered Species - Wisconsin species designated as rare or unique due to proximity to the farthest extent of their natural range or due to anthropogenic deleterious impacts on the landscape or both.

ERW: Exceptional Resource Water- Wisconsin's designation under state water quality standards to waters with exceptional quality and which may be provided a higher level of protection through various programs and processes.

FHMD: Fisheries and Habitat Management Database – or Fish Database – the state's repository for fish taxonomy and auto-calculated metrics involving fish assemblage condition and related.

FIBI: **Fish Index of biological integrity (Fish IBI).** An Index of Biological Integrity (IBI) is a scientific tool used to gauge water condition based on biological data. Results indicate condition and provide insight into potential degradation sources. In Wisconsin, specific fish IBI tools are developed for specific natural communities. Biologists review and confirm the natural community to use the correct fish IBI tool.

HUC: **Hydrologic Unit Code.** A HUC is a code that represents nested hydrologic watersheds delineated by a multiple agencies at the federal and state level including USGS, USFS, and Wisconsin DNR.

MIBI: **Macroinvertebrate Index of biological integrity.** In Wisconsin, the MIBI, or macroinvertebrate Index of biological integrity, was developed to assess macroinvertebrate community condition.

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 except for fisheries taxonomy and habitat data.

NC: Natural Community. A system of categorizing water based on inherent physical, hydrologic, and biological components. Streams and Lakes have uniquely derived systems that result in specific natural community designations for each lake and river segment in the state. These designations dictate the appropriate assessment tools which improves the condition result, reflecting detailed nuances reflecting the modeling and analysis work foundational to the assessment systems.

MDM: Maximum Daily Averages – maximum daily average is a calculated metric that may be used for temperature, dissolved oxygen and related chemistry parameters to characterize water condition.

mg/L: milligrams per liter - a volumetric measure typically used in chemistry analysis characterizations.

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.

ND: No detection – a term used typically in analytical settings to identify when a parameter or chemical constituent was not present at levels higher than the limit of detection.

NRCS: USDA Natural Resources Conservation Service - the federal agency providing local support and land management outreach work with landowners and partners such as state agencies.

ORW: Outstanding Resource Water- Wisconsin's designation under state water quality standards to waters with outstanding quality and which may be provided a higher level of protection through various programs and processes.

SC: Species of Special Concern- species designated as special concern due to proximity to the farthest extent of their natural range or due to anthropogenic deleterious impacts on the landscape, or both.

SWIMS ID. Surface Water Integrated Monitoring System (SWIMS) identification number is the unique monitoring station identification number for the location of monitoring data.

TDP: Total Dissolved Phosphorus – an analyzed chemistry parameter collected in aquatic systems positively correlated with excess productivity and eutrophication in Wisconsin waters.

TMDL: Total Maximum Daily Load – a technical report required for impaired waters Clean Water Act. TMDLs identify sources, sinks and impairments associated with the pollutant causing documented impairments.

TP: Total Phosphorus - an analyzed chemical parameter collected in aquatic systems frequently positively correlated with excess productivity and eutrophication in many of Wisconsin's waters.

THR: Threatened Species - Wisconsin species designated as threatened due to proximity to the farthest extent of their natural range or due to anthropogenic deleterious impacts on the landscape, or both.

TWA: **Targeted Watershed Assessment.** A monitoring study design centered on catchments or watersheds that uses a blend of geometric study design and targeted site selection to gather baseline data and additional collection work for unique and site-specific concerns for complex environmental questions including effectiveness monitoring of management actions, evaluation surveys for site specific criteria or permits, protection projects, and generalized watershed planning studies.

TSS: Total suspended solids – an analyzed physical parameter collected in aquatic systems that is frequently positively correlated with excess productivity, reduced water clarity, reduced dissolved oxygen and degraded biological communities.

US: Upstream

WATERS ID. The Waterbody Assessment, Tracking, and Electronic Reporting System Identification Code. The WATERS ID is a unique numerical sequence number assigned by the WATERS system, also known as "Assessment Unit ID code." This code is used to identify unique stream segments or lakes assessed and stored in the WATERS system.

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.

WSLOH: Wisconsin State Laboratory of Hygiene – the state's certified laboratory that provides a wide range of analytical services including toxicology, chemistry, and data sharing.

WQC: Water quality criteria – a component of Wisconsin's water quality standards that provide numerical endpoints for specific chemical, physical, and biological constituents.

Targeted Watershed Assessment Goals

The targeted watershed assessment project goal was to collect biological, physical, and chemical parameters within the Soft Maple-Hay Creek watershed and use these data to describe the current condition of the watershed. Where possible, compare the current conditions of the waterways to the historical water quality data collected prior to the implementation of the priority watershed project. This report presents monitoring results, identifies issues, or concerns, and provides recommendations for future monitoring and management

The Soft Maple Hay Creek Watershed was a Priority Watershed Project in Rusk County WI. Priority Watershed Projects were cooperative efforts to assess and address nonpoint pollution sources between the Wisconsin Department of Natural Resources (WDNR) and the Wisconsin Department of Agriculture Trade and Consumer Protection (DATCP) and Local Land Conservation Departments (LCDs) throughout the state. The Rusk County Land Conservation Department administered the watershed project at the local level over an 11-year period from 1996 through 2007. The goal of the Priority Watershed Project was to reduce nonpoint source impacts to waterways by working with landowners to install various agricultural best management practices (BMPs) throughout the watershed.

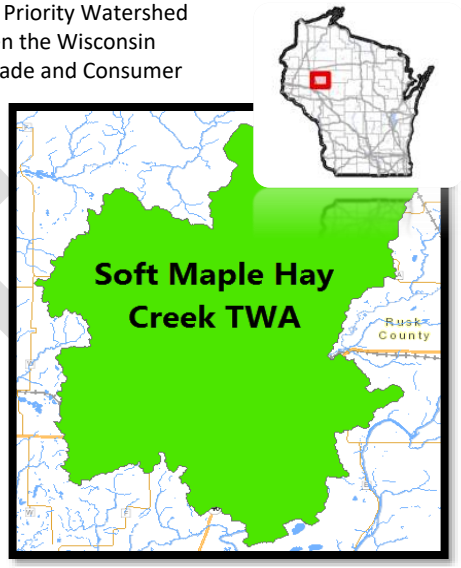


Figure 2: Soft Maple Hay Creek Watershed Location

Management Practices

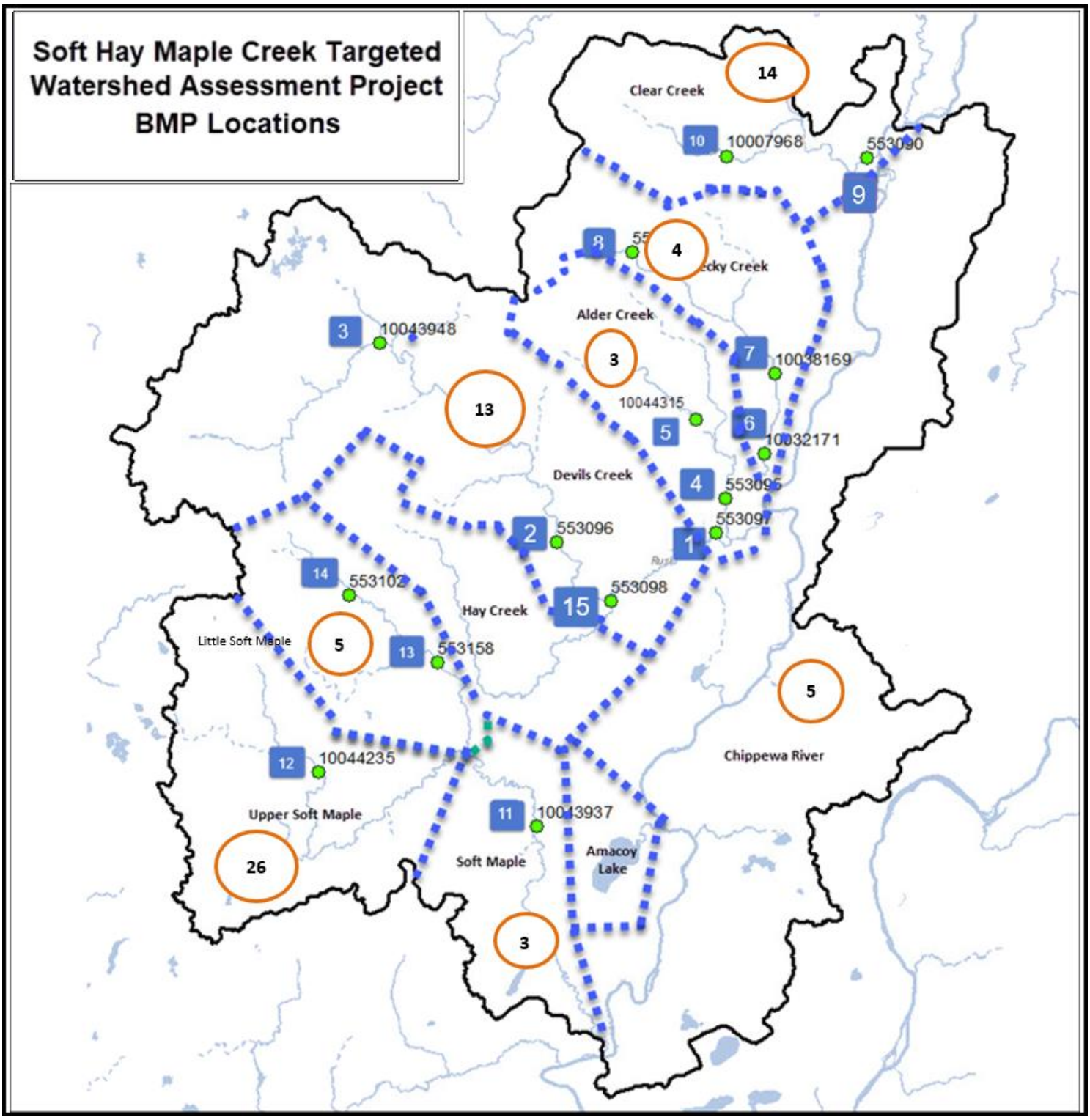
Rusk County LCD staff reported to the WDNR the name of property owners, site location and types of BMP implemented over the project's lifetime. A total of 68 BMPs were reported installed by 35 different property owners. There were 19 named practices installed in 10 sub-watersheds with named waterways (Table 1). The Big Soft Maple and Devils Creek sub-watersheds had the most BMPs installed with 26 and 13 practices, respectively. The BMPs nutrient management and streambank shore protection-riprap were the most common practices with 12 and 8 installations respectively (Table 1, Figure 3).

Clear Creek US STH 40. Photo by Jon Kleist, DNR.

Table 1. Number of Best Management Practices in Subwatersheds of the Soft Maple and Hay Creek Watershed

Practice	Subwatersheds with Best Management Practices										
	Big Soft Maple	Little Soft Maple	Clear Creek	Alder Creek	Devils Creek & Tribs	Becky Creek	Hay Creek	Chip R. & Tribs	Buff Creek	Amacoy Lake	Total
Nutrient Management	7		1		2		1	1			12
Barnyard	4	1			1	1		2			9
Stream crossing	1	1				1		1			4
Clean Water Diversion	1						1				2
Milk house Waste Control							1				1
Manure Storage	3		1		3		1				8
Streambank Stabilize			1								1
Stream Protection	3	3	1	1							8
Grassed Waterway	1				2						3
Field Diversion					1			1			2
Manure Storage Abandon	1										1
Streambank Improvement						1					1
Stream bank Shape/Seed	2					1					3
Livestock Fencing	1			1	2				1	1	6
Cattle Crossing				1							1
Rotational Grazing	1										1
Access Road	1										1
Barnyard Runoff Control					1					1	2
Critical Area Stabilize					1					1	2
Total	26	5	4	3	13	4	4	5	1	3	68

Figure 3. Number of best management practices implemented in each subwatershed
The circled number indicates how many practices were implemented in that subwatershed from 1996-2007.



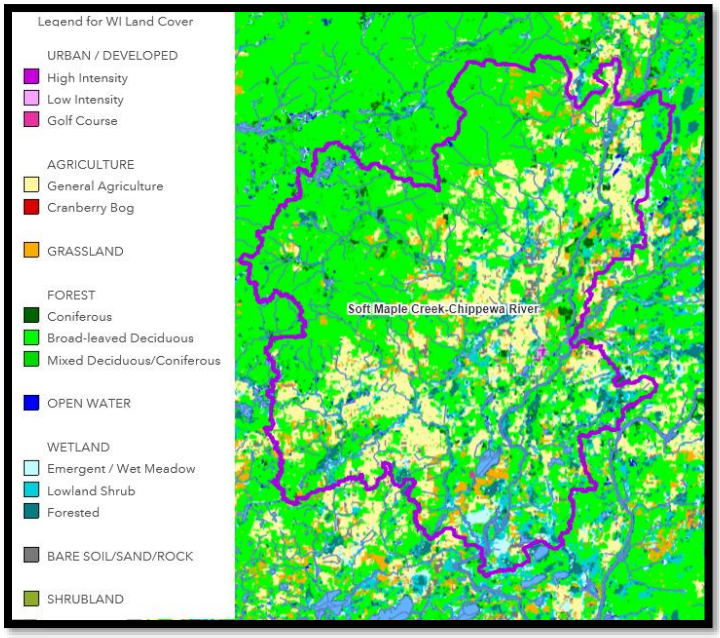
Resources

About the Watershed

The Soft Maple and Hay Creek Watershed, located in Rusk County, is 113,122 acres or 176.75 mi^2 in size. Over 266 miles of streams and rivers, 1050 acres of lakes and 14,185 acres of wetlands are located in the watershed. Land use is dominated by forest (54.46%), agriculture (18.81%) and wetlands (14.85%). (Figure 4). In the 1990s the area was ranked high for nonpoint source issues affecting streams and groundwater (Roesler, 1995). Water quality degradation by cattle and barnyard runoff is a problem in this watershed. The only point source discharge to surface water is from the Village of Weyerhauser, which discharges to a tributary to Soft Maple Creek. (Roesler, 1995)

Land Use and Population

The Soft Maple and Hay Creek Watershed is located in Rusk County, which had a population of 14,147 in 2019; the county population has decreased by 3.96% since 2010. The major municipalities in the watershed are the Villages of Weyerhauser and Bruce. Forested areas are in the headwaters of the watershed, while agricultural activities are concentrated near the Chippewa River, in the lower reaches of the watershed (Figure 4).



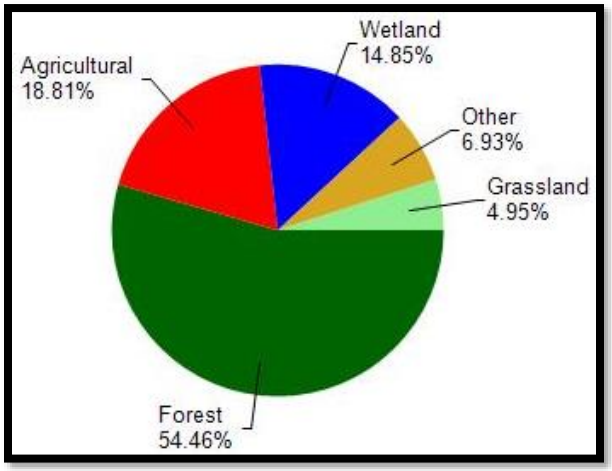


Figure 4. Wisconsin Land Cover Data in the Soft Maple and Hay Creeks Watershed (NLCD,2016)

Hydrology

The Soft Maple Hay Creek Watershed has three general landscape features (Roesler, 1995). The northwest third of the watershed is a portion of the "Blue Hills" area. This area contains steep quartzite ridges overlain by a mix of glacial ground and end moraines. The Blue Hills area is the headwaters for many of the trout streams in the watershed including Devils, Clear, Becky, Alder and Little Soft Maple Creeks. These high gradient streams originate in the Blue Hills and flow into an area of pitted outwash along the banks of the Chippewa River, a second landscape feature. This area of pitted outwash is relatively flat with scattered depressions. Here the stream gradients decrease and areas of depositional material such as sands and small gravel become more numerous in the stream beds. The third landscape feature is an area of glacial end moraines in the southwestern corner of the watershed near Weyerhauser. This area has numerous small ridges and large wetland areas. Much of the Big Soft Maple Creek subwatershed is in this area. Soils throughout the watershed are mostly loams with some areas of sandy loam, sand, and silts. Lake Superior greatly influences the northern portion of the Ecological Landscape especially during the winter season, producing greater snowfall than in most areas in Wisconsin.

Ecological Landscapes

The North Central Forest Ecological Landscape occupies much of the northern third of Wisconsin. Its landforms are characterized by end and ground moraines with some pitted outwash and bedrock-controlled areas. Kettle depressions and steep ridges are found in the northern portion. Two prominent areas in this Ecological Landscape are the Penokee-Gogebic Iron Range in the north extending into Michigan, and Timm's Hill, the highest point in Wisconsin (1,951 feet) in the south. The vegetation is mainly forest, with many wetlands and some agriculture, though the growing season is not as favorable as it is in southern Wisconsin.

The historic vegetation was primarily hemlock-hardwood forest dominated by hemlock, sugar maple, and yellow birch. There were some smaller areas of white and red pine forest scattered throughout the Ecological Landscape, and individual white pines trees were a component of the hemlock-hardwood forest. Harvesting hemlock to support the tanneries was common at the turn of the century, and the species soon became a minor component of forests due to over-harvesting and lack of regeneration. Currently, forests cover approximately 80% of this Ecological Landscape. The northern hardwood forest is dominant, made up of sugar maple, basswood, and red maple, and also including some scattered hemlock and white pine pockets within stands. The aspen-birch forest type group is also relatively abundant, followed by spruce-fir. A variety of wetland community types also are present, both forested and non-forested.

Outstanding and Exceptional Resources

Wisconsin designates the state's highest quality waters as Outstanding Resource Waters (ORWs) or Exceptional Resource Waters (ERWs). (NR 102 WI Adm. Code). Waters designated as ORW or ERW are surface waters which provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities. These waters receive additional protection through Wisconsin's permitting processes. There are 5 streams listed as ORW or ERW waters in the Soft Maple Hay Creek Watershed (Table 2).

Table 2: Outstanding and Exceptional Resource Waters

Waterbody Name	WBIC	ORW/ERW	Start Mile	End Mile
Soft Maple Creek	2356600	ERW	0	14.32
Soft Maple Creek	2356600	ORW	14.32	23.56
Devils Creek	2366600	ORW	4.59	21.8
Alder Creek	2366700	ERW	0	7.82
Becky Creek	2369600	ERW	0	8.86
Clear Creek	2370100	ERW	0	8.03

Devils Creek downstream of CTH O, an outstanding resource water. Photo by Jon Kleist, DNR.

Impaired Waters

The Clean Water Act requires states publish waters that do not meet water quality standards. This list of impaired waters is updated every two years. There are 3 waters, Becky Creek, Amacoy Lake and Perch Lake, listed as Impaired in this watershed. They are Impaired from nonpoint source pollution and air deposition (Table 3).

Table 3: Impaired Waters in the Soft Maple Hay Creek Watershed (UC17)

Local Name	WBIC	End Mile (acres)	Pollutant	Impairment	Sources	Status
Becky Creek	2369600	1.0	Sediment/ Total Suspended Solids	Degraded Habitat	Livestock (Grazing or Feeding Operations), Dairies (Outside Mile Parlor Areas), Non-Point Source	TMDL Approved Implementation
Amacoy Lake	2359700	278	Unknown Pollutant	Excess Algal Growth	Non-Point Source (Rural or Urban)	303d Listed
Perch Lake	2368500	23	Mercury	Contaminated Fish Tissue	Atmospheric Deposition - Toxics	303d Listed

Trout Waters

Wisconsin trout streams are placed into 3 classes for fish management purposes. Efforts have been made to list all trout streams in the State of Wisconsin, but it is recognized that this listing in not exhaustive.

Class I are high quality trout waters, having sufficient natural reproduction to sustain populations of wild trout at or near carrying capacity. Consequently, streams in this category require no stocking of hatchery trout. These streams or stream sections are often small and may contain small or slow-growing trout, especially in the headwaters. Class II streams may have some natural reproduction, but not enough to utilize available food and space therefore, stocking is required to maintain a desirable sport fishery. These streams have good survival and carryover of adult trout, often producing some fish larger than average size. Class III are marginal trout habitat with no natural reproduction occurring. They require annual stocking of trout to provide trout fishing. Generally, there is no carryover of trout from one year to the next (WDNR, 1980.)

Classified trout waters in the Soft Maple Hay Creek Watershed are listed in Table 4.

Table 4: Trout Waters in the Soft Maple Hay Creek Watershed (UC17) [1]

Waterbody Name	WBIC	Start Mile	End Mile	Trout Class
Alder Creek	2366700	0	7.82	CLASS I
Becky Creek	2369600	0	8.86	CLASS I
Clear Creek	2370100	0	8.03	CLASS I
Devils Creek	2366600	0	4.59	CLASS III
Devils Creek	2366600	4.59	15.83	CLASS II
Devils Creek	2366600	15.83	21.8	CLASS I
Little Soft Maple Creek	2357300	0	8.04	CLASS II
Soft Maple Creek	2356600	7.74	16	CLASS III

Species of Special Concern

One NHI listed species of caddisfly was found in this watershed and one uncommon caddisfly and two very uncommon chironomid midge species were also collected in this study.

[1] Mile 0 represents the mouth of the river or stream. Mileage markers go "up" as you trace the stream upstream toward the headwaters.

Monitoring Project

Project Purpose

The primary purpose of this project was to collect biological, physical, and chemical parameters within the Soft Maple-Hay Creek watershed and where possible, compare the current conditions of the waterways to the historical water quality data collected prior to the implementation of the priority watershed project. Much of these pre-data were collected in in the early 1990's. Secondarily, the project was to evaluate the effectiveness of BMP practices implemented in the watershed.

The fish surveys were used to determine the correct natural community of watershed streams. Fish surveys, macroinvertebrate samples, quantitative and qualitative habitat evaluations, and nutrient sampling were used to gather water quality information. The information gathered may be used for updating waterbody assessment status, watershed planning, direct future monitoring for 303d or ERW/ORW status, making management recommendations, and updating waterbody and watershed narratives in WATERS.

Site Selection and Study Design

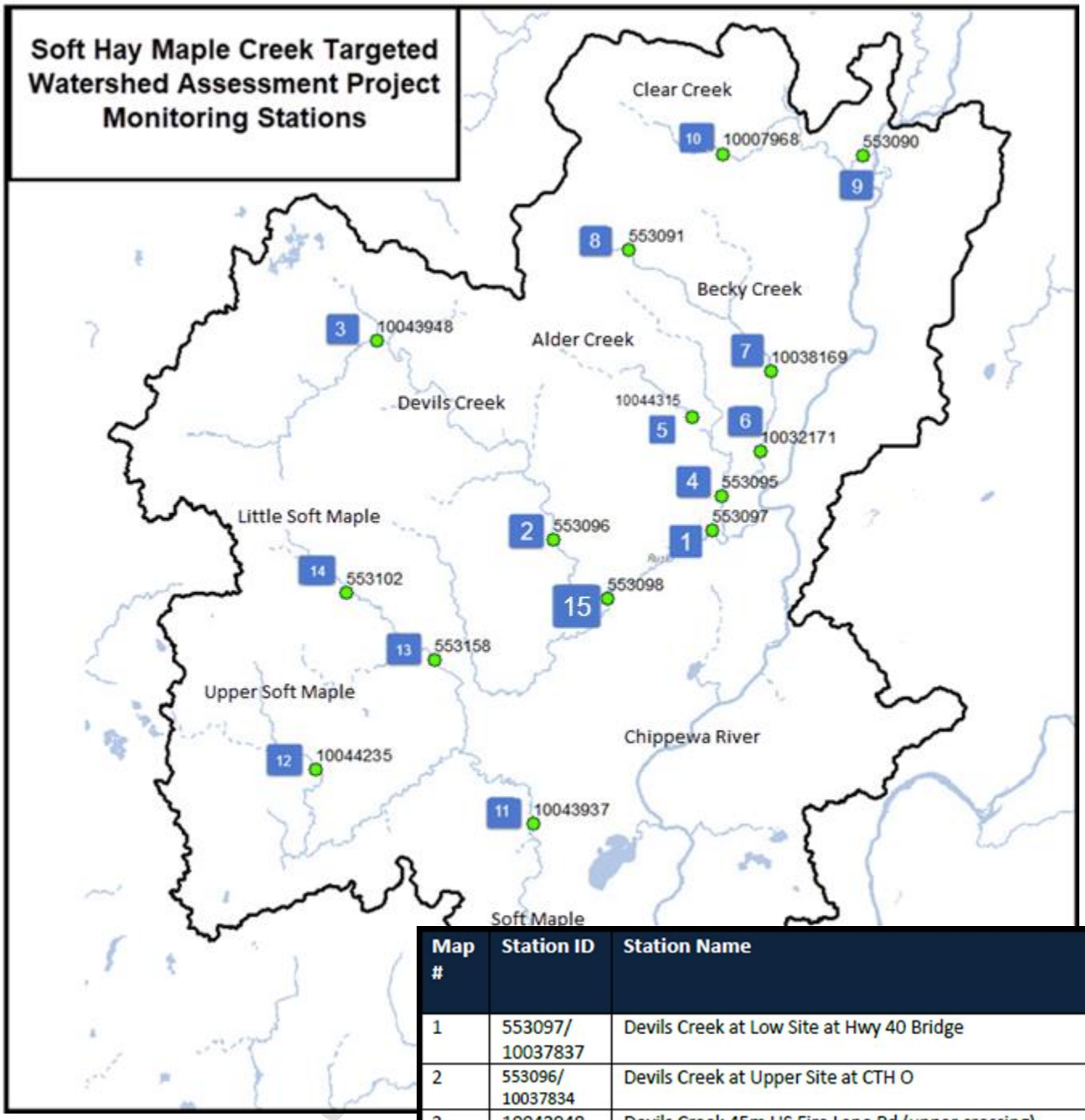
The project plan was to evaluate the Best Management Practices that were installed in the watershed as well as describe overall watershed health. As such the initial project design included survey sites near BMP practices. After reviewing the BMP installation report and noting the limited number (68) and varied types of agricultural BMPs installed over such a large watershed (Figure 3), coupled with the limited number and location of available fisheries, chemistry, and macroinvertebrate pre-data, no effort was made to select sites near any BMPs. The pre-data available did not lend itself well to a pre/post BMP evaluation. Therefore, the study design shifted to re-appraise the watershed and monitor its current water quality after the competition of the priority watershed project and perhaps see if there was any observable change in watershed health.

The watershed was divided into sub-watersheds for each named stream where BMP practices were installed. Sites were selected at road crossings near the headwaters and as close to the stream mouth of each stream. (Table 5, Figure 5). When possible, the sites sampled (which were mostly water chemistry sites) during the watershed appraisal in the early 1990's were used. By chance, there were a few survey sites that were near visibly identifiable BMP installations such as stream bank protection and improvement areas.

Table 5. Monitoring Stations in the Soft Maple Hay Creek Watershed

Map #	Station ID	Station Name	WBIC	Waterbody Name
1	553097	Devils Creek at Low Site at Hwy 40 Bridge	2366600	Devils Creek
2	553096	Devils Creek at Upper Site at CTH O	2366600	Devils Creek
3	10043948	Devils Creek 45m US Fire Lane Rd (upper crossing)	2366600	Devils Creek
4	553095	Alder Creek - Low Site at Hwy 40 Bridge	2366700	Alder Creek
5	10044315	Alder Creek US Adams Road	2366700	Alder Creek
6	10032171	Becky Creek US Highway 40 near old cattle crossing	2369600	Becky Creek
7	10038169	Becky Creek US Edgewood Road	2369600	Becky Creek
8	553091	Becky Creek Up Site Imalone Rd Bridge	2369600	Becky Creek
9	553090	Clear Creek at Low Site Hwy 40 Bridge	2370100	Clear Creek
10	10007968	Clear Creek at Hwy H Station # 2	2370100	Clear Creek
11	10043937	Big Soft Maple Creek 35m US Amacoy Lake Rd	2356600	Soft Maple Creek
12	10044235	Big Soft Maple Creek DS Railway Avenue	2356600	Soft Maple Creek
13	553158	Little Soft Maple Creek at Kief Rd Near Weyerhauser	2357300	Little Soft Maple Creek
14	553102	Little Soft Maple Creek at Upper Site Tyman Rd Bridge	2357300	Little Soft Maple Creek
15	553098	Hay Creek at Tyman Rd Near Bruce WI	2367200	Hay Creek

Figure 5. Monitoring Stations in the Soft Maple and Hay Creek Watershed



Map #	Station ID	Station Name
1	553097/ 10037837	Devils Creek at Low Site at Hwy 40 Bridge
2	553096/ 10037834	Devils Creek at Upper Site at CTH O
3	10043948	Devils Creek 45m US Fire Lane Rd (upper crossing)
4	553095	Alder Creek - Low Site at Hwy 40 Bridge
5	10044315	Alder Creek US Adams Road
6	10032171	Becky Creek US Highway 40 near old cattle crossing
7	10038169	Becky Creek US Edgewood Road
8	553091	Becky Creek Up Site Imalone Rd Bridge
9	553090/ 190007967	Clear Creek at Low Site Hwy 40 Bridge
10	10007968	Clear Creek at Hwy H Station # 2
11	10043937	Big Soft Maple Creek 35m US Amacoy Lake Rd
12	10044235	Big Soft Maple Creek DS Railway Avenue
13	553158	Little Soft Maple Creek at Kief Rd Near Weyerhauser
14	553102	Little Soft Maple Creek at Upper Site Tyman Rd Bridge
15	553098	Hay Creek at Tyman Rd Near Bruce WI

Table 6. Soft Maple Hay Creeks Watershed Monitoring Conducted by Station

Map #	Station ID	Station Name	WBIC	Water Chemistry	Monitoring Conducted		
					Invertebrate	Fish	Habitat
1	553097	Devils Creek at Low Site at Hwy 40 Bridge	2366600	2015	2015	2015	2015
2	553096	Devils Creek at Upper Site at CTH O	2366600	2015	2015	2015	2015
3	10043948	Devils Creek 45m US Fire Lane Rd (upper crossing)	2366600	2015		2015	2015
4	553095	Alder Creek - Low Site at Hwy 40 Bridge	2366700	2015	2015	2015	2015
5	10044315	Alder Creek US Adams Road	2366700			2015	2015
6	10032171	Becky Creek US Highway 40 near old cattle crossing	2369600	2015	2015	2015	2015
7	10038169	Becky Creek US Edgewood Road	2369600		2015	2015	2015
8	553091	Becky Creek Up Site Imalone Rd Bridge	2369600	2015	2015	2015	2015
9	553090	Clear Creek at Low Site Hwy 40 Bridge	2370100	2015	2015	2015	2015
10	10007968	Clear Creek at Hwy H Station # 2	2370100	2015		2015	2015
11	10043937	Big Soft Maple Creek 35m US Amacoy Lake Rd	2356600	2015	2015	2015	2015
12	10044235	Big Soft Maple Creek DS Railway Avenue	2356600	2015		2015	2015 **
13	553158	Little Soft Maple Creek at Kief Rd Near Weyerhauser	2357300	2015	2015	2015	2015
14	553102	Little Soft Maple Creek at Upper Site Tyman Rd Bridge	2357300	2015	2015	2015	2015
15	553098	Hay Creek at Tyman Rd Near Bruce WI	2367200	2015	2015	2015	2015 **

** Qualitative habitat surveys were completed at these stations.

Big Soft Maple US Amacoy Lake Road. Photo by Jon Kleist, DNR.

Methods, Equipment, and Quality Assurance

Monitoring was conducted at specific stations described in Table 6 using the following methods and equipment following WDNR standard operating protocols.

Fish Assemblage

Standard WDNR methods were used to conduct fish surveys at the sampling stations (Lyons 1992). The station length was calculated to be 35 times the average stream width, with a minimum of 100 and a maximum of 400 meters respectively. Fish were collected by electroshocking. A stream tow barge with a generator and 2-3 probes or backpack shocker(s) with a single probe were used for electroshocking. All fish shocked were captured and identified to species and counted. Game and panfish were measured to the nearest mm and counted. The fisheries assemblage was collected with the following standard methods:

- Wadeable Stream Fish Community Evaluation Form 3600-230 (R 7/00)
- Guidelines for Assessing Fish Communities of Wadeable Streams in Wisconsin

Habitat Evaluation

At most stations, quantitative habitat evaluations were completed (Simonson, et. al., 1994). These evaluations include measurements of average stream width and depth, streambed composition and embeddedness of rocky and gravel substrates, riparian buffers and land use estimates, evidence of sedimentation, and fish cover. Due to time limitations, qualitative habitat surveys were completed at the Hay Creek and upper Soft Maple Creek sites (Simonson, et. al., 1994). Qualitative habitat surveys include visual estimates of the parameters evaluated in the quantitative habitat surveys.

- Qualitative Habitat Rating less that 10m Form (3600-532A) (R 6/07)
- Guidelines for Qualitative Physical Habitat Evaluation of Wadeable Streams (2007)
- Guidelines for Evaluating Habitat of Wadeable Streams Revised June 2002 (Quantitative Habitat)
- Wadeable Stream Quantitative Habitat Evaluation Form 3600-228 (R 6/07)

Macroinvertebrates

Macroinvertebrate samples were collected by kick sampling with a D-frame net in the fall of 2015 using WDNR standard sampling methods (WDNR 2000). Riffle areas within a station were sampled when appropriate substrates were available. If riffles were not present in a survey station, vegetation sweeps were conducted. Generally, macroinvertebrate samples were collected at the headwater and downstream station on each waterway. Samples were preserved and sent to the University of Wisconsin-Stevens Point Entomology Lab for analyses.

- Guidelines for Collecting Macroinvertebrate Samples in Wadeable Streams
- Wadeable Macroinvertebrate Field Data Report Form 3200-081 (R 08/14)

Water Sampling

Water chemistry grab samples were collected from the center of the stream channel where adequate flow and depth were present. A single water sample was collected during the growing season (May through October) on each waterway at the DS and US fish survey stations when possible. These water samples were usually collected at base low conditions prior to conducting the fish survey. Samples were field preserved and shipped in coolers on ice to the Wisconsin State Lab of Hygiene (SLOH) for analysis (WDNR 2005)

- Guidelines and Procedures for Surface Water Grab Sampling (Dec. 2005 Version 3)
- Guidance for Flow Monitoring Wadeable Streams (v1.0) 2016
- Guidance for Dissolved Oxygen Meter Sampling

Results

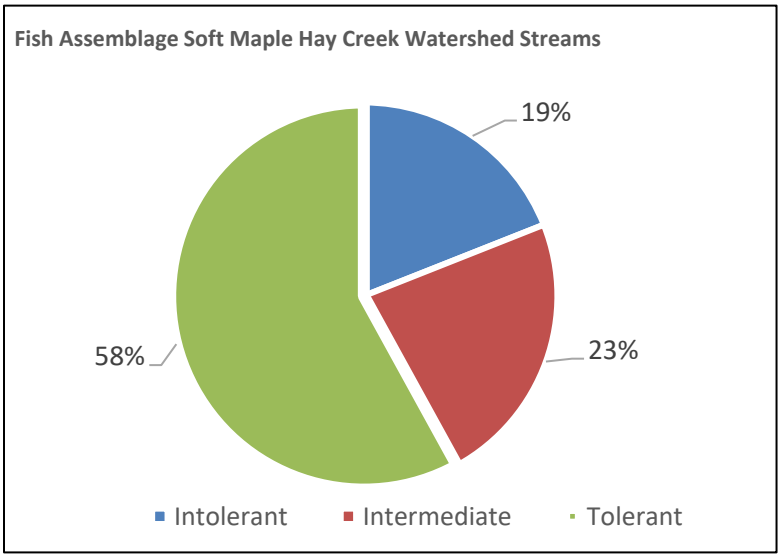
Fish Species

The fish community is an environmental indicator that can help characterize the water quality of a stream resource. Fish Species are classified as tolerant, intermediate, and intolerant and can indicate the presence of environmental stressors including thermal, chemical, or habitat issues. Survey sites included a headwater and downstream station on all streams surveyed except for Hay Creek. Only a downstream station was surveyed on Hay Creek. In addition, sites that were surveyed during the watershed appraisal process were surveyed when possible.

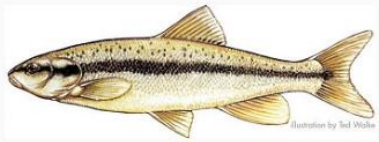
A total of 15 fish surveys were conducted on 7 named waterways (Table 7). These waterways included Devils Creek, Alder Creek, Becky Creek, Clear Creek, Big Soft Maple Creek, Little Soft Maple Creek and Hay Creek. There were 26 species of fish captured in the surveys. Fifty-eight percent of the fish species captured in the surveys were tolerant species (Figure 6). The most common fish species captured across all waterways were white sucker, western blacknose dace, and creek chub. These species accounted for 53% of the total fish collected in the surveys.

There are 6 trout streams in the watershed (Table 5). Brook trout were captured in 5 of these 6 waterways. Trout were captured at all sites on Devils, Alder, Clear, and Little Soft Maple Creeks. No trout were captured in Big Soft Maple Creek, a class III trout water. Trout were only captured at the headwater site on Becky Creek. Clear Creek had the highest number of trout captured at both its downstream and upstream sites with 140 and 144 individuals, respectively.

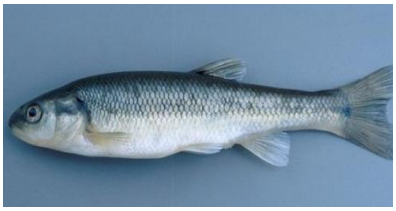
Figure 6. Fish Assemblage Tolerance Percentages Soft Maple Hay Creek Watershed



The **Western Blacknose Dace** is a common small minnow, distributed throughout the Mississippi and Great Lakes watersheds.



Creek Chub is a minnow that known for the stone piles they build in streams, into which eggs are deposited. Minnows are a big family of fishes, with about 230 species in North America.



DNR photo taken by John Lyons. Courtesy of the Pennsylvania Fish & Boat Commission. https://www.fishandboat.com/Fish/PennsylvaniaFishes/

Natural Community Verification

The DNR has developed a model to predict the natural community for streams in the state (Lyons, 2008). This model accurately predicts the natural community of streams 70% of the time (Lyons, 2008). To account for potential misclassifications, the predicted natural community of streams is reviewed with field data using a standard method to assign the most appropriate natural community. This process is referred to as natural community verification (Lyons 2013). This important step in reviewing the biological community affects the condition values, as the natural community dictates which index of biotic integrity to use (WisCALM 2018).

All available fish survey data and stream temperature data for each waterway was used to review the natural community of each watershed stream surveyed in 2015 (Table 7 and Table 8, Figure 7). These data were reviewed to assess the natural community for the entire stream length following the verification methodology, best professional judgment, and knowledge of the watershed. The predicted natural communities varied from coldwater to cool-cold and cool-warm headwaters and mainstems depending on the waterway and stream reach. There were several streams and reaches where the observed natural community was different than the modeled community and changes are recommended. The recommended natural community is shown in Table 8. In general, the streams tended to be warmer than predicted by the model. Some stream reaches did not have enough survey information available to assess the natural community. Other reaches had conflicting survey results, and in those cases, the predicted natural community was retained.

Table 7: Fish Assemblages and Tolerance Values in Soft Maple Hay Creek Surveys

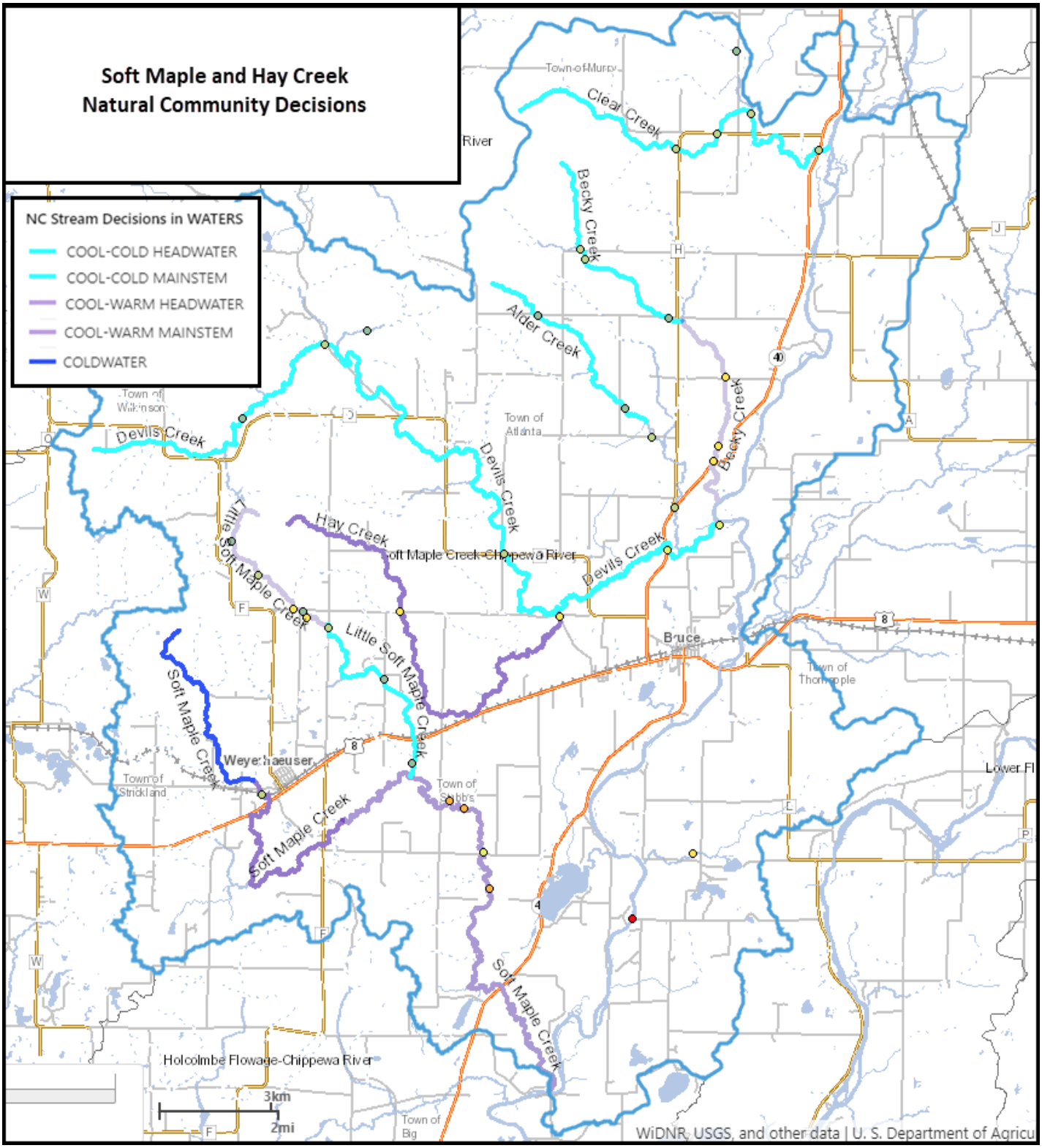
Site Number:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Station ID	553097/ 10037837	553096/ 10037834	10043948	553095	10044315	10032171	10038169	553091	553090	10007968	10043937	10044235	553158	553102	553098	
Water:	Devils Cr	Devils Cr	Devils Cr	Alder Cr	Alder Cr	Becky Cr	Becky Cr	Becky Cr	Clear Cr	Clear Cr.	Big Soft Maple	Big Soft Maple	Little Soft Maple	Little Soft Maple	Hay Creek	Tolerance Rating
Brook Trout	2	98	28	16	74			54	140	144			9	6		Intolerant
Western Blacknose Dace	3	191	23	126	20	175	110	36	30	151	8	12	72	101	27	Tolerant
Mottled Sculpin	17	2	10	6	6	127	24	41	97	95			15			Intolerant
Longnose Dace		49	11	17		4	5	6	7	3						Intolerant
Central Mudminnow	35				2	47	41	2	6	2	8	14		12	2	Tolerant
Burbot	39	53	11	72	1	1	4	2	28	9		2	2			Intermediate
Creek Chub	67	32	1	86	1	166	116		8		291	57	121	62	41	Tolerant
White Sucker	103		3	110	1	373	105		38		381	16	37			Tolerant
Common Shiner	6	7		19	2	104	111				42	6	2			Intermediate
Pearl Dace	2			15	12	132	87						44	159	12	Intermediate
Brook Stickleback	2					91	12		7		14	7	4	5	1	Tolerant
Finescale Dace						3	1		1			1			7	Intermediate
Hornyhead Chub						56	3				13					Intermediate
Johnny Darter	42	1	1	13		78	10				91			1		Intermediate
Central Stoneroller						11										Intermediate
Blackside Darter	38			10		12			3		7					Intermediate
Blackchin Shiner						8										Intolerant
Blacknose Shiner		1				2			1		1					Intolerant
Lamprey (amnocetes)	18	6	2	41							21					Intolerant
Fantail Darter	6	11		11					2	4	8		2	1		Intermediate

Site Number:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Station ID	553097	553096	10043948	553095	10044315	10032171	10038169	553091	553090	10007968	10043937	10044235	553158	553102	553098	
Water:	Devils Cr	Devils Cr	Devils Cr	Alder Cr	Alder Cr	Becky Cr	Becky Cr	Becky Cr	Clear Cr	Clear Cr.	Big Soft Maple	Big Soft Maple	Little Soft Maple	Little Soft Maple	Hay Creek	Tolerance Rating
Northern Redbelly Dace		1														Intermediate
Brassey Minnow				10							1		2			Intermediate
Iowa Darter					1											Tolerant
Golden Shiner											1					Intermediate
Redhorses												3				
Fathead Minnow													3			Tolerant
Station ID	553097	553096	10043948	553095	10044315	10032171	10038169	553091	553090	10007968	10043937	10044235	553158	553102	553098	
Modeled NC	Cool-Cold MS	Cool-Cold MS	Cool-Cold MS	Cool-Cold HW	Cool-Cold HW	Cool-Cold HW	Cool-Cold-HW	Coldwater	Cool-Cold HW	Cool-Cold HW	Cool-Cold-MS	Cool-Cold-HW	Coldwater	Coldwater	Cool-Cold-HW	
Fish IBI NC	Cool-Cold MS	Cool-Cold HW	Cool-Cold HW	Cool-Cold HW	Cool-Cold HW	Cool-Warm HW	Cool-Warm HW	Cool-Cold HW	Cool-Cold HW	Cool-Cold HW	Cool-Warm MS	Cool-Cold HW	Cool-Cold HW	Cool-Warm HW	Cool-Warm HW	
FIBI Used	Cool-Cold Transition	Small Stream	Small Stream	Small Stream	Small Stream	Small Stream	Small Stream	Small Stream	Small Stream	Small Stream	Cool-Warm Transition	Small Stream	Small Stream	Small Stream	Small Stream	
Condition Result	90	100	80	100	100	100	100	60	80	100	60	50	100	100	50	
Condition Value	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Fair	Good	Excellent	Good	Fair	Excellent	Excellent	Fair	
Habitat Value/ Condition	35/Fair	55/Good	70/Good	58/Good	53/Good	60/Good	60/Good	73/Good	68/Good	70/Good	68/Good	77/Excellent	68/Good	55/Good	77/Excellent	
mIBI Value/ Cond.	5.5/Good	9.7/Excellent		8.8/Excellent		9.2/Excellent		9.2/Excellent	9.7/Excellent		7.4/Good		9.1/Excellent	8.0/Excellent	7.4/Good	
HIBI Value/Cond	3.1/Excellent	2.8/Excellent		3.7Very Good		4.5/Good		1.9/Excellent	2.1/Excellent		3.5/Excellent		1.9/Excellent	3.2/Excellent	4.3/Very Good	
Total Phosphorus (Mg/L)	0.0621	0.0613	0.0829	0.0724		0.138		0.0436	0.0637	0.0328	0.142	0.0803	0.108	0.0607	0.0465	

Table 8. Natural Community Verification Table Soft Maple Hay Creek Watershed

Waterway and Stream Reach	WBIC	Modeled Natural Community	Change Recommended	Natural Community	Comments
Becky Creek from stream mouth to confluence with Unnamed Creek 23697000	2369600	Cool-Cold HW	Yes	Cool-Warm HW	Multiple fish surveys and stream temperature data suggest a change
Becky Creek from confluence with 23697000 to headwaters	2369600	Coldwater	Yes	Cool-Cold HW	Multiple fish surveys and stream temperature data suggest a change
Clear Creek	2370100	Cool-Cold HW	No	Cool-Cold HW	Verified as modeled
Alder Creek from stream mouth to confluence with Unnamed Creek 2366900	2366700	Cool-Cold HW	No	Cool-Cold HW	Conflicting surveys change not recommended until further surveys can be conducted
Alder Creek from stream confluence with Unnamed Creek 2366900 to headwaters	2366700	Coldwater	Yes	Cool-Cold HW	Multiple Surveys suggest a change
Devils Creek from stream mouth to Hay Creek confluence	2366600	Cool-Cold MS	No	Cool Cold MS	Verified as modeled
Devils Creek from Hay Creek confluence to with Unnamed Creek 5005534	2366600	Cool-Cold MS	Yes	Cool Cold HW	Multiple Surveys suggest a change
Devils Creek from confluence with Unnamed Creek 5005534 to headwaters	236600	Cool-Cold HW and Coldwater	No	Cool-Cold HW and Coldwater	Not Surveyed in 2015, conflicting or no survey information. Change not recommended until further surveys can be conducted
Little Soft Maple Creek from stream mouth to confluence with Unnamed Creek 2357400	2357300	Cool-Cold HW	No	Cool-Cold HW	No survey information no change recommended
Little Soft Maple Creek from confluence with Unnamed Creek 2357400 to Norwegian Rd	2357300	Coldwater	Yes	Cool-Cold HW	Multiple surveys recommend change. Changing community type at road crossing not ideal but the fish surveys strongly indicate there is a difference US of road crossing
Little Soft Maple Creek from Norwegian Rd to headwaters	2357300	Coldwater	Yes	Cool-Warm HW	Multiple surveys recommend change
Hay Creek -all	2367200	Cool-Warm HW Cool-Cold HW Coldwater	Yes	Cool-Warm HW	Recommend change all of stream to Cool-Warm HW, intact watershed, large areas of wetland, no coldwater species captured in any survey.
Big Soft Maple Creek from mouth to confluence with Unnamed creek 2357700	2356600	Cool-Cold MS	Yes	Cool-Warm MS	Multiple surveys recommend change
Big Soft Maple Creek from confluence with Unnamed creek 2357700 to confluence with Unnamed Creek 2358500	2356600	Cool-Cold-HW	Yes	Cool-Warm HW	Multiple Surveys in area recommend a change
Big Soft Maple Creek from confluence with Unnamed Creek 2358500 to Headwaters	2356600	Coldwater	No	Coldwater	No survey information in this area. This segment is probably warmer than modeled but additional surveys should be conducted.

Figure 7. Natural Community Determinations, Soft Maple and Hay Creek Watershed



Fish Surveys Index of Biological Integrity

The indexes of biological integrity were applied to the 2015 fish surveys based on the stream segments assigned natural community according to WisCALM 2018. The Warm Transitional and Cool Transitional IBIs were applied to the mainstem sites on Big Soft Maple and Devils Creeks respectively; the small stream (intermittent) IBI was applied to all headwaters. Fish IBI scores ranged from fair to excellent. Of the 15 sites surveyed, 9 scored excellent, 3 good and 3 fair (Table 9, Figure 8 and Table 10, Figure 9).

Stream Habitat Condition

Stream and riparian habitat quality were assessed at 13 fish survey stations based on DNR Wadeable Stream Quantitative Fish Habitat Rating guidance (Simonson et al, 1994), and at 2 sites with the Wadeable Stream Qualitative Fish Habitat Rating Guidance (Table 9, Figure 8). The quantitative habitat rankings ranged from fair to good for the 13 sites surveyed. The Devils Creek site at STH 40 was the only fair score. The other sites all were rated good. Due to time limitations a qualitative habitat survey was done at the US site on the Big Soft Maple Creek and at the Haymeadow Creek site. Both scores were rated excellent, however this may represent a bit of a bias when filling out the qualitative habitat survey. These sites did not appear to have better habitat than the headwaters sites on Clear or Becky Creeks, which were the two highest quantitative scored sites and rated as good. Overall quality habitat was present at all the stream segments surveyed.

Macroinvertebrate Surveys of Biological Integrity

Macroinvertebrate samples were collected at 10 sites in 2015 during this project period. The samples were generally collected at the DS survey site. Two streams, Becky and Little Soft Maple, had a second sample collected at the headwater sites. A mid reach macroinvertebrate sample was collected at Devils Creek at CTH O as part of another project and is included with this study.
The MIBI scores ranged from 5.5 – 9.7 (Table 10, Figure 9 and Figure 10). All sites were rated good or excellent in the 2015 study. HIBI scores ranged from 1.9 - 4.3, again in the good to excellent range. Figure 10 provides a visual representation of the current MIBI value ratings of the streams in the watershed based on data collected for this study and analyzed using WisCALM 2018 thresholds. Overall, these streams had diverse macroinvertebrate communities with high percentages of sensitive species represented in the samples (Figure 9 and Figure 10).

Thirteen macroinvertebrate samples were collected at seven of these sites over the last 20 years. These samples are included in Table 9 for comparative purposes. The original appraisal samples for the priority watershed project were collected in 1994. There are too few samples spread out over 20 years to do any type of pre/post watershed project statistical analysis. The stream MIBI and HBI values appear similar from 1994 and 2015. The MIBI values ranged from 5.2-11.1. These scores are rated good to excellent. There was a HIBI score on Becky Creek that was rated poor in 2008. However, the MIBI score at that site in 2008 rated good. 2008 was a drought year and it's possible that low flows influenced the HIBI score. The 2010 HIBI sample score was rated very good.

The Macroinvertebrate Index of Biological Integrity (mIBI) and Hilsenhoff Biological Index (HIBI) were applied to the 2015 macroinvertebrate surveys. Also reported in the table below are indicators of aquatic health including Shannon's Diversity Index, Species Richness, Percent Ephemeroptera, Plecoptera and Trichoptera (EPT), and Percent Chironomid.

Water Chemistry

Thirteen of the survey sites were sampled for Total Phosphorus, Ammonia as N, Nitrate+Nitrite, Total Nitrogen and Total Suspended Solids 1x each between June and September 2015. Field Measurements of dissolved oxygen, temperature, specific conductance, pH and transparency were recorded at sampling event. These data are reported in Table 11 and Table 12. Total phosphorus values were observed above the state standard in NR 102 WI Adm. Code of 0.075mg/L in Becky, Devils, Little Soft Maple, and Big Soft Maple Creeks.

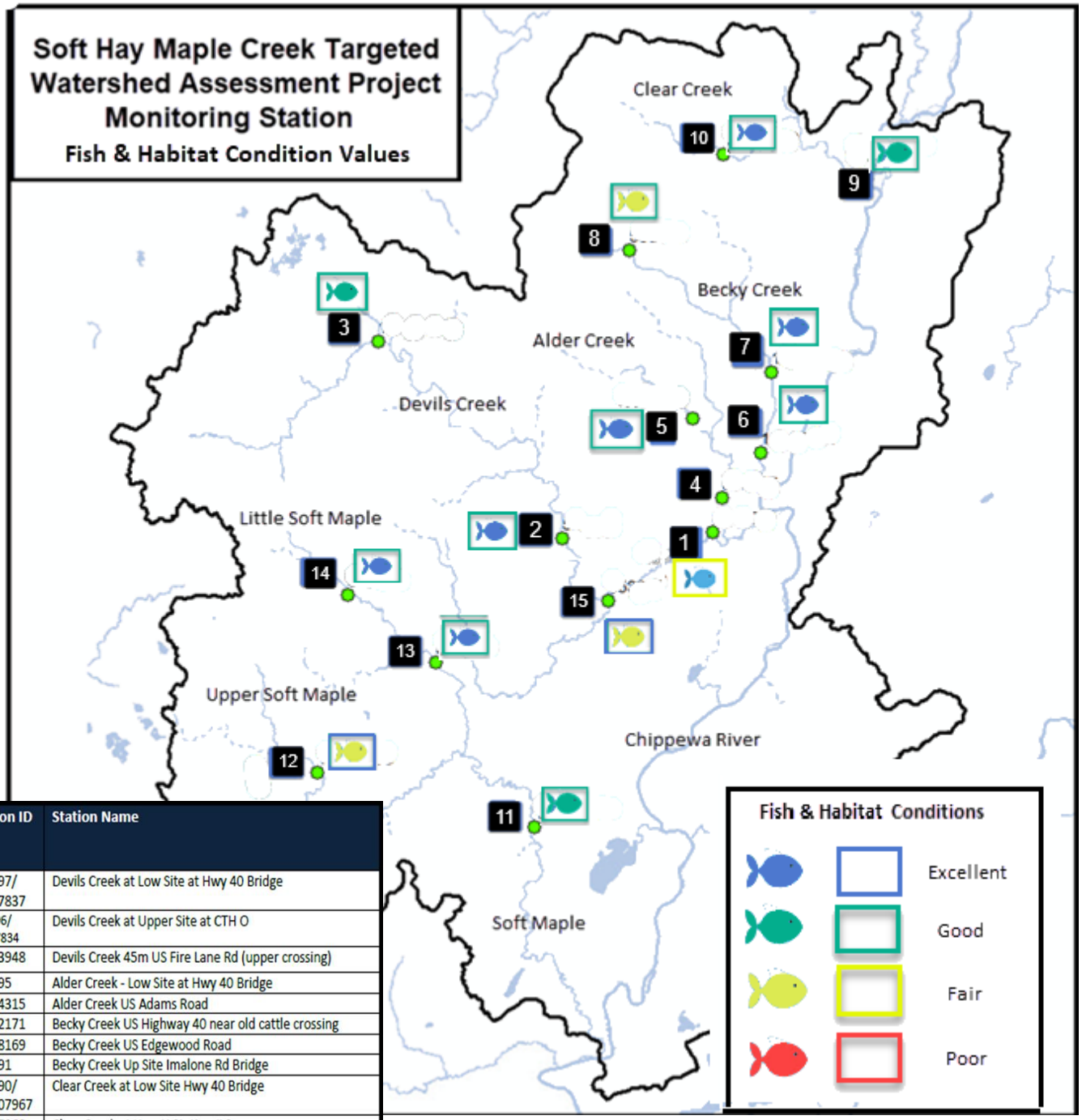
Table 9. Fish Biological Integrity and Habitat Condition

MAP Id	Station Number	Station Name	Natural Community	Stream Order	Fish IBI	Fish Rating	Habitat Score	Habitat Ranking
1	553097	Devils Cr Low Site Hwy 40 Bridge	Cool-Cold MS	4	90	Excellent	35	Fair
2	553096	Devils Cr Upper Site at CTH O	Cool-Cold HW	4	100	Excellent	55	Good
3	10043948	Devils Cr 45m US Fire Lane Rd (upper crossing)	Cool-Cold HW	3	80	Good	70	Good
4	553095	Alder Creek Low Site - Hwy 40 Bridge	Cool-Cold HW	3	100	Excellent	58	Good
5	10044315	Alder Creek US Adams Road	Cool-Cold HW	2	100	Excellent	53	Good
6	10032171	Becky Creek Upstream Highway 40 near old cattle crossing	Cool-Warm HW	3	100	Excellent	60	Good
7	10038169	Becky Creek Upstream of Edgewood Road	Cool-Warm HW	3	100	Excellent	60	Good
8	553091	Becky Creek - Up site Imalone Rd Bridge	Cool-Cold HW	2	60	Fair	73	Good
9	553090	Clear Creek Low Site Hwy 40 Bridge	Cool-Cold HW	3	80	Good	68	Good
10	10007968	Clear Creek Hwy H station #2	Cool-Cold HW	2	100	Excellent	70	Good
11	10043937	Big Soft Maple Cr 35m US Amacoy Lake Rd	Cool-Cold MS	4	60	Good	68	Good

MAP Id	Station Number	Station Name	Natural Community	Stream Order	Fish IBI	Fish Rating	Habitat Score	Habitat Ranking
12	10044235	Big Soft Maple DS Railway Ave	Cool-Cold HW	3	50	Fair	77	Excellent
13	553158	Little Soft Maple Creek at Kief Rd, Near Weyerhauser	Cool-Cold HW	3	100	Excellent	68	Good
14	553102	Little Soft Maple Upper Site Tyman Rd Bridge	Cool-Warm HW	3	100	Excellent	55	Good
15	553098	Hay Creek Tyman at Tyman Rd (Bruce, WI	Cool-Warm HW	3	50	Fair	77	Excellent

***These were Quantitative Habitat evaluations except for Hay Creek and Soft Maple US site*

Figure 8. Fish Biological Integrity and Habitat Condition



Map #	Station ID	Station Name
1	553097/ 10037837	Devils Creek at Low Site at Hwy 40 Bridge
2	553096/ 10037834	Devils Creek at Upper Site at CTH O
3	10043948	Devils Creek 45m US Fire Lane Rd (upper crossing)
4	553095	Alder Creek - Low Site at Hwy 40 Bridge
5	10044315	Alder Creek US Adams Road
6	10032171	Becky Creek US Highway 40 near old cattle crossing
7	10038169	Becky Creek US Edgewood Road
8	553091	Becky Creek Up Site Imalone Rd Bridge
9	553090/ 190007967	Clear Creek at Low Site Hwy 40 Bridge
10	10007968	Clear Creek at Hwy H Station # 2
11	10043937	Big Soft Maple Creek 35m US Amacoy Lake Rd
12	10044235	Big Soft Maple Creek DS Railway Avenue
13	553158	Little Soft Maple Creek at Kief Rd Near Weyerhauser
14	553102	Little Soft Maple Creek at Upper Site Tyman Rd Bridge
15	553098	Hay Creek at Tyman Rd Near Bruce WI

Table 10. MIBI and HIBI scores and ratings and associated metrics

Map Id	Station Number	Station Name	mIBI Value	mIBI rating	HIBI	HIBI rating	Date	Shannon's DI	Species Richness	% EPT indiv.	% Chirono indv
1	553097	Devils Creek Low Site at Hwy 40 Bridge	5.499	Good	3.135	Excellent	10/7/2015	2.262	30	55.56	25.93
1	553097	Devils Creek Low Site at Hwy 40 Bridge	5.902	Good	4.818	Very Good	10/21/2011	3.876	28	34.78	52.17
1	553097	Devils Creek Low Site at Hwy 40 Bridge	7.2	Good	3.486	Excellent	5/12/1994	3.662	46	38.46	33.33
2	553096	Devils Creek - Upper Site at CTH O	9.73405	Excellent	2.777	Excellent	10/7/2015	4.513	39	50.28	19.34
2	553096	Devils Creek - Upper Site at CTH O	9.19	Excellent	3.692	Very Good	10/19/2009	3.805	30	49.26	25.87
4	553095	Alder Creek Low Site - Hwy 40 Bridge	8.76962	Excellent	3.68	Very Good	10/7/2015	4.346	39	60.26	22.44
4	553095	Alder Creek Low Site - Hwy 40 Bridge	8.75	Excellent	3.821	Very Good	5/10/1994	4.338	46	50.87	15.03
6	10032171	Becky Creek US Highway 40 near old cattle crossing	9.21894	Excellent	4.531	Good	11/4/2015	4.47	39	62.77	13.14
8	553091	Becky Creek - Up site Imalone Rd Bridge	9.16592	Excellent	1.875	Excellent	11/2/2015	4.31	31	74.19	12.10
9	553090	Clear Creek - Low Site Hwy 40 Bridge	9.66508	Excellent	2.055	Excellent	11/2/2015	4.155	32	80.42	6.30
9	553090	Clear Creek - Low Site Hwy 40 Bridge	11.0967	Excellent	2.986	Excellent	10/9/2000	3.811	30	84.57	8.03
9	553090	Clear Creek - Low Site Hwy 40 Bridge	10.7499	Excellent	2.968	Excellent	5/6/1994	3.911	39	72.86	7.86
11	10043937	Big Soft Maple Creek 35m US Amacoy Lake Rd	7.40778	Good	3.468	Excellent	11/4/2015	3.768	36	55.62	3.38
13	553158	Little Soft Maple Creek at Kief Rd, Near Weyerhauser	9.10983	Excellent	1.93	Excellent	10/21/2015	3.865	24	78.20	9.03
13	553158	Little Soft Maple Creek at Kief Rd, Near Weyerhauser	5.87346	Good	4.417	Very Good	10/19/2009	2.562	14	5.16	43.88
13	553158	Little Soft Maple Creek at Kief Rd, Near Weyerhauser	9.54901	Excellent	2.275	Excellent	9/26/2001	4.009	38	71.97	11.08
14	553102	Little Soft Maple Upper Site Tyman Rd Bridge	8.02525	Excellent	3.179	Excellent	10/21/2015	4.456	39	63.24	14.71
15	553098	Hay Creek at Tyman Rd Near Bruce	7.40857	Good	4.336	Very Good	10/21/2015	3.068	16	50.42	44.54
15	553098	Hay Creek at Tyman Rd Near Bruce	5.22782	Good	6.008	Fair	9/26/2001	3.21	23	30.33	10.66
15	553098	Hay Creek at Tyman Rd Near Bruce	8.36514	Excellent	7.357	Fairly Poor	5/10/1994	3.946	26	4.13	83.51
16	10007963	Becky Creek Hwy 40 Station #1	8.772	Excellent	4.418	Very Good	3/30/2010	1.541	16	6.29	3.28
16	10007963	Becky Creek Hwy 40 Station #1	6.8335	Good	8.103	Poor	11/13/2008	2.177	15	19.11	79.62
16	10007963	Becky Creek Hwy 40 Station #1	7.103	Good	4.549	Good	10/8/2000	3.084	31	60.47	13.95

***S**pecies Richness, % chironmidae individual, and EPT % individual for sample location in the Soft Maple Hay Creek watershed.*

Figure 9. Macroinvertebrate Biological Integrity (mIBI)

Map Id	Station Number	Station Name
1	553097	Devils Creek Low Site at Hwy 40 Bridge
2	553096	Devils Creek - Upper Site at CTH O
4	553095	Alder Creek Low Site - Hwy 40 Bridge
6	10032171	Becky Creek US Highway 40 near old cattle crossing
8	553091	Becky Creek - Up site Imalone Rd Bridge
9	553090	Clear Creek - Low Site Hwy 40 Bridge
11	10043937	Big Soft Maple Creek 35m US Amacoy Lake Rd
13	553158	Little Soft Maple Creek at Kief Rd, Near Weyerhauser
14	553102	Little Soft Maple Upper Site Tyman Rd Bridge
15	553098	Hay Creek at Tyman Rd Near Bruce
16	10007963	Becky Creek Hwy 40 Station #1

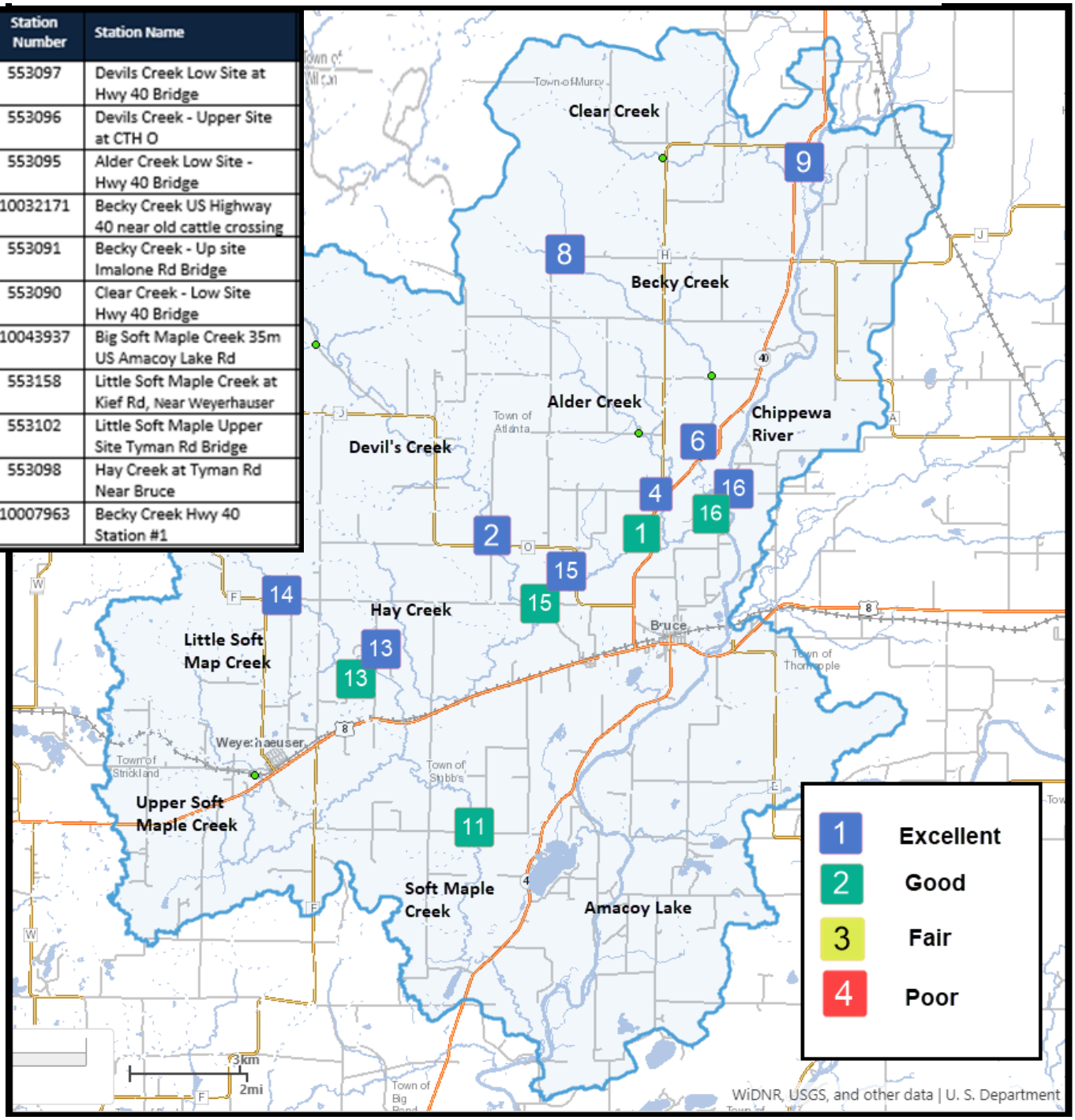
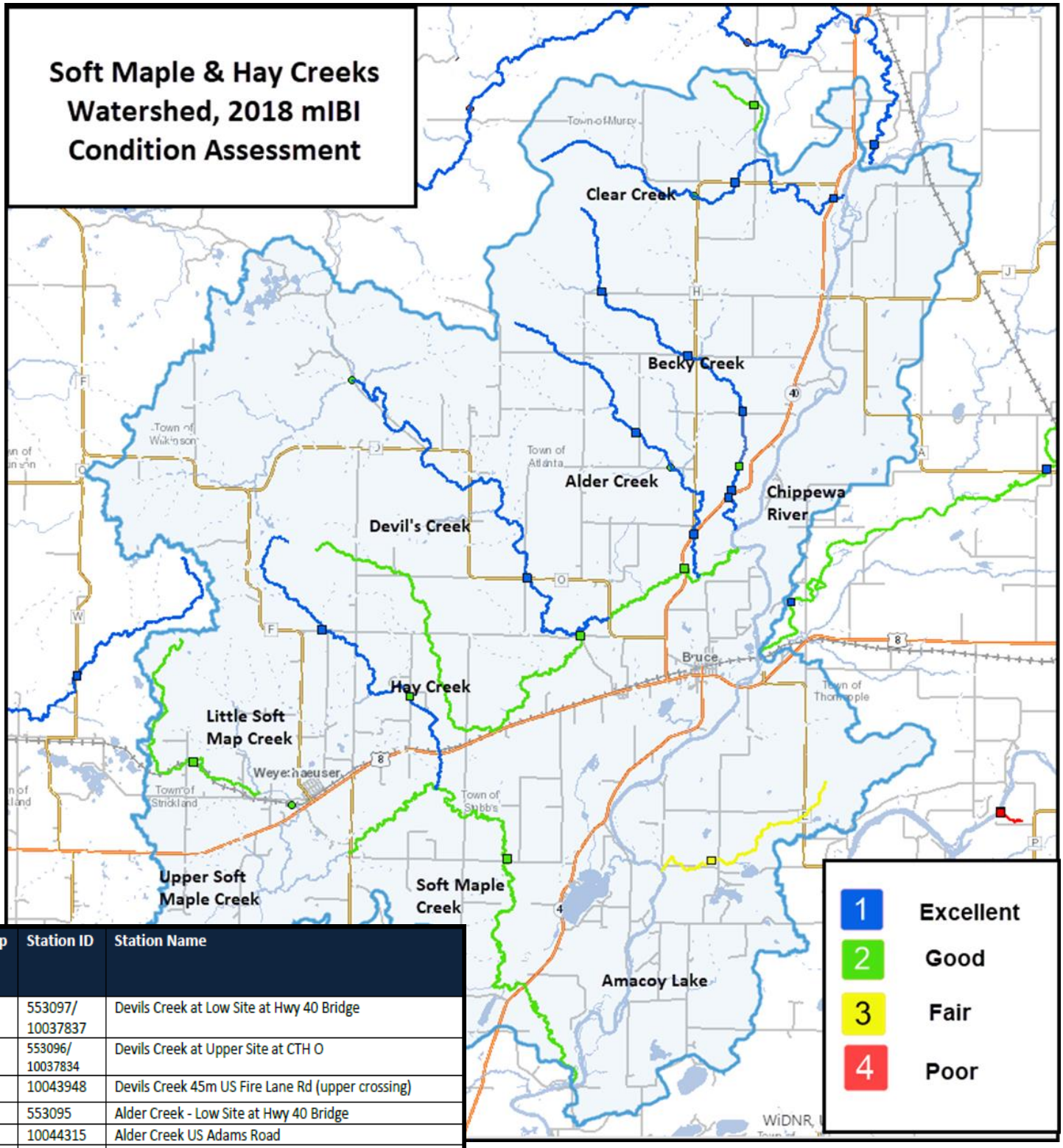


Figure 10. Stream Macroinvertebrate Biological Integrity (mIBI) (WisCALM 2018 Assessment Method).



Map #	Station ID	Station Name
1	553097/ 10037837	Devils Creek at Low Site at Hwy 40 Bridge
2	553096/ 10037834	Devils Creek at Upper Site at CTH O
3	10043948	Devils Creek 45m US Fire Lane Rd (upper crossing)
4	553095	Alder Creek - Low Site at Hwy 40 Bridge
5	10044315	Alder Creek US Adams Road
6	10032171	Becky Creek US Highway 40 near old cattle crossing
7	10038169	Becky Creek US Edgewood Road
8	553091	Becky Creek Up Site Imalone Rd Bridge
9	553090/ 190007967	Clear Creek at Low Site Hwy 40 Bridge
10	10007968	Clear Creek at Hwy H Station # 2
11	10043937	Big Soft Maple Creek 35m US Amacoy Lake Rd
12	10044235	Big Soft Maple Creek DS Railway Avenue
13	553158	Little Soft Maple Creek at Kief Rd Near Weyerhauser
14	553102	Little Soft Maple Creek at Upper Site Tyman Rd Bridge
15	553098	Hay Creek at Tyman Rd Near Bruce WI

Table 11. Nutrient and Total Suspended Solids Results and Field Parameters

		Becky creek - up site Imalone rd bg	Becky creek upstream HWY 40 at old cattle crossing	Alder creek - low site at hwy 40 bridge	Clear creek - clear creek hwy h station # 2	Clear creek - low site hwy 40 bridge	Devils creek 45m us fire lane rd (upper crossing)	Devils creek - upper site at cth o	Devils creek - low site at hwy 40 brg	Little soft maple creek - upper site tyman rd bridge	Little soft maple creek at kief rd near weyerhauser	Big soft maple creek ds railway avenue	Big soft maple creek 35m us amacoy lake rd	Hay creek at tyman rd near bruce wi
		7/29/2015	7/27/2015	7/3/2015	7/22/2015	7/15/2015	8/14/2015	7/30/2015	8/5/2015	**08/14/2015**	**08/10/2015**	**9/25/2015**	**08/11/2015**	**9/25/2015**
Site #		8	6	4	10	9	3	2	1	14	13	12	11	15
Residue total NFLT (Total Suspended Solids)	MG/L	ND	3.25	5	ND	ND	ND	ND	ND	ND	4.5	3.4	4.4	ND
Total Nitrogen	MG/L	0.336	1.1	0.729	0.427	0.707	0.401	0.34	0.0229	0.348	1.064	0.908	0.041	0.457
Nitrogen NH3-N Dissolved	MG/L	ND	0.0384	0.0196	0.0156	0.0158		ND	0.369	0.0186	0.027	0.0364	0.687	ND
Nitrogen NO3+NO2 DISS (AS N)	MG/L	0.165	0.299	0.285	0.201	0.212		0.0837	0.494	0.0801	0.0343	ND	0.247	ND
Total Phosphorus	MG/L	0.0436	0.138	0.0724	0.0328	0.0637	0.0829	0.0613	0.0621	0.0607	0.108	0.0803	0.142	0.0465
Temperature	C	18.1	21.3	15.9	16.2		17.6	18.2	16.7	19.6	17.7	16.9	17.7	16.6
Cloud Cover	%	50	20					20		20	30		10	
Stream Flow	CFS		0.8		1.9			8.5	11.6	0.3	5.1		28.9	
Conductivity Field	UMHOS/ CM	63	91	133	66		121	135	177	91	57	60	163	29
Dissolved Oxygen Field	MG/L	9.2	9.3	10.5	10.5		9.1	9.4	8.5	8.8	9.9	5.8	9	11.8
Oxygen, Dissolved, Percent Saturation %	%	97.6		106.1	106			99.5	87.5	95.4		60.6	94.5	121
pH Field	SU	7.7	7.7	7.5	7.6		7.5	7.9	7.6	7.7	7.2	6.4	7.7	6.5
Transparency Tube	CM	>120.0	>120.0	>120.0	>120		>120	>120.0	>120.0	>120.0	>120.0	>120.0	>120.0	>120.0

Discussion

Watershed Characterisitics

Streams in the studied watersheds start in the Blue Hills and generally flow from northwest to southeast toward the Chippewa River. The upper reaches of the watersheds are characterized by steep or rolling terrain and soils of low permeability. Because of this, runoff waters quickly reach the stream channels in greater volume. These areas are generally forested, agricultural lands and residential development are limited. The waterway's shoreline buffers are generally intact; however, the stream banks often show signs of erosion and stream channel widths are wider than expected for headwater streams due to the increased flows. This results in streams that flow bank to bank in the spring and during runoff events but during typical summer conditions the actual wetted width of the waterway is confined to the middle of the streambed. The increased flows move fine sediments downstream leaving coarser streambed materials. Fine sediments are confined to the channel edges and in backwater areas if present at all.

Devils Creek upstream of STH 40. Photo by Jon Kleist, DNR.

The lower reaches of the watersheds, as the streams near the Chippewa River, are characterized by gentler terrain and soils with greater permeability. This area is also mainly forested but has more residential development and agricultural lands compared to the headwaters. The waterway's stream buffers are generally intact but there are localized areas of crop or pasturelands near or on the stream banks. The stream gradients are less steep and flow velocities are slower than the headwater areas. The wetted width of the stream channel is usually bank to bank during normal flows. The floodplains are wider, and the streams often flow over the banks during runoff events. The stream banks are less eroded through this area but the increased flows from the steeper headwater areas still causes some bank erosion. The slowing water velocities, compared to the headwaters, allows for more sediment deposition to occur. The streambed materials consist of more fine materials. The riffle areas are generally coarse gravel, cobble, and rock but sand and silt are common in runs and pools. These channel characteristics affect the distribution of habitat available, the biological communities of the streams, as well as the reported habitat ranking scores.

There is limited agriculture and residential development in the watershed, but some localized impacts from agricultural practices exist. Crop fields were observed adjacent to stream banks in the lower reaches of Devils and Becky Creeks. It was not possible to survey all the stream channel corridors in the watershed, so other impacted areas are likely present. While the overall impact of agriculture and/or development to the waterways are limited and are not causing water quality problems to the point of impairment they should be identified and addressed through best management practices. Addressing any impacted areas will be beneficial to water quality and localized impacts will show quicker recovery when compared to watersheds with widespread agricultural impacts.

Biological Community

The biological communities of the streams in the Soft Maple/Hay Creek watershed are generally in excellent to good conditions. A diverse fish community was present, twenty-six species of fish were captured in the surveys ranging in tolerance from intolerant to tolerant (Table 8). The fish communities of the streams in the watershed are in generally excellent to good condition based on the fish IBI scores. Brook trout were captured in all the surveyed streams except for Hay and Big Soft Maple Creeks. In past surveys WDNR fisheries staff have captured brook trout at other survey sites on Big Soft Maple Creek. Clear Creek had the highest number of Brook trout captured in the fish surveys and were present throughout the system, however brook trout were only captured in headwater area of Becky Creek. Burbot were commonly captured in surveys and were widely distributed throughout the watershed. Mottled sculpin an intolerant coldwater fish species was also common in the watershed and captured in all streams except for Big and Little Soft Maple, and Hay Creeks. Past fish surveys have captured mottled sculpin in Little Soft Maple Creek. While trout were common in many streams, the fish communities consisted of mainly transitional forage fish species. All of the streams in the watershed should be considered transitional between cold and warm. Most are headwater streams. The DS stations on Devils Creek at STH 40 and Big Soft Maple at Amacoy Lake road were the only mainstem sites surveyed based on the fish communities.

The Macroinvertebrate community was rated as excellent to good based on the macroinvertebrate IBI (MIBI) and Hilsenhoff (HIBI) scores for the samples collected across the watershed in 2015 (Figure 11). The headwater portions of Devils and Becky, and all of Alder, Clear and Little Soft Maple Creeks had excellent MIBI scores. These scores are reflective of the habitat at the macroinvertebrate sampling sites. These sites all had well defined riffles with coarse gravel and cobble streambed substrates. Past macroinvertebrate sampling at these sites dating back to 1994 show similar MIBI and HBI scores, indicating these areas had and continue to maintain water quality conducive to supporting excellent macroinvertebrate communities.

The DS sample sites on Big Soft Maple and Devils Creeks were in areas of the watershed where the stream gradient is less steep and sediment from the headwater areas is starting to settle out. The riffles here had a greater percentage of sand covering the gravel substrates. These sediments do not appear to be affecting the macroinvertebrate habitat at these sites based on the MIBI and HIBI, which were good and excellent at these sites too. The macroinvertebrate scores at Devils creek have remained constant since 1994, indicating stable conditions through this reach. No past samples were available for the Big Soft Maple Creek site. The Hay Creek macroinvertebrate site was in sedge meadow wetland complex, but a riffle was able to be sampled. The wetlands in the sample area do not appear to be affecting the macroinvertebrate MIBI score currently. Past sampling on Hay Creek dating back to 1994 showed good and excellent MIBI scores. The HBI scores were fair and fairly poor in the past. These lower HIBI scores are probably not associated with poor or changing water quality but likely reflective of the habitat surveyed or the surrounding wetlands influence on the macroinvertebrate community.

The lower site on Becky Creek at STH 40 continues to recover from livestock pasturing. These areas have had livestock removed for 10 years or more (Roesler 2011). The stream banks were well vegetated at the site US of STH 40. Vegetated islands and point bars were forming, narrowing the stream channel. The streambed in riffle areas was mainly gravel and cobble with a light coating of sand and silt. But these light sediments do not appear to be affecting the macroinvertebrate community. The MIBI and the HIBI scored excellent and good respectively in 2015 and are essentially the same as reported in the 2010 study by Roesler when the MIBI and HIBI scores were good and excellent respectively.

Water Quality Data

The undeveloped nature of the watershed (74%) helps limit the impacts of non-point source pollution from agricultural or other developed areas. In addition, over 14% of the watershed is comprised of wetlands which help trap nutrients and sediment and slow runoff velocities. Water sampling for nutrients was part of the watershed appraisal in 1994. Water samples were collected from all the streams re-surveyed in 2015 as part of this study. A mean value of .050 mg/L, or 50 µg/L was reported as a good estimate of the normal background phosphorus concentration for streams in the watershed. Sites on Becky, Soft Maple, and Devils Creeks had the highest total phosphorus concentrations in 1994.

A single water sample was collected at most of the study sites between July 3rd and September 25th of 2015 and analyzed for nutrients and total suspended solids. These samples were collected to get an idea of the nutrient concentration of the waterways at the various sites but not to check for impairments related to total phosphorus.

Table 12. Total Phosphorus Concentrations for Streams in the Soft Maple, Hay Creek Watershed 1994 and 2015.

Site	Sample Year	TP µg/L
Becky Creek-Upper	1994	30
	2015	44
Becky Creek-Lower	1994	174
	2015	138
Alder Creek-Lower	1994	49
	2015	72
Clear Creek-Upper	1994	26
	2015	33
Clear Creek-Lower	1994	34
	2015	64
Devils Creek-Upper	1994	66
	2015	83
Devils Creek-Lower	1994	50
	2015	62
Little Soft Maple-Upper	1994	37
	2015	61
Little Soft Maple-Lower	1994	28
	2015	108
Big Soft Maple-Upper	1994	129
	2015	80
Big Soft Maple-Lower	1994	126
	2015	142
Hay Creek-Lower	1994	54
	2015	46

Since the appraisal report was written in 1995, Wisconsin has adopted a statewide surface water quality standard for total phosphorus in surface water for streams of 0.075 mg/L or 75 µg/L ***(NR 102.06).*** A single total phosphorus sample over 0.075 mg/L does not indicate a water is impaired for exceeding the phosphorus criteria. Impairment decisions for phosphorus in surface waters require 6 samples collected monthly May through October. Decisions for listing impaired waterways in WisCALM 2018 are based on a 90% CI around the median of these 6 sample values and are not applicable in this case. However, the 0.075mg/L standard is useful as a comparative tool for a single sample.

The watershed appraisal report lists total phosphorus concentrations from runoff events and low flow, and lists the results as either upper, middle or lower in the watershed. The samples collected in 2015 were not collected during a runoff event but may not have been a "low" flow. The site locations sampled in 2015 correspond well with those sampled in 1994, some are the same site while others are nearby. In 2015 Soft Maple, Becky, and Little Soft Maple Creeks had the highest total phosphorus followed by Devils Creek (Table 12). The headwaters of Clear and Becky Creeks had the lowest total phosphorus concentrations in the 2015 samples. The lower sites on Becky, Little Soft Maple, and Soft Maple as well as the upper sites on Devils and Soft maple creeks all *exceeded the 0.075 mg/L standard in 2015*. With only a single sample from 1994 and 2015 limited conclusions can be drawn about changes in phosphorus values in the watershed.

In general, phosphorus concentrations were and remain elevated in Soft Maple and the lower reaches of Becky Creek. The upper reaches of Becky and Clear creeks continue to have low total phosphorus concentrations. Hay Creek phosphorus values also appear to be low and

stable around the reported average value of 0.050mg/L. Alder, Devils, and Little Soft Maple creeks should continue to be monitored as their total phosphorus values are either near or exceeding the total phosphorus criteria.

Management Recommendations

The following management, monitoring and assessment recommendations for watershed residents, DNR, and partner organizations and agencies are designed to maintain and/or further improve water quality and biological integrity.

Priority Recommendations

- Continue to work with partners to encourage landowners to implement Agricultural BMPs in the watershed.
- Continue to work with partners to maintain culverts and conduct periodic culvert audits to verify adequate water flow and fish passage.
- Ensure that Wisconsin's Forestry Best Management Practices BMPs for water quality are implemented with partners including Rusk County Forestry, industrial forest owners, private landowners and other potential partners.
- The culvert on the US crossing of Hay Creek is perched and should be set properly when replaced

Monitoring and Assessment Recommendations

- Continued periodic biological monitoring of watershed streams to assess stream health.
- Conduct biological monitoring of the lower reaches of Becky Creek DS of STH 40 if required to demonstrate that the stream should be removed from the impaired waters list.
- Continued monitoring of nutrients in Becky, Alder, Devils, Little Soft Maple, Big Soft Maple to determine if total phosphorus values change or increase over time, as total phosphorus concentrations in these streams are either near or exceeding the total phosphorus criteria.
- Engage water quality monitoring volunteers to participate to collect nutrient water quality samples.
- Encourage the Rusk County LCD to inventory the shoreland areas of the watershed streams to identify areas that may be contributing nutrients and sediments to waterways.

Management Recommendations for DNR

- Remove Becky Creek from the impaired waters list.
- Encourage local communities to apply for grants to continue best management practices designed to reduce runoff of total phosphorus and sediment in the agricultural areas of the watershed.
- Engage with the Rusk County Forestry Department to make sure forestry BMPs are implemented and that the forest roads are maintained and not contributing to sedimentation of watershed streams.

Appendix A: References

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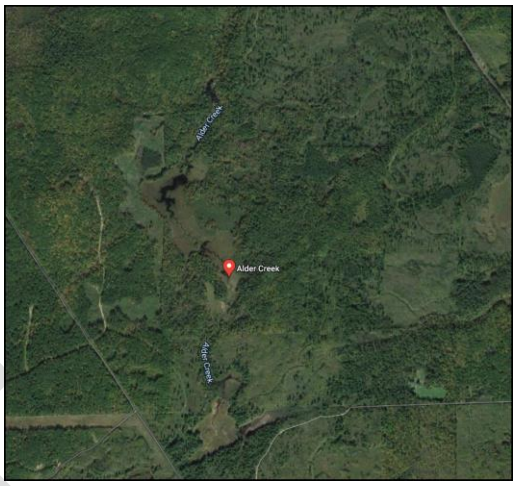
Appendix B: Soft Maple & Hay Creek Stream Narratives



Satellite (Aerial Photo) of Alder Creek.

Alder Creek, WBIC: 2366700

Alder Creek is classified as a Class I trout stream and is a cool cold headwater natural community for its entire 7.82-mile length. The stream gradient is high (81 ft/mile) in the Blue Hills and moderate (23 ft/mile) at the lower elevations nearer to its confluence with Devils Creek. The stream was surveyed at 2 sites in 2015, US of STH 40 and US of Adams Road. These two sites are in the lower third of the watershed about 1.75 miles apart where the stream is 2nd and 3rd order. Both survey sites were in areas that had previously been impacted by agriculture with row cropping near the stream banks or pastured with unlimited cattle access. The impacts of these practices were still visible on the stream banks or in the floodplain at the time of the survey. These impacts no longer appear to be ongoing. The station US of STH 40 was through a wooded corridor tucked between STH 40 and CTH H, with the stream bank buffer fairly intact. The streambed was mainly rock and cobble with silt and sand limited to the streambank margins. The station US of Adams road was through a wooded corridor as well. The stream banks were mainly vegetated with speckled alder and showed signs of flashy stream flows and channel erosion. The streambed was mostly sand through this station and areas of streambank slumping were observed. The only gravel present was limited to a couple of point bars at channel meanders. A fish habitat project had been completed through this area by the local land conservation department, date unknown but appeared to be an old project. Many of the habitat structures had washed out and were visible in the streambed and floodplain, some of the cross-log structures had moved and were causing bank erosion. Overall, the biological community at these stations was healthy. Good numbers of trout were captured at both stations and the fish community was diverse. The macroinvertebrate community was healthy as well, based on biotic indices and species diversity scores.

Past descriptions in WDNR files indicate that Alder Creek is seriously threatened by stream bank pasturing and receives direct barnyard runoff (Roesler, 1995). Area fisheries management files describe extensive habitat degradation and have documented problems relating to cattle operations, including bank erosion, habitat destruction and nutrient input. The entire stream system from mouth to headwaters was not evaluated in this project. It is possible that agricultural impacts are still present in the watershed. The two stations surveyed had agricultural impacts present in the past which were no longer ongoing. Habitat ratings were good at both survey sites in 2015, compared to fair ratings in the past study (Roesler, 1995). Nutrient input is still present based on the water sample results from this study and remain unchanged from past studies. The habitat conditions have improved in the watershed based on the two sites surveyed in 2015, likely due to the changes in land use away from agriculture. At the stations surveyed, habitat and water quality are suitable to maintaining diverse biological communities.

Becky Creek, WBIC: 2369600

Becky Creek is 8.86 miles in length and classified as a Class I trout stream. It is a cool warm headwater natural community from its confluence with the Chippewa River US to its confluence with an unnamed stream, WBIC 23697000. From that confluence US it is a cool-cold headwater. The stream gradient is high (112 ft/mile) in the Blue Hills and moderate (15 ft/mile) at the lower elevations nearer to its confluence with the Chippewa River. Becky Creek was surveyed at 3 sites in 2015 (from downstream to upstream sites) US of STH 40 (#16), US of Edgewood Road (#7) and US of Imalone Road (#8). The STH 40 and Edgewood Road sites were cool warm headwater sites and were in areas of previous agricultural impacts (cattle pasturing), the Imalone road site was a cool-cold headwater site in an unimpacted forested watershed.

Becky Creek US STH 40, April 2010. Photo by Craig Roesler DNR.

Becky Creek US STH 40, July 2015. Photo by Jon Kleist, DNR.

The WDNR determined Becky Creek was not meeting its designated use as a Class I Coldwater fishery in the lower reaches of Becky Creek, from its confluence with the Chippewa River US approximately 1.6 miles to just above STH 40. The waterbody was listed as impaired on the Wisconsin 2004 303(d) list. The pollutant causing the impairment was identified as sediment. The sediment deposits were considered an objectionable deposit under narrative criterion in NR 102.04(1) that were present in such amounts as to interfere with public rights in state waters. Becky Creek was also listed as impaired due to excessive pathogens. The segment was ranked as a high priority on the Wisconsin 2004 303(d) list. A TMDL was written in 2005 to address the excessive sedimentation that was causing the poor coldwater biotic community, however insufficient data was available to develop a TMDL to address pathogens.

The Becky Creek subwatershed as described it the TMDL is 10.74 square miles in size. The land use data was developed for the Soft Maple/Hay Creek Watershed project and lists 51% of the land use in the watershed as woodlot, 25% agriculture/pasture, 18% wetland, 5% cropland, and 1% developed land. Land use in the Becky Creek subwatershed changes from forested hills with a relatively higher stream gradient to a more agricultural, lower gradient stream over the lowermost 5 miles.

Becky Creek US of STH 40, July 2015 (top) and April 2010 (bottom).

Photos below show two locations that are not the same site, but are similar representative reaches of the stream at this monitoring station. The stream banks are currently well vegetated and woody cover is continuing to establish itself since the discontinuation of cattle pasturing.

Becky Creek Study, 2009-10

An assessment of Becky Creek (Roesler, 2011) was completed by the WDNR in 2009 and 2010 to evaluate the biotic community and health of Becky Creek five years after the water was listed as impaired (CWA Section 303(d)) to determine if the listing was still appropriate. The study was initiated in 2009, which coincided with a drought period during which time the lower reaches of Becky Creek went dry, so the study was extended into 2010.

The study involved temperature monitoring, fish community and macroinvertebrate surveys, streamflow and channel measurements, and a count of woody stems near the bank. A portion of the listed segment of Becky Creek had been heavily pastured and had a barnyard runoff problem. The Roesler report (2011) states the runoff problem had been addressed "years ago" and the new landowner is no longer pasturing the streambanks. However, the impact of cattle pasturing in previous years, such as an overly wide stream channel, trampled streambanks and limited vegetative growth, were still visible in 2009-10.

Stream temperature monitoring conducted for the report showed the stream had a coolwater temperature regime. The formerly pastured reaches were approximately 1-degree F higher than an un-pastured nearby stream segment. This was thought to be due to lack of shading and a wider and shallower stream channel.

Fish surveys were conducted in the impacted reach and in a nearby unimpacted reach. Both sites had similar fish communities and IBI scores. At the impacted reach, 18 species of fish were present and species requiring cool water (stenothermal) comprised 18% of the catch. The segment's small stream IBI score was 100 (excellent) while the coldwater IBI score was 10 (poor). The fish survey at the un-impacted site had 13 species of fish present with coolwater species comprising 20% of the catch. The small stream IBI score was 90 (excellent) and the coldwater IBI score was 10 (poor).

The Macroinvertebrate samples collected in 2010 had good to excellent MIBI and HIBI scores. The site within the impacted reach had an MIBI of 8.8 and an HIBI of 3.0, both excellent. The unimpacted site had an MIBI of 6.5 (good) and an HIBI of 3.5 (excellent). The macroinvertebrate IBI scores were slightly better in the impacted reach, but at these values these scores indicate that both segments have similar water quality.

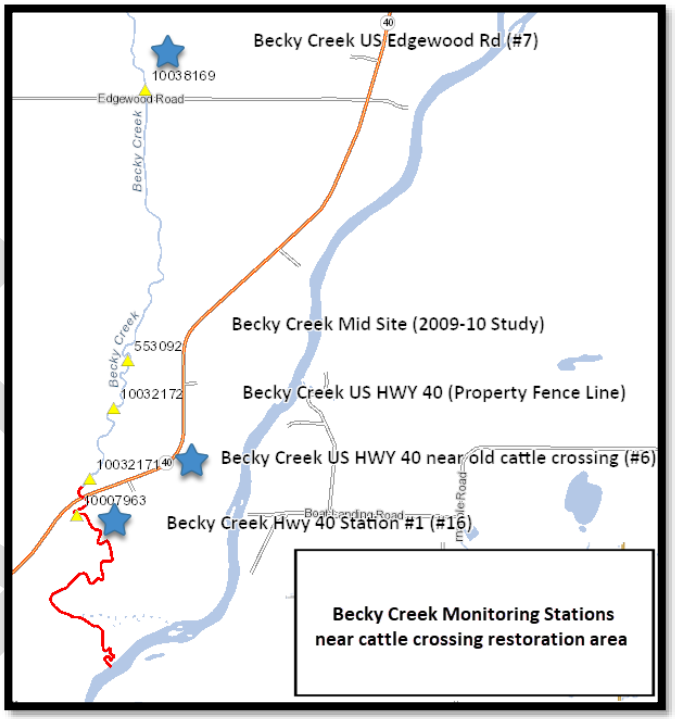
The "width depth study," conducted in April of 2010, concluded that cattle pasturing had substantially widened the channel. The impacted reach had an average stream width of 20.6 feet and depth of 7.5 cm compared to the unimpacted reach with a width if 13.8 feet and a depth of 9.4 cm at a flow of 2.2 cfs. The flow study indicated that downstream of Imalone Road, Becky Creek was a "losing stream" and was not receiving any input from groundwater. Additional conclusions from the study were that the lower segment of Becky Creek should be

removed from the 303d list, the lack of groundwater in the lower reaches was due to hydrologic conditions and was probably limiting the coldwater fish populations including trout, and that the formerly pastured, impaired, stream reach was showing signs of natural recovery.

Becky Creek Study, 2015

Becky Creek surveys in 2015 were designed to describe the current condition of the stream, not replicate the Roesler study of 2009-10. The 2015 study included repeat surveys of the listed stream segment US of STH 40 and the headwater site US of Imalone Road. The unimpacted site of 2010 was not part of this study. A site US of Edgewood Road that was formerly pastured was surveyed in 2015.

Figure 11. Lower Becky Creek Monitoring Stations



The STH 40 site continued to recover from unlimited cattle access and streambank pasturing since 2010. Row crop fields of corn were observed in the riparian area and near the top of the stream bank in places along the survey station but were not continuous. The stream banks and the near bank area had sloughed to narrow the channel and form a terrace for a floodplain. These areas were well vegetated, consisting of wetland grasses and sedges. Areas of dense reed canary grass were also present. The stream channel still appeared to be changing and narrowing, areas of mid channel sediment islands were well vegetated and trapping sediment and slowly reconnecting to the stream banks. The stream bed was mainly rock and gravel, with soft sediments confined to the stream banks and in pools.

The fish community was best described as a cool-warm head water natural community US of STH 40. Seventeen species of fish were captured in the 2015 survey with 9% stenothermic (2010 survey 18 species and 20% stenothermic). The small stream IBI score was excellent. The macroinvertebrate IBI was excellent and the HIBI was good. The quantitative habitat assessment score was rated good. This method includes a more comprehensive methodology than the woody stem count and channel width depth measurements of past surveys and provides better and more thorough evaluation of stream habitat.

The site US of Edgewood Road (#7) was in an area of former cattle pasturing. It appeared that the cattle have been excluded from the stream for several years. However, cattle were still pastured within 50 feet of the streambanks for most of the survey station. The banks of the survey site had been riprapped as part of a habitat project. The riparian area (un-pastured) was mostly a wet meadow community with some areas of extensive reed canary grass. The streambed was mostly gravel with some sandy areas. Fines were mainly confined to the stream edges and pools. Thirteen species of fish were captured in the survey with 5% stenothermal. The small stream IBI rating was excellent. The site is best described as a cool-warm headwater community. A macroinvertebrate sample was not collected. The quantitative habitat rating was good.

The Site US of Imalone Road was in an area of steep slopes and higher stream gradient than the other survey sites. The stream channel was unique and was dotted with large rocks and boulders. The riparian area was wooded with steep slopes. Six species of fish were captured in the survey with 64% stenothermic, including 54 young of year brook trout. The small stream IBI rating was fair. The site is best described as a cool-cold headwater fish community. This was the only survey station where brook trout were captured in the 2015 study. The macroinvertebrate MIBI and the HIBI were both rated excellent. This site had the lowest (best) HIBI score in the study area in 2015. It should be noted that this site had an HIBI score of 1.90 in the 1990s during the watershed appraisal process and was the best score in the study area at that time. The quantitative habitat score rating was good. Overall this site had a high-quality biological community and remains unchanged since the early 1990's.

The Soft Maple Hay Creek Surface Water appraisal report included 3 sites on Becky Creek, an US, a mid-reach and a DS site. Habitat ratings were good at the US site and fair at the middle and lower sites. Water quality declined greatly at the middle and lower sites. Total phosphorus was 300% (150 µg/L) above background levels (50 ppm) at the middle site. Total phosphorus concentrations increased 50% again by the lower site to about 225 µg/L. These total phosphorus values were the highest found in the watershed and were attributable to cattle pasturing and barnyard runoff (Roesler, 1995).

The total phosphorus sample results in 2015 were 44 µg/L at Imalone Road and 138 µg/L US of STH 40. A sample was not collected at the Edgewood Road site. The values referenced from the watershed appraisal report included runoff values and are not directly comparable.

Phosphorus concentrations are declining in Becky Creek. However, Becky Creek still has elevated phosphorus values greater than the 75 μg/L state standard listed in NR 102 Wis. Adm Code US of STH 40.

In 2018, Becky Creek from the STH 40 crossing to its headwaters was assessed using new biological data (fish Index of Biotic Integrity (IBI) scores and the MIBI) which were part of this study. These assessments showed that Fish and Aquatic Life water quality designated use is supported. This water is considered in "good" condition and should be removed from the impaired waters list. Becky creek, while a trout water, is not a coldwater stream and the coldwater IBI should not be used to assess the condition of the fish community assemblage. The impacted areas of Becky Creek continue to recover from cattle pasturing and barnyard runoff. Phosphorus and other nutrients remain elevated in the lower reaches of Becky Creek. These should continue to be monitored. It will take years and possibly more BMP work in the watershed to bring TP values below 75 μg/L.

The lower reaches of Becky Creek should be re-assessed for trout water potential. Past studies have concluded the lack of coldwater in these areas is a result of hydrological conditions (Roesler 2011). No trout were captured in the mid and DS stations in 2015, nor were they captured in 2009-10. Fish surveys since 1967 have not found trout present in the lower segments of Becky Creek (Roesler, 2011). Trout are present in the headwaters and appear to be reproducing because young of year trout were captured in the 2015 survey. If conditions capable of supporting trout were present in the lower reaches of Becky Creek, trout could and should colonize from US to DS. The physical habitat conditions were good in these reaches in 2015, naturally occurring thermal limitations and low flows are likely limiting trout populations through these areas.

Clear Creek, WBIC: 2370100

Clear Creek is classified as a Class I trout stream and is a cool-cold headwater stream for its entire 8.03 miles. The stream gradient is high (44 ft/mile). The stream was surveyed at 2 sites in 2015, US of CTH H and US of STH 40. The site US of CTH H (2nd Order) was near the headwaters of the stream while the site US of STH 40 (3rd Order) was in the lower reaches of the watershed and close to its confluence with the Chippewa River. Both sites were in wooded stream corridors with intact stream buffers. The riparian zone at upper site was dominated by speckled alder and the downstream site was a northern hardwood forest. A large area of eroded bank was observed just US of STH 40 on the outside (north) bend of the riverbank. This bank erosion was likely due to the steep slopes and sandy soils in this area and not land use practices. At both sites the stream bed was manly rock, cobble, and gravel. Soft sediments were limited to the stream margins and in some of the pools at the DS site. Overall the biological community at these stations were healthy. Good numbers of trout were captured at both stations and the fish community was diverse. Clear creek had the highest number and best size structure of brook trout surveyed in the 2015 study. The macroinvertebrate community was also healthy, based on biotic indices and species diversity scores.

Clear Creek upstream State HWY 40. Photo by Jon Kleist, DNR.

Past descriptions in WDNR files states that the upper reaches of the watershed were mostly wooded with no barnyards present. Agricultural land use increased in the lower drainage area and in the 1990's 4 barnyards were present with one heavily and several lighted pastured stream segments. Large deposits of manure residue were observed in pool edges near the lower site during the 1990 study (Roesler, 1995) The nonpoint source control plan for the soft maple Hay Creek Watershed noted that the total Phosphorus exceeded "background" levels of 50 μg/L by 10-20 percent in the 1990s. These values included water samples collected during runoff events. In this study a single low flow water quality sample was collected at the US and DS sites. Phosphorus levels were low in these samples and similar to low flow samples collected in the 1990's. Nutrient levels appear unchanged between the two studies. The HIBI value in the 1990s was excellent at both the upstream and downstream sites. The MIBI and HIBI were excellent at the lower site in this study. The entire stream system from mouth to headwaters was not evaluated in this project. Agricultural impacts were not observed at either site in this study but may be present in the watershed. At the stations surveyed, habitat and water quality are suitable to maintaining diverse biological communities which are currently in excellent condition.

Devils Creek, WBIC: 2366600

Devils Creek DS CTH O. Photo by Jon Kleist, DNR.

Devils creek has a length of 18.4 miles and is classified as a Class I-III trout water; the lower 6.4 miles is class III, the middle 5.5 miles is class II and the upper 4.5 miles is class I. Devils Creek is a cool cold main stem stream from its mouth to its confluence with Hay Creek. US of this confluence it changes to a cool-cold headwater stream until its confluence with an unnamed tributary WBIC 5005534 (Table 9). US of this confluence there is not enough survey information to determine a natural community based on fish community surveys and the modeled communities are the best information currently available. Stream gradient is high (32 ft/mi) in the Blue Hills and low (7 ft/mile) in its lower reaches. Devils creek was surveyed at 3 sites during the 2015 study period, US of STH 40, DS of a "middle" crossing of CTH O, and US of Fire Lane Road (note CTH O crosses Devils creek 4x). Sites from DS to US are STH 40, CTH O, Fire Lane Road. The sites at Fire Lane road and CTH O had steeper gradients compared to the STH 40 site. The streambed was mainly rock, cobble and gravel at the Fire Lane Road and CTH O sites due to steeper stream gradient. The stream channel had a good mix of riffles and runs and occasional pools at these sites. The streambed US of STH 40 was mainly sand, with some silt in the pools and along the stream margins. Very little gravel and rock was present, especially when compared to the other sites. The riffles were mostly sand with scattered wood serving to break the water surface and provide the turbulence of a riffle. The STH 40 site was an area of sediment deposition. The riparian zones of all three sites were wooded and mostly northern hardwood forest. The US site on Fire Lane Road is within the Rusk County Forest, and Devils Creek's watershed is completely forested and mostly in county ownership until its crosses CTH O near the intersection of Fire Lane Road. As ownership changes from public to private, agricultural land use increases. Most of the agricultural land use is in the lower reaches of the watershed in areas with less steep terrain.

Past descriptions in WDNR files states water quality showed significant impacts from nonpoint sources at both the upper and lower site. The locations are not specifically located in any reports. The upper site drainage area is described as less than 10 percent developed land, therefore was likely at one of the two upper crossings of CTH O. The upper site total phosphorus reportedly exceeded background levels (of 50 μg/L) by 130 percent or around 115 μg/L at the upper site and by 70% or around 85 μg/L at the lower site in the 1990s. These samples were collected during runoff and baseflow and may not be directly comparable to total P vales in this study which were around 60 μg/L at both (US and DS) sites. The current total P values were below the state standard of 75 μg/L. In the 1990s, erosion from gravel roads was described as a very substantial source of suspended solids for the stream. At that time, severe erosion of roads was observed after heavy rains, and the re-channelization of a short segment of a Devils Creek tributary was observed which added suspended solids. Based on observations during this study, the gravel roads in the upper reaches of the watershed remain sources of suspended solids in the watershed. The influence of agriculture is present in the watershed especially in the lower portions of the watershed. A crop field was visible from Devils Creek at the lower site, US of STH 40 during the fish survey and habitat evaluation. There were several areas observed, where channelized runoff from the crop fields entered Devils Creek.

The biological communities appear to be healthy based on the current fish and macroinvertebrate IBIs at the 3 sites surveyed in 2015 and are similar to past surveys. The habitat conditions have probably improved slightly in the watershed, likely due to the changes in land use away from agriculture. At the stations surveyed, habitat and water quality are suitable to maintaining diverse biological communities.

Hay Creek, WBIC: 2367200

Hay Creek has a length of 6.9 miles and is classified as a warm water forage fish stream. The natural community of Hay Creek is a cool-warm headwater for its entire length. The stream gradient is high (51 ft/mi) in the headwaters within the Blue Hills and low gradient (3 ft/mi) as it nears its confluence with Devils Creek. Hay creek was surveyed at one site (near it's confluence with Devils Creek) at its DS crossing of Tyman Road near the intersection of Zebro and Tyman Roads during the study period. The US Tyman Road crossing of Hay Creek was visited for a possible fish survey in late August, however at the time of the site visit there was very little flow in the creek and a survey was not possible. A perched culvert, that was a barrier to fish movement, was noted at this crossing by WDNR staff. The floodplain and surrounding riparian zone of Hay Creek at the DS site were entirely wetland and best described as a fresh wet meadow. The stream bed was mostly gravel and hard substrate with fine sediments only present in the pools and at the stream margins. Due to time constraints this site was evaluated by qualitative habitat assessment and was rated excellent. Although this may be a bit of a bias in the habitat evaluation method as this site did not appear to have a greater diversity of habitat compared to other stream sites in the watershed that were evaluated by quantitative methods and rated good. However, the site had quality habitat. The fish community consisted of mostly tolerant minnow species.

Past WDNR studies state shallow depths, low flows, and wetland drainage were the greatest habitat limitations. Water quality was good, with the exception of dissolved oxygen concentrations. Total phosphorus, suspended solids, and fecal coliform concentrations were low and approached background levels (50 μg/L for TP). The suspended solids concentrations were the lowest of any sampling site. Total nitrogen concentrations were also the lowest of any sampling site. The lower third of Hay Creek passes through an extensive wetland area. Retention of suspended solids and nutrients in the wetland probably helps maintain the low concentrations found at the mouth of the stream. However, the stream also appeared to be of very good quality above the wetland. While this wetland helps maintain low concentrations of suspended solids and nutrients, it does cause severe dissolved oxygen depletion. Dissolved oxygen concentrations at the sampling site were the lowest of any site, with a minimum concentration of 1.5 mg/1 measured in past studies. Low dissolved oxygen concentrations were not observed in 2015.

Arched Pipe at Kief Road, Little Soft Maple Creek. Photo by Jon Kleist, DNR.

<u>Little Soft Maple Creek, WBIC: 2357300</u>

Little Soft Maple Creek is 8.04 miles in length and a Class II Trout Water. The stream gradient is considered high at 50 ft/ mi. The natural community of Little Soft Maple Creek is a cool-cold headwater stream from its mouth to Norwegian Road and a cool-warm headwater upstream from that point (Table 9). Typically, a change in natural community occurs at the confluence with a tributary, but not in this case. It is not clear why the fish community changes to a colder community at Norwegian Road, but multiple surveys support this observation. The most likely explanation is the influence of groundwater entering the stream in this area but further study would need to be completed to document. The stream was surveyed at two sites in 2015. An US site at Tyman Road and mid-reach site at Kief Road. The riparian corridor at the Tyman Road site was wooded with the near stream corridor dominated by speckled alder transitioning to a northern hardwood forest. The riparian corridor at the Kief road site was mainly wooded but a few areas of grassy banks with forest overstory were present. A segment of the survey station at Keif road had a fallow farm field within sight of one bank for approximately 150m. Both sites had stream beds of mainly gravel and cobble with soft sediments limited to the stream margins. The fish communities at both sites were mostly forage fish with a few brook trout captured in each survey. The fish biotic indices were rated excellent at each site. Both the macroinvertebrate indices, the MIBI and the HIBI, were rated excellent at both sites.

The road culvert at Kief Road was replaced by an arched culvert as a conservation practice through a cost sharing agreement by the local land conservation department and the township to allow for aquatic life passage. The project was successful, and a natural stream bed was observed within the arched pipe during the fish survey.

Past descriptions in WDNR files state habitat ratings were fair at US and DS sites on the Little Soft Maple. Shallow depths and low flows were listed as the greatest habitat limitations. Total phosphorus and suspended solids concentrations in the upper watershed were somewhat elevated. The drainage area for the upper site was 95 percent undeveloped. The source of the elevated total phosphorus and suspended solids concentrations was unknown. The HIBI value was excellent (3.29). At the lower site, total phosphorus exceeded background levels (50 μg/L) by about 30 percent (65 μg/L). The drainage area for the lower site included substantial agricultural areas. Four barnyards were present. Wetlands and beaver ponds were thought to be buffering the impacts of agricultural sources. The HIBI value was excellent at 3.14. Its coldwater input into Soft Maple Creek was thought to be the primary factor in the ability to support a limited coldwater community in Soft Maple Creek.

Little Soft Maple US Kief Rd. Photo by Jon Kleist, DNR.

In 2015, TP was 60 μg/L at the Tyman Road site, essentially unchanged from past studies. TP was elevated at the Kief Road site at 108 μg/L (above the 75ppb standard in WIsCALM 2018). The biological indices were also similar in 2015 (excellent) and unchanged from past studies. The Habitat ratings in 2015 were slightly better at good compared to past studies. Overall the stream is supporting a diverse biological community with quality habitat at the surveyed sites.

Soft Maple Creek (Big Soft Maple) , WBIC: 2356600

Soft Maple Creek is 16.8 miles in length with a drainage area of 29.8 square miles. The stream gradient is moderate at 13 ft/mi. The upper 4.7 miles is classified warm water forage fish. The middle 6.3 miles is a class III trout stream. The lower 5.8 miles is classed as warm water sport fish. The natural community of soft maple creek from its mouth to its confluence with unnamed stream WBIC 2357700 is a cool-warm mainstem. US from this point to its confluence with unnamed stream WBIC 2358500 near the village of Weyerhaeuser is a cool-warm headwater stream. From this point US there is no reliable survey data. The natural community model predicts the stream to be coldwater, however this probably incorrect. Big Soft Maple in most likely a cool-warm headwater US of this point and additional fish surveys should be conducted in this area in the future to properly assign a natural community.

Big Soft Maple upstream Amacoy Lake Road. Photo by Jon Kleist, DNR.

Big Soft Maple was surveyed at two sites in 2015. A headwater site DS of West Railway Avenue in the Village of Weyerhaeuser and a mainstem site US of Amacoy Lake Road. The riparian area at the US site was mostly a northern hardwood forest. The stream edges were lined with speckled alder alternating with wetland grasses and sedges. The site extended past a railroad bridge. The stream bed was mostly rock and gravel. The rocks were covered with moss and algae. Silt and sand were present but mostly confined to the stream edges and pool areas. This site was selected because Big Soft Maple was un-wadeable US of West Railway Avenue. A beaver dam was present which was flooding a large wetland complex US of the road. This beaver impoundment likely influenced the fish community and stream habitat at the survey site. Soft Maple Creek was a much larger stream at the DS site at Amacoy Lake Road. The riparian area at this site was mostly a wet meadow dominated by sedges and grasses. There were a few scattered speckled alder, and elm, willow, and silver maple trees present. The streambed was mostly soft sand that was unstable. The site was mostly a long run with a few pools. Scattered wood in the stream channel was the main cover for fish. Both sites had fish communities dominated by tolerant forage fish such as creek chubs and white suckers. The FIBI ratings were fair at the US site and good at the Amacoy Lake Road site. The Amacoy Lake Road site had a much greater species diversity compared to the upstream site and was likely influenced by fish movement upstream from the Chippewa River. The macroinvertebrate community was sampled at the lower site at Amacoy Lake Road. The MIBI and the HIBI were rated good and excellent respectively. The sandy stream bed with limited riffles was challenging to sample for macroinvertebrates. Riffles were mostly woody cover attached to the streambed that in shallow areas broke the surface to provide turbulence. Water quality and habitat were conducive to support good fish and macroinvertebrate communities.

Big Soft Maple upstream Amacoy Lake Road. Photo by Jon Kleist, DNR.

Past descriptions in WDNR files state Big Soft Maple has documented problems relating to cattle operations, including bank erosion, habitat destruction, and nutrient inputs. Gravel and rubble comprise less than 10% of the substrate at the “upper site”, the habitat rating was fair at the upper site and good at the lower site. Poor substrate and shallow pool depth were the greatest habitat limitations at the upper site. Water quality showed significant impacts from nonpoint sources at both sites. The location of sites from past studies could not be identified therefore it is unknown if conditions have improved in the stream or if we missed areas of agricultural impacts in past studies. The upper site was described as DS of the Village of Weyerhauser, therefore the US site surveyed in 2015 was probably higher in the watershed.

At the upper site in the 1990s, total phosphorus exceeded background levels by 300 percent (150 μg/L) and suspended solids exceeded background levels by 60 percent. The mean fecal coliform concentration was in the upper range of all sites sampled and exceeded the water quality standard by a factor of 8. The drainage area for the upper site contained substantial agricultural areas and the Village of Weyerhauser.

The Weyerhauser wastewater treatment ponds discharge to a small tributary of Soft Maple Creek. The ponds are operated on a fill and draw basis. Releases are normally made during periods of high flow. However, samples collected in January 1995, from the tributary above and below the treatment ponds indicated seepage discharges to the tributary during much of the year. Total phosphorus increased from 20 ug/l above the ponds to 160 ug/L below the ponds. Dissolved oxygen depletion was a problem at the upper site. A minimum dissolved oxygen concentration of 2.8 mg/L was measured. The stream showed wide fluctuations in dissolved oxygen over a 24-hour period. The HIBI value was the second worst value in the watershed (6.12) and indicated fairly significant organic pollution in past studies. This area was not surveyed in 2015 and should be studied in the future.

At the sites surveyed in 2015, TP was 80 and 142 μg/L at the US and DS sites respectively. Both values exceed the 75 μg/L TP standard in WisCALM 2018, but do not mean the waterbody is impaired for phosphorus as these are single sample results. The 142 μg/L value at the Amacoy Lake Road site is similar the 150 μg/L value reported in the 1990's and likely shows that TP values remain elevated and unchanged through 2015.

Amacoy Lake, WBIC: 2359700

Amacoy lake was not part of the 2015 study, this information is from WDNR files. Amacoy Lake has a drainage area of 3,054 acres. Drainage from a large area at the north end of the watershed passes through a pond and wetland complex before reaching the lake. Amacoy Lake is a 278-acre lake with a maximum depth of 20 feet and a mean depth of 13 feet. The shoreline is heavily developed. Water quality was monitored at Amacoy Lake during 1994 as part of the Soft Maple and Hay Creek Priority Watershed appraisal. Additional monitoring was done for a Lake Management Planning Grant (LMPG) study conducted in 1991-92. It is the largest lake in the watershed and has the most diverse and highest quality warmwater sport fishery. Amacoy Lake's fish community includes muskellunge, northern pike, walleye, largemouth bass, all the common panfish species, minnows, white sucker, redhorse, carp and channel catfish.

The 1990 monitoring established that nonpoint nutrient input from cropland runoff is degrading water quality and fish production. The controversial flood control structure on the Amacoy Lake outlet may be curtailing fish migration patterns and recruitment dynamics. Prior to construction of the flood control structure, there was free interchange of floodwater and fish populations between the lake and the Chippewa River. Amacoy Lake lies within the floodplain of the Chippewa River. The lake has an outlet which drains to the river. A water control structure was constructed for Amacoy Lake in 1967 to stabilize water levels. Some lake residents feel the fishery has declined and the water quality has deteriorated since the installation of the control structure. The structure raised the "normal" lake level which resulted in some negative impacts such as shoreline erosion, elimination of shoreline beaches, and a die-off of large numbers of oak trees. The control structure appears to have had a serious negative effect on the lake's walleye population. However, Amacoy Lake does not have suitable conditions for successful in-lake walleye spawning. The project team has concluded that there is not sufficient evidence, at this time, that a renovated water-control structure will substantially improve water quality in Amacoy Lake.

Chippewa River, WBIC: 2050000

The Chippewa River was not surveyed in 2015 as part of this study, this information is from Roesler 1995. It is classified as a warm water sport fishery. The gradient of this segment is very low (1.7 ft/mi). The 180 square mile drainage area of the Soft Maple and Hay Creek Watershed accounts for only 10.5 percent of the total drainage area of the Chippewa River. Gravel and rubble comprised more than 50 percent of the substrate at the upper site sampled. Gravel and rubble comprised less than 10 percent of the substrate at the lower site, with sand being the dominant substrate at the site. Habitat ratings at both sites were good. The lower site had near background concentrations of total phosphorus, suspended solids, and fecal coliform. The upper site had near background total phosphorus concentrations, but suspended solids and fecal coliform concentrations were higher and were in the mid-range of all sampling sites.

Dissolved oxygen concentrations at both sites were good, with minimum concentrations of 8.4 mg/1 at the upper site and 7.2 mg/1 at the lower site. The RBI value worsened significantly from the upper to the lower site. The RBI value was excellent (2. 79) at the upper site, but only very good (4.17) at the lower site. The Chippewa River shows obvious problems with sedimentation limiting fish habitat. Variable flow conditions exist, due at least in part to upstream peaking. Hydropower facilities are an additional known limitation to Chippewa River fish production. Buff Creek is a 3.0-mile-long warmwater forage stream. It does not have a particularly high fisheries potential, nor severe non-point problems. Cranberry Creek (3.0 miles) is a major tributary to the Chippewa River and is classified as a warmwater forage fish community. Stream bank pasturing is a limiting factor to its fish production potential. Bass Lake is a 26-acre, landlocked seepage lake with a sustained warmwater sportfish community. Bruce Lake is a small (35 acre), shallow lake that experiences winter kill. Bull Moose Lake also has shallow depth and winter kill tendency. Caley Lake is a small (54. 8 acre), shallow (6' max.), landlocked seepage lake. Periodic winter kill limits its warmwater sports fish community. Round Lake is a 104 acre, 5' deep, winter kill lake. It has a very limited pan fishery for bullheads, yellow perch, and pumpkinseed. An aeration system is being planned and designed for this lake.

Appendix C: Soft Maple and Hay Creek Water Quality Standards Attainment Table[i]

Stream Name	WBIC	Start Mile	End Mile	Current Use	Attainable Use	Supporting Use	Designated Use	Assessment	Monitoring	DNR Category
Alder Creek	2366700	0	2.73	Cold (Class I)	Cold (Class I)	Fully Supporting	Cold	Monitored	B1, B3	Category 2
	2366700	2.73	4.13	Cold (Class I)	Cold (Class I)	Fully Supporting	Cold	Monitored	B3	Category 2
	2366700	4.13	7.82	FAL	FAL	Fully Supporting	Default FAL	Monitored	B3	Category 2
Amacoy Lake	2359700	0	282.5	Shallow Lowland	FAL	Fully Supporting	Default FAL	Monitored	P3, B2	Category 5A
Audie Lake	2368700	0	109.7	Deep Headwater	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Bass Lake	2359500	0	35.51	Deep Seepage	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Becky Creek	2369600	0	1.24	Class I Trout	Class I Trout	Not Supporting	Cold	Monitored	B1	Category 4A
	2369600	1.24	8.86	Class I Trout	Class I Trout	Fully Supporting	Cold	Monitored	B1	Category 2
Bog Lake	2356800	0	38.17	Shallow Seepage	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Bruce Lake	2360700	0	35	Reservoir	FAL	Supporting	Default FAL	Monitored	P1	Category 2
Buff Creek	2359300	0	4.69	FAL	FAL	Supporting	Default FAL	Monitored	XX, B2	Category 2
Bull Moose Lake	1837800	0	42.18	Shallow Seepage	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Caley Lake	1838500	0	54.84	Shallow Seepage	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Chippewa River	2050000	110.1	144.2	WWSF	WWSF	Fully Supporting	Default FAL	Monitored	B1	Category 2
Chippewa River	2050000	144.2	163.4	WWSF	WWSF	Fully Supporting	Default FAL	Monitored	B1	Category 2
Clear Creek	2370100	0	8.03	Cold (Class I)	Cold (Class I)	Fully Supporting	Cold	Monitored	B1, B4	Category 2
Cranberry Creek	2357900	0	3	WWFF	WWFF	Not Assessed	Default FAL	Evaluated	B1	Category 3
Cranberry Lake	2358400	0	10.88	Deep Headwater	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Devils Creek	2366600	0	4.59	Class III Trout	FAL	Fully Supporting	Default FAL	Monitored	B1	Category 2
Devils Creek	2366600	4.59	15.83	Cold (Class II)	Class II Trout	Fully Supporting	Cold	Monitored	B3, B2	Category 2
Devils Creek	2366600	15.83	21.8	Cold (Class I)	Class I Trout	Fully Supporting	Cold	Monitored	B4	Category 2
Hay Creek	2367200	0	10.37	WWFF	WWFF	Supporting	Default FAL	Monitored	B1, B3	Category 2
Johns Creek	2368300	0	3	FAL	FAL	Not Assessed	Default FAL	Not Assessed	B1	Category 3
Little Soft Maple	2357300	0	8.04	Cold (Class II)	Cold (Class II)	Fully Supporting	Cold	Monitored	B1, B2	Category 2
Lost Mans Lake	1863900	0	1.65	Small	FAL	Not Assessed	Default FAL	Not Assessed	NA	Category 3
North Lake	1871000	0	14.43	Deep Seepage	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Perch Lake	2368500	0	18.16	Deep Headwater	FAL	Fully Supporting	Default FAL	Monitored	B1	Category 2
Round Lake	1878200	0	107.8	Shallow Seepage	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Saxton Lake	2359200	0	5.1	Small	FAL	Supporting	Default FAL	Monitored	P1	Category 2

Stream Name	WBIC	Start Mile	End Mile	Current Use	Attainable Use	Supporting Use	Designated Use	Assessment	Data	DNR Category
Soft Maple Creek	2356600	0	7.74	FAL	FAL	Not Assessed	Default FAL	Not Assessed	XX	Category 3
	2356600	7.74	14.32	Class III Trout	FAL	Supporting	Cold	Monitored	B3	Category 2
	2356600	14.32	16	Class III Trout	FAL	Not Assessed	Cold	Not Assessed	NA	Category 3
	2356600	16	23.56	FAL	FAL	Supporting	Default FAL	Monitored	B4, B3	Category 2
Unnamed Lake	1884300	0	6.6	Small	FAL	Supporting	Default FAL	Monitored	P1	Category 2
Unnamed Stream	2360800	0	22.03	FAL	FAL	Fully Supporting	Default FAL	Monitored	P3, B3	Category 2
Un Spring	2358200	0	0.15	Small	FAL	Not Assessed	Default FAL	Not Assessed	NA	Category 3
Unnamed	1933300	0	10.76	FAL	FAL	Supporting	Default FAL	Modeled	NA	Category 3
Unnamed Stream	1928400	0	10.85	FAL	FAL	Supporting	Default FAL	Modeled	NA	Category 3
Unnamed	2358900	0	6.59	Small	FAL	Supporting	Default FAL	Modeled	NA	Category 3
Unnamed Lake	1928600	0	7.54	Small	FAL	Supporting	Default FAL	Not Assessed	NA	Category 3
Unnamed Lake	1933800	0	6.6	Small	FAL	Supporting	Default FAL	Not Assessed	NA	Category 3
Unnamed T34n R08w S13-05	2360300	0	30	Reservoir	FAL	Supporting	Default FAL	Monitored	P1, B2	Category 2
Unnamed Lakes	(multiple)	0	56.08	Small Lake	FAL	Not Assessed	Default FAL	Not Assessed	NA	Category 3
Unnamed	(multiple)	0	210	FAL	FAL	Not Assessed	Default FAL	Not Assessed	NA	Category 3

The 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 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.
- Assessment – field indicates what type of data or information supports the decisions in the table (current, attainable, and supporting attainable).
- Data – Specific data areas used for the decision (see below)
- DNR Category Is water meeting or not meeting standards

Category 2: Water has been assessed and meetings at least standards for the assessed designated use.
Category 3: Insufficient data exists to determine if water quality standards are met.
Category 4A: Water is impaired and a TMDL or other restoration plan is in process.
Category 5A: Waters is impaired and a TMDL or other process is required.