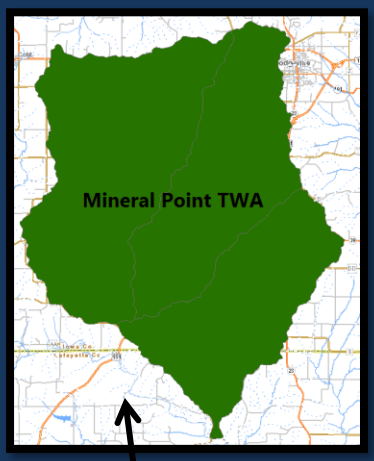
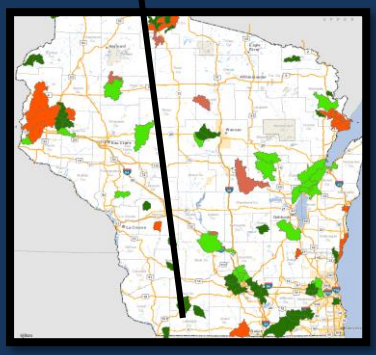
A Watershed Report created by the Bureau of Water Quality in support of the Clean Water Act.

Photo: The Department owns a 360-acre parcel of land on Mineral Point Branch known as the "Davis Property". This property shows how managed grazing is compatible with wildlife management and stream health.





MINERAL POINT BRANCH TWA WQM PLAN 2017

Mineral Point and Sudan Branches (SP09)
HUCs: 070900030101, 070900030102, 070900030103
Monitored in 2015

Mineral Point Branch, South Oak Park Road.
Photo by James Amrhein, Wisconsin DNR.

WISCONSIN DEPT. OF NATURAL RESOURCES

EGAD # 3200-2017-04
Water Quality Bureau,
Wisconsin DNR

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Mineral Point Branch at Ludden Lake. Photo by James Amrhein, Wisconsin, DNR.

Wisconsin Water Quality Monitoring and Planning

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

This plan is hereby approved by the Wisconsin DNR Water Quality Program and is a formal update to the

Water Quality Management Plan. This plan will be forwarded to USEPA for certification as a formal plan update.

Water Resources Field Supervisor — Date 2/6/18

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

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

Basin/Watershed Partners

- Iowa County Land Conservation Department
- Lafayette County Land Conservation/Planning/Zoning
- Wisconsin Dept. of Natural Resources
- Driftless Area Land Conservancy
- The Prairie Enthusiasts
- The Nature Conservancy
- Southwest Wisconsin Resource Conservation and Development Council
- Harry and Laura Nohr Chapter of Trout Unlimited
- Wisconsin Smallmouth Alliance

Report Acknowledgements

- James Amrhein, Primary Author and Investigator, Southern District, Wisconsin DNR
- Victoria Ziegler, Program Support, Water Quality Bureau, Wisconsin DNR
- Lisa Helmuth, Program Coordinator, Water Quality Bureau, Wisconsin DNR

EGAD # 3200-2017-04

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Abbreviations

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

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

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

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

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

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

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

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

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

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

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

Watershed Discussion & Management Recommendations

Watershed Goals

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

Figure 1: Mineral Point Branch TWA Watershed.

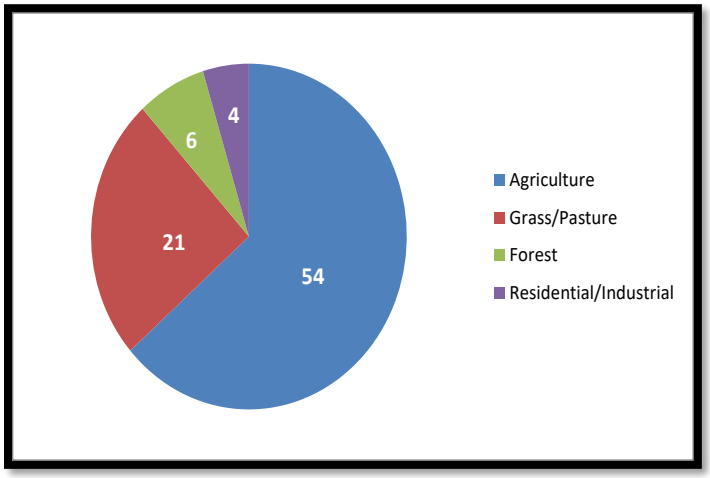
Watershed Overview

The Mineral Point and Sudan Branches Watershed lies in southwestern Iowa County and dips into extreme northern Lafayette County (Figure 1). The majority of the 70,300 acre (110 mi^2) watershed is in agriculture (row crops or pastureland), with scattered woodlands and grasslands making up a majority of the balance (Figure 2). As the name of the watershed implies, Mineral Point Branch and Sudan Branch are the two main streams that drain this area. Mineral Point Branch has its headwaters along the Military Ridge just west of Dodgeville and flows 29 miles southward into Lafayette County where it joins the Pecatonica River a couple of miles northwest of Calamine. The Sudan Branch likewise has its headwaters along the Military Ridge just east of Cobb, near the village of Linden. The Sudan Branch flows 18 miles southeast and joins the Mineral Point Branch about 3 miles southwest of the village of Mineral Point (WDNR, 2003).

Population, Land Use

The population of this watershed is not expected to grow significantly (less than 2%) over the next 20 years. Land use in the watershed is primarily agricultural, with a mixture of forest , suburban and other uses making up the balance. There are two municipalities in the watershed: Linden and Mineral Point. In addition to the discharges from these two municipalities, Bloomfield Healthcare and Rehabilitation Center, an assisted living facility, also discharges to surface water in the watershed. There are also localized water quality issues caused by historic mining activity. Runoff from waste piles that remain from lead, copper and zinc mining have caused aquatic toxicity issues on Brewery Creek near Mineral Point and on Pedler Creek near Linden.

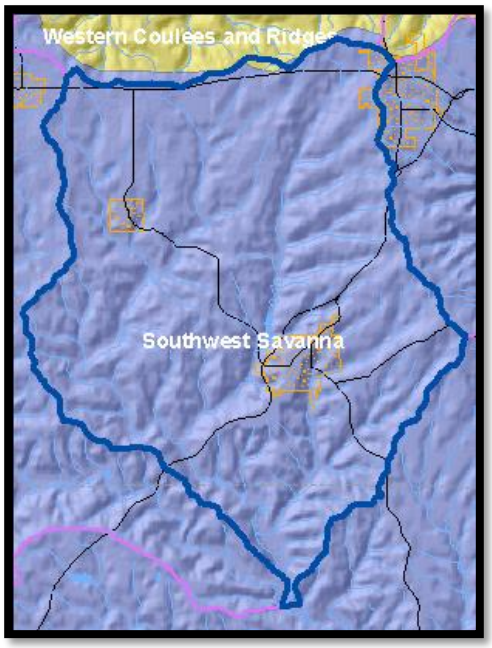
Figure 2: Percentage of Land Uses, Mineral Point Branch TWA



Ecological Landscapes

This watershed's ecological landscapes are depticted in Figure 3. The Southwest Savanna Ecological Landscape is located in the far southwestern part of the state. It is characterized by deeply dissected topography, unglaciated for the last 2.4 million years, with broad open hilltops and river valleys, and steep wooded slopes. The climate is favorable for agriculture but the steep slopes limit it to the hilltops and valley bottoms. Soils are underlain with calcareous bedrock. Soils on hilltops are silty loams, sometimes of shallow depth over exposed bedrock and stony red clay subsoil. Some valley soils are alluvial sands, loams, and peats. Some hilltops are almost treeless due to the thin soil while others have a deep silt loam cap.

Figure 3: Ecological Landscapes in the Mineral Point and Sudan Branches (SP09).



Historic vegetation consisted of tall prairie grasses and forbs with oak savannas and some wooded slopes of oak. Almost three-quarters of the current vegetation is agricultural crops with lesser amounts of grasslands, barrens, and urban areas. The major forest types are oak-hickory and maple-basswood. High-quality prairie remnants occur on rocky hilltops and slopes that are not farmed. Some prairie pastures and oak savannas still exist. The grassland areas harbor many rare grassland birds, invertebrates, and other grassland species. Relict stands of pine occur on bedrock outcroppings along some stream systems.

Hydrology

Rivers and streams in this watershed cover over 170 miles and range from small intermittent tributaries to larger rivers. The upper 3 miles of Sudan Branch, upstream of CTH X is considered Class II trout water, as is the entire length of Rock Branch. Portions of Sudan Branch, Pedler Creek and Mineral Point Branch are considered managed smallmouth bass waters. Mineral Point Branch is on the state's 303(d) list of impaired waters because it exceeds the state's phosphorus criteria and Brewery Creek is on the impaired waters list due to aquatic toxicity caused by heavy metals which exceed the acute criteria.

Ludden Lake is a 50-acre impoundment that was created in 1963 by constructing a dam on the Mineral Point Branch by the Mineral Hills Development Company. This company eventually dissolved and ownership of the lake and dam was taken up by the Ludden Lake District and Dam Commission which were formed in 1993. A new boat ramp and parking area completed in 1997 has improved access to the lake. That same year, northern pike were stocked into the lake. Smallmouth bass, largemouth bass, walleye, black crappie, bluegill, and carp have been found in the lake. Little is known about the water quality although algal blooms are significant in the warm months, likely due to nutrient enrichment from the surrounding agricultural landscape. Emergent aquatic vegetation from the upper end of the lake was eradicated, thus releasing a large sediment and nutrient load into the lake. Property owners around the lake have formed a lake district as a step towards addressing water quality and lake issues.

Study Summary

The 2015 watershed survey was conducted by water resources biologists on 37 sites in the watershed. Sites were selected to cover named streams and selected unnamed tributaries in the HUC 10. The study showed that streams of the Mineral Point and Sudan Branches watershed are in good condition from a fisheries standpoint. The mainstem portions of Sudan Branch and especially Mineral Point Branch contain a variety of fish species and can provide reasonable angling opportunity. There are impacts from nonpoint source pollution as evident by macroinvertebrate Index of Biological Integrity (MIBI) and the habitat scores. These impacts are most notable in the bank erosion which has exacerbated the widening of streams and led to a depressed width-to-depth ratio

score and rating. Managed grazing (appropriate numbers of livestock for the acreage), rotational grazing, and stream crossings should be employed in the riparian corridors to help maintain sod cover and help mitigate bank erosion and trampling. This would help reduce the rate of stream widening. In areas that are row cropped, buffers, cover crops, no-till farming and implementation of nutrient management plans would help reduce bank erosion and runoff of sediment and nutrients to the systems.

Management Recommendations

- Total phosphorus exceeds the state criteria of 0.075 mg/L and thus Mineral Point Branch will remain on the state's 303(d) list of impaired waters. The aforementioned nonpoint source best management practices would also help reduce phosphorus delivery to the stream. Fisheries management has several recommendations for Mineral Point Branch: no stocking of fish, maintaining the current size regulations, develop projects which would provide more habitat for smallmouth bass, especially the creation of deep pools and runs to hold adults year round. Below Ludden Lake specifically, fisheries management recommends looking at efforts to secure stream bank easements.
- Fisheries management should determine the reason for lack of trout returns in the upper Sudan Branch and in Rock Branch and to determine if it is practical to continue stocking efforts on these two streams.
- Fisheries management may consider the lower half of Laxey Creek as a managed smallmouth bass water (nursery stream) as it may be hospitable for some production of bass.
- DNR should seek opportunities to work collaboratively on projects which would benefit overall ecosystem health. Such opportunities include working with the Southwest Grasslands and Stream Conservation Area and Southwest Grasslands Bird Conservation Area. The department should work with groups to identify areas which would overlap as a priority for these programs, such as the upper Mineral Point watershed. These projects would also benefit Ludden Lake.
- Ludden Lake should be added to the state's 303(d) list of impaired waters because total phosphorus and chlorophyll-a sample data exceeded criteria and thresholds for shallow lowland lakes. The department should seek the aforementioned opportunities to work with partners to decrease soil and nutrient loss in the watershed upstream of Ludden Lake in order to improve water clarity, enhance macrophyte growth, and maintain the depth of the lake system which has been decreased over time due to sediment loads from upstream.
- The classification of Brewery Creek should be updated to reflect the biota using a contemporary classification system.
  The classification of Furnace Branch should be updated to reflect the current biota using a contemporary classification system.
- DNR should revise the classification of Laxey Creek to remove the variance section at the headwater.
- There are a number of perched culverts on the tributaries that feed the upper Mineral Point Branch along Survey Road. The department should look for opportunities to work with the county and townships to properly replace these culverts.

Sudan Branch off Stude Rd. Photo by James Amrhein, Water Quality Biologist, Wisconsin DNR

Ecological, Aquatic Resources

Trout Waters

DNR uses three categories to classify the different types of trout streams throughout Wisconsin. These are evident in Wisconsin Trout Stream Maps, which provides a comprehensive list of trout streams and a set of trout stream maps covering the majority of the state. Efforts have been made to list all trout streams in the State of Wisconsin, but it is recognized that this listing in not exhaustive. Trout waters in this watershed are listed in Table 1.

High quality trout waters (Class I) that have sufficient natural reproduction to sustain populations of wild trout, at or near carry 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.

Table 1: Trout waters in the Mineral Point and Sudan Branches Watershed (SP09).

Waterbody Name	WBIC	Start Mile	End Mile	Trout Class
Rock Branch	928200	0	2.96	CLASS II
Rock Branch	928200	2.95	4.23	CLASS II
Sudan Branch	929000	12.78	17.66	CLASS II

Impaired Waters

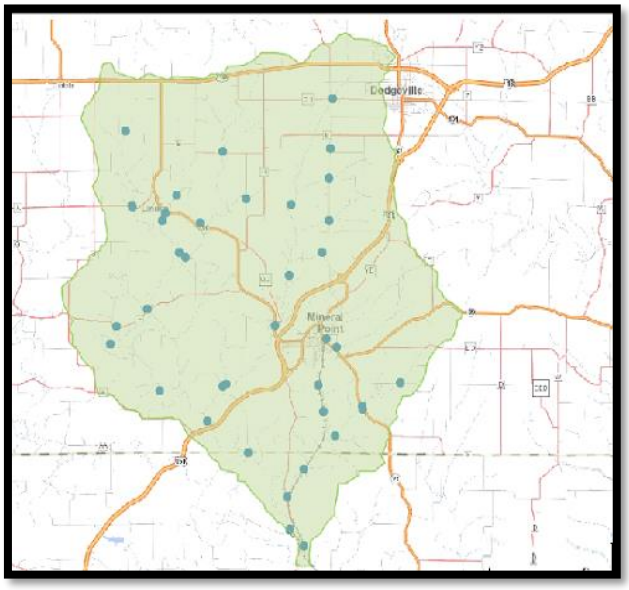
Every two years, Section 303(d) of the Clean Water Act requires states to publish a list of all waters that do not meet water quality standards. The list, also known as the Impaired Waters List, is updated to reflect waters that are newly added or removed based on new information. Impaired waters in this watershed are impaired for historical discharges, mine tailings, and runoff issues (Table 2).

Table 2: Impaired waters listed in Mineral Point and Sudan Branch Watershed.

Local Name	WBIC	Start Mile	End Mile	Pollutant	Impairment	Sources	303 Status
Brewery Creek	928600	0	3.32	Lead	Chronic Aquatic Toxicity	Industrial Point Source Discharge, Non-Point	EAP Project
Brewery Creek	928600	0	3.32	Zinc	Chronic Aquatic Toxicity	Industrial Point Source Discharge, Non-Point	EAP Project
Mineral Point Branch	927900	0	29	Total Phosphorus	Impairment Unknown	Non-Point Source	303d Listed
Pecatonica River	889100	0	102	Total Phosphorus	Impairment Unknown	Non-Point Source	303d Listed
Trib To Brewery Creek	928700	0	2.25	Zinc	Acute Aquatic Toxicity	Industrial Point Source Discharge, Toxicity	303d Listed
Trib To Brewery Creek	928700	0	2.25	Lead, Cadmium, Mercury	Acute Aquatic Toxicity	Industrial Point Source Discharge, Toxicity	303d Listed

Monitoring Project Discussion

Figure 4: Mineral Point and Sudan Branch Watershed.



Purpose of Project

The purpose of this study was to monitor the contemporary status of a subwatershed (HUC 12) in the Mineral Point Branch watershed. DNR collected fish, habitat, macroinvertebrate and water chemistry data for streams in this watershed. The data help determine whether these streams are achieving their attainable use in order to update the watershed tables, list waters that are not meeting their attainable use, and assess the overall health of the watersheds as required by Section 305(b) of the Clean Water Act. The data, used in conjunction with observations about watershed health, are also used to guide planning for improvements where needed. This subwatershed and the adjoining subwatersheds that make up the HUC 10 were identified as one of the top group watersheds for nutrient input by the WI Nutrient Reduction Strategy. The follow are outcomes of this study:

- Watershed was monitored with a baseline survey.
- Watershed was monitoring to understand its status and any presence of and sources of impairments.
- Streams in the system were monitored to assess condition.
- Waters are subject of watershed planning.

Site Selection and Study Design

The 2015 watershed survey was conducted by water resources biologists on 37 sites in the watershed (Figure 4). Sites were selected to cover named streams and selected unnamed tributaries in the HUC 10. The fisheries assemblage was determined by electroshocking a section of stream with a minimum station length of 35 times the mean stream width (Lyons, 1992). A stream tow barge with a generator and two probes was used at most sites. A backpack shocker with a single probe was used at sites generally less than 2 meters wide.

All fish were collected, identified, and counted. All gamefish were measured for length. At each site, qualitative notes on average stream width and depth, riparian buffers and land use, evidence of sedimentation, fish cover and potential management options were also recorded. A qualitative habitat survey (Simonson, et. al., 1994) was also performed at each site. Macroinvertebrate samples were obtained by kick sampling and collecting using a D-frame net at these same sites in the watershed in fall, 2015 and sent to the University of Wisconsin-Stevens Point for analysis.

Additionally, water samples were collected once per month throughout the growing season (May through October) at two sites on Mineral Point Branch – upstream and downstream of the confluence of Sudan Branch. These samples were analyzed for total phosphorus. Diatom samples were also collected at these same sites to be analyzed for calculation of a diatom nutrient index (DNI).

Bioassays were run on water samples collected from three sites on Brewery Creek to look at toxicity to aquatic organisms from heavy metals caused by leaching of mine waste. Continuous water temperature loggers were also placed at sites on Brewery Creek, Laxey Creek, Mineral Point Branch, Pedler Creek, Rock Branch, Sudan Branch and several unnamed streams and programmed to take hourly water temperatures throughout the “summer” (June – August) period.

Study Results

Because the natural communities model (Lyons, 2008) predicted most of the waters in the watershed to be cool transitional waters, the coolwater index of biotic integrity (IBI) developed by Lyons (2012) was applied to all streams. Where appropriate and based on natural community verification (Lyons, 2013), additional IBIs were applied.

A total of 47 species were found in the watershed. White sucker, creek chub, brook stickleback, and johnny darters were quite prevalent throughout the watershed, with central stoneroller, common shiner, hornyhead chub, fantail darter, and southern redbelly dace also being widely distributed. Most species found were either coolwater transitional or warmwater species (Lyons, 2012). A total of 8 intolerant species were found as well as 3 stenothermal coldwater species (Table 4).

Ludden Lake, 2015. Photo by James Amrhein

Qualitative habitat surveys (Table 5) showed overall habitat to be "fair" to "good" at all sites. Riparian buffer scores varied widely, with 40% of sites having no buffer, primarily due to pasturing in the corridor. Bank erosion also varied widely with about half the sites having a "poor" or "fair" bank erosion score, and the other half having "good" to "excellent". Streams with significant pool areas were scarce throughout the watershed. Of the named streams in the watershed, Brewery Creek and Mineral Point Branch had the lowest width-to-depth ratios with a majority of their sites being "fair". Riffle or bend scores were predominantly "good" throughout the watershed, as were fine sediment scores. Three-quarters of the sites surveyed had "good" to "excellent" fish habitat.
The average and median phosphorus concentration was approximately 0.11 mg/l at both sites and thus was not significantly different (Table 3). All concentrations except for the October sample taken at CTH O were at or above the state's water quality criteria of 0.075 mg/l (WDNR, 2013) for total phosphorus. It was noted by biologists that the data collected at North Oak Park Road may have been influenced by cattle activity immediately upstream of the sample site on any particular sampling day.

Table 3: Total Phosphorus Concentration Mineral Point Branch

Date Collected	North Oak Park Rd*	CTH O
05/19/2015	0.078	0.102
06/16/2015	0.119	0.18
07/16/2015	0.12	0.137
08/11/2015	0.159	0.119
09/24/2015	0.075	0.075
10/20/2015	0.128	0.055
Average	0.113	0.113
Median	0.120	0.110

*May have been influenced by cattle activity upstream of sample site

Temperature data, collected hourly from May to October at 13 sites showed temperature varied by stream and position in the watershed (Table 6 and Appendix C). The unnamed tributaries which generally represent 1st through 3rd order streams generally had peak daily mean temperatures less than 20.7°C, which would define them as coldwater (Lyons, et. al., 2009). Likewise, Brewery Creek and the headwaters of Mineral Point Branch also had

maximum mean temperatures below that same threshold. Mineral Point Branch at CTH QQ, downstream of Ludden Lake, had the highest water temperatures with daily mean temperatures routinely in excess of 24.6°C, or warm (Ibid). Further downstream at North Oak Park Road and at CTH O, temperatures were more moderate, but still exceeded cool-warm to warm temperatures. Other major systems such as Laxey Creek, Pedler Creek, Sudan Branch and Rock Branch have mean water temperatures that fall in the cool transitional range. The temperature data portrayed in this study is informative; however, the stream and temperature model is based on 20 years of annual temperature. *While variations from the modeled results or predicted stream community may arise for one or more analyzed year within a given study, the model verification process incorporating fish community results, extreme temperature datasets, and additional site specific information provide greater weight for the final natural community validation or recommended change process.*

Sudan Branch, Wisconsin.
Photos by James Amrhein, Wisconsin DNR.

Table 4: Fish Species and Related Data

	Brewery Creek			Unnamed Trib (928700)	Furnace Creek	Laxey Creek			Unnamed Trib (929800)	Mineral Point Branch									Unnamed Trib (931300)	Unnamed Trib (931200)	Unnamed Trib (931000)	Unnamed Trib (930900)	Unnamed Trib (930300)	Pedler Creek			Rock Branch		Unnamed Trib (928500)	Sudan Branch						Unnamed Trib (929400)	Unnamed Trib (5037481)
Species	Dwnstrm Copper St	Ferndale Rd	Along ATV Trail	Merry Christmas Lane	CTH O	CTH B	STH 39	Cave Rd	Bloomfield Rd	Survey Rd	Mill Creek Rd	State Property off Bennett Rd	STH 39	N. Oak Park Rd *2014*	Pitz-Schaaf Rd	S. Oak Park Rd	CTH O	Upstrm confl. w/ Pecatonica	Survey Rd	Survey Rd	Survey Rd *2013*	S. Barreltown Rd	Upstrm of Mineral Pt Br	Off Wearne Rd	Upstrm Linden WWTP	Dwnstrm Linden WWTP	STH 23	Suthers Rd	Brecken Rd	Whitson Rd	Roaster Rd	Along Cave Rd	CTH E	Lost Grove Rd	Off Stude Rd	CTH E	Upstrm confl. w/ Sudan Br
Banded Darter							2	1				10	50	29	111	3	5	4														15	27	15		
Bigmouth Buffalo													1			2	45																			
Bigmouth Shiner																														6	19			13		
Black Bullhead					1									1																			1			
Black Crappie (size range - inches)													8 (2.0 - 5.0)																						
Blackside Darter					4									2		10		4																		
Bluegill (size range - inches)				1 (2.5)									28 (1.2-4.3)																							
Bluntnose Minnow						9	25	118		19	45	123	40	5	27			5			1				5	2				18	40	38	28	18		
Brook Stickleback	12		1			18	6		27	4		5							11	39	21	72	44	2	2		87	2	10	35		5	1			2	1
Brook Trout (size range - inches)						17 (5.8-7.6)																															
Brown Trout (size range - inches)		6 (1.7-10.6)	6 (1.9-11.1)																								2 (7.0-7.4)	1 (2.2)			17 (1.4-2.1)*	1 (15.1)	1 (7.7)				
Central Stoneroller		13		4	2	31	259	223	1	16	28	11	1	14	2		2							3	19	4	24	13			77	276	61	175	132	3	3
Channel Catfish (size range - inches)													1 (22.1)	7 (22.6-26.0)	17 (13.6-25.0)	16 (6.3-23.5)	12 (11.8-22.4)	26 (10.1-20.1)															1 (22.3)	1 (18.0)		
Common Carp													3				6																			
Common Shiner		2			47	150	250	268	11	265	732	1890	1370	94	61	41	28	17		13	20		1	11	40	208	12	48			170	203	92	136	185		
Creek Chub	152	158	146	272	85	249	81	128	53	20	25	10	7		2			1		3			30	127	159	185	45	103	19	114	155	94	38	12	9	41	46
Emerald Shiner													7		38	47		13																		
Fantail Darter				306		24	94	87	45	120	216	80			3				70	112	63		18	24	31	12	263	123	3		125	20	65	41	7	6	7
Freshwater Drum															9	6	3	1																1		
Gizzard Shad																	21																			
Golden Redhorse													8	6	50	48	20	3															5	12		
Green Sunfish													5																							
Hornyhead Chub		3	1	2	37	3	38	30			215	231	25	20	9		4	2							5	5	7	29			50	16	13	11	19		
Johnny Darter			8	12	7	19	24	5	4	21	6	43	6	1	8			2	41	177	15		105	13	16	9	35	38		11	28	30	22	17	9		18
Largemouth Bass													13 (2.7-6.5)	7 (3.2-4.6)																						
Mottled Sculpin																								2	15	2		2		28	30					1
Northern Hog Sucker													1	11	23	65	21	13														4	20	30		
Northern Pike															3 (23.8-28.0)		1 (25.2)	1 (22.0)																		
Pumpkinseed (size range - inches)																								1 (4.0)	9 (3.5-4.2)											
Quillback															3	15	18																			
Rockbass (size range - inches)													5 (3.1-5.6)	3 (3.8-4.3)																						
Rosyface/Carmine Shiner					4		8	15					18		22	43	4	15														7	16	23	58		
Sand Shiner													2		3		13	1																		
Shorthead Redhorse					1								5	6	46	45	106	33															18	18		
Silver Redhorse															19	23	146																6	8		
Slenderhead Darter															25	20	2	5																		
Smallmouth Bass (size range - inches)					1 (6.6)		3 (4.0-4.5)	1 (3.9)			1 (7.9)	7 (7.3-9.6)	40 (1.7 - 13.2)	79 (2.1-15.3)	17 (1.7-14.3)	52 (1.9-14.7)	12 (2.4-11.5)	10 (2.4-15.9)														1 (5.6)	5 (6.4-11.1)	29 (5.0-15.9)	33 (2.3-13.4)		
Southern Redbelly Dace		2	9			12	53	17	2	21	300	3								4				6	9	11	182	124		16	51	20				3	
Spotfin Shiner													34	4	9	23	26	21																		
Stonecat											3	8		3	2	15		2														1	1	10		
Suckermouth Minnow															12		33														1	5		4	29		
White Crappie																	1 (11.5)																			
Walleye												1 (6.2)			1 (16.8)		5 (14.1-14.6)																			
White Sucker		9	63		123	72	144	150		110	484	971	205	108	27	24	10	15					27	3	26	60	69	129		1	160	122	320	152	223	2	
Common Shiner x Creek Chub											2	1																								
Common Shiner x Unknown spp.													1																							
Common Shiner x Rosyface Shine							1																													
Modelled Natural Community[1]	CCHW	CCHW	CCHW	CCHW	CCMS	CCHW	CWHW	CCMS	CCHW	CCHW	CCHW	CCMS	CWMS	CCMS	CCMS	CWMS	CCMS	CWMS	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCHW	CCMS	CCMS	CCMS	CCHW	Cold
Verified?	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No
Verifed Natural Community[2]	CWHW			CWHW	CWMS	CWHW	CWMS	CWMS	CWHW	CWMS	CWMS	CWMS	Warm MS	CWMS	Warm MS	Warm MS	Warm River	Warm Ms	CWHW	CWHW	CWHW	CWHW	CWHW	CWHW	CWHW	CWHW	CWHW	CWHW	CWHW*		CWHW	CWMS	CWMS	CWMS	CWMS	CWHW	CWHW
Cool-cold/Cool-warm IBI[3]	10/20	10/40	40/20	50/60	80/80	70/80	100/100	100/90	60/60	80/60	90/80	100/90	100/100	100/90	100/100	90/90	100/100	100/100	70/50	80/60	70/50	20/20	70/50	60/70	70/90	70/90	80/70	90/80	30/20	50/50	90/90	100/100	90/80	100/90	100/90	40/40	60/60
Other IBI (where appropriate)	10 (Poor)[4]	70 (Good)[4]	60 (Fair)[4]	80 (Good)[4]		100 (Excellent)[4]			100 (Excellent)[4]				82 (Excellent)5		74 (Excellent)[5]	72 (Excellent)[5]	67 (Excellent)[5]	77 (Excellent)[5]	60 (Fair)[4]	100 (Excellent)[4]	70 (Good)[4]	20 (Poor)[4]	80 (Good)[4]	100 (Excellent)[4]	100 (Excellent)[4]	100 (Excellent)[4]	100 (Excellent)[4]	100 (Excellent)[4]	30 (Poor)[4]	100 (Excellent)[4]	100 (Excellent)[4]				80 (Good)[4]	80 (Good)[4]

Stenothermal Coldwater Species

Tolerant Species

Intolerant Species

Species names in italics indicate warmwater species

1) Lyons, John. 2013. DRAFT Methodology for Using Field Data to Identify and Correct Wisconsin Stream "Natural Community" Misclassifications. Version 4. May 16, 2013.

2) Natural Community suggested by the methodology cited above.

3) Coolwater IBI: Poor < 20; Fair 21-40; Good 41-60; Excellent 61-100

4) Lyons, John. 2006. A Fish-Based Index of Biotic Integrity to Assess Intermittent Headwater Stream in Wisconsin, USA.

5) Lyons, John. 1992. Using the Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams of Wisconsin.

Table 5: Qualitative Habitat Survey Results

Station Name	Date Time	Flow (cfs)	Width (m)	Mean Depth (m)	Riparian Buffer Score	Bank Erosion Score	Pool Area Score	Width Depth Score	Riffle or Bend Ratio Score	Fine Sediments Score	Fish Cover Score	Overall Habitat Score	Habitat Rating
BREWERY CR. STATION 1 (N. OF STH 23) (Downstream of Copper St)	01-Jun-15		2	0.15	15	5	0	5	5	10	5	45	Fair
BREWERY CREEK AT FERNDALE RD	04-Jun-15	2.97	2.2	0.2	15	10	3	5	10	10	10	63	Good
BREWERY CREEK NEAR RECREATIONAL TRAIL	19-Jun-15	3.67	4.5	0.2	15	5	0	5	5	5	5	40	Fair
Unnamed Trib (928700) to Brewery Cr at Merry Christmas Ln	04-Jun-15	1.34	3	0.2	0	15	3	10	10	15	10	63	Good
FURNACE CREEK AT CTH O	18-Jun-15	9.78	5	0.3	10	5	0	5	0	0	10	30	Fair
Laxey Creek (formerly Pedler Cr). - Dwns. Cth B	17-Jun-15	3.49	4	0.3	0	15	3	10	10	10	10	58	Good
Laxey Creek (formerly Pedler Cr). - Ups. Sth 39	17-Jun-15	6.04	5	0.4	0	10	3	10	10	10	10	53	Good
Laxey Creek (formerly Pedler Cr.) - Ups. Cave Rd.	18-Jun-15	7.06	4.5	0.4	15	10	7	10	10	5	10	67	Good
Trib. To Laxey Cr (formerly Pedler Cr). - Ups. Bloomfield Rd.	29-May-15	1.09	1.6	0.3	0	15	3	15	10	10	10	63	Good
Mineral Point Branch E of Survey Rd	28-May-15	2.51	3	0.4	15	10	3	10	10	10	10	68	Good
Mineral Point Branch at Mill Creek Road	14-Jul-15	5.15	5	0.5	0	5	3	10	15	10	5	48	Fair
Mineral Point Br - Start of state property off West Bennett Rd	21-Aug-15		6.5	0.3	0	5	0	5	10	10	5	35	Fair
Mineral Point Branch - STH 39	30-Jul-15		8	0.5	10	0	0	5	5	5	10	35	Fair
Mineral Point Branch - Farm Crossing at Pitz-Schaaf Rd	30-Jul-15	23.26	9.9	0.5	5	5	0	5	10	10	10	45	Fair
Mineral Point Branch at S. Oak Park Rd	31-Jul-15	23.58	9.9	0.5	5	5	0	5	10	10	10	45	Fair
Mineral Point Br - CTH O	See qualitative habitat for stream > 10 m wide below												
Mineral Point Br - 20 m upstrm of confl. with Pecatonica R	21-Aug-15		9	0.5	10	0	0	5	10	5	10	40	Fair
Unnamed Trib (931300) to Mineral Point Br at Survey Rd	28-May-15	0.99	2	0.1	15	10	0	5	10	10	5	55	Good
Unnamed Trib (931200) to Mineral Point Br at Survey Rd	28-May-15	0.71	1.2	0.1	15	10	0	10	10	5	10	60	Good
Unnamed Trib (931000) to Mineral Point Br at Survey Rd	03-Jun-13		2.5	0.2	15	10	7	10	10	10	10	72	Good
Unnamed Trib (930900) to Mineral Point Br at S. Barneltown Rd	28-May-15		0.9	0.1	15	0	0	10	5	10	5	45	Fair
Unnamed Trib (930300) to Mineral Point Br upstrm of confl. with Mineral Pt Br.	01-Jun-15	0.67	1.5	0.2	0	10	3	10	10	5	5	43	Fair
Peddler Creek - Private drive off Wearne Rd	29-May-15	1.55	3	0.4	15	5	3	10	10	5	10	58	Good
Linden Branch (Pedler Cr) at Sth 39	03-Jun-15	1.66	2.5	0.3	0	5	3	10	10	10	10	48	Fair
Linden Branch (Pedler Cr) - Bl Linden Stp	03-Jun-15	1.66	2.5	0.3	0	5	3	10	10	10	10	48	Fair
Rock Br - End Of Station 1 (STH 23)	04-Jun-15	2.08	3	0.2	0	10	3	10	10	10	10	53	Good
Rock Branch at Suthers Road	19-Jun-15	2.37	3	0.4	15	15	3	10	10	5	15	73	Good
Unnamed Trib (928500) to Rock Br at Brecken Rd	01-Jun-15		1.2	0.1	15	10	0	10	10	5	10	60	Good
Sudan Branch at Whitson Road	03-Jun-15	1.13	1.6	0.2	15	15	3	5	10	10	10	68	Good
Sudan Branch at Roaster Rd	14-Jul-15	3.32	3	0.3	0	5	0	10	10	10	10	45	Fair
Sudan Branch - Farm lane (bridge) off Cave Rd	03-Aug-15	4.55	5	0.5	0	5	3	10	10	5	10	43	Fair
Sudan Branch - CTH E	03-Aug-15	8.51	9.5	0.4	10	5	0	5	5	5	5	35	Fair
Sudan Branch upstream of Lost Grove Rd	04-Aug-15	10.34	8	0.5	0	5	3	10	10	10	10	48	Fair
Sudan Branch - End of farm road at 376 Stude Rd	04-Aug-15	11.19	9.9	0.5	0	5	3	5	10	10	10	43	Fair
Unnamed Trib (929400) to Sudan Br at CTH E	29-May-15	0.95	1	0.4	0	15	0	15	5	10	10	55	Good
Unnamed Trib (5037481) to Sudan Br upstrm of confl. with Sudan Br	29-May-15		1	0.1	15	5	0	10	10	5	5	50	Good

Station Name	Date Time		Width (m)	Mean Depth (m)	Bank Stability Score	Maximum Thalweg Depth Score	Riffle or Bend Ratio Score	Rocky Substrate Score	Fish Cover Score	Overall Habitat Score	Habitat Status
Mineral Point Branch - Cth O	31-Jul-15	35.19	14	0.5	0	16	4	0	8	28	Fair

Table 6: Comparison of Temperature Data, Modelled Community and Verified Community Temperature ranges[1]

Site	June-Aug Mean	July Mean	Maximum Daily Mean	Thermal Regime (Based on Water Temperature Data)	Modelled Natural Community	Verified Community (Fish Assemblage Based)
Brewery Creek - Bike Trail Along Ferndale Road	17.01	17.44	20.00	Cold	Cool-Cold	Cool-Cold
Laxey Creek - Cave Road	19.75	20.40	23.43	Cool-Warm	Cool-Cold	Cool - Warm
Mineral Point Branch - Survey Road	16.96	17.34	20.91	Cold	Cool-Cold	Cool - Warm
Mineral Point Branch - CTH QQ	24.19	25.14	27.51	Warm	Cool - Warm	Warm
Mineral Point Branch - N. Oak Park Rd	22.61	23.50	26.03	Warm	Cool-Cold	Cool-Warm[1]
Mineral Pont Branch - CTH O	21.99	22.61	26.16	Warm	Cool-Cold	Warm
Trib (931200) to Mineral Point Br - Survey Rd	17.07	17.41	20.18	Cold	Cool-Cold	Cool - Warm
Trib (931000) to Mineral Point Br - Survey Rd	15.62	15.89	18.09	Cold	Cool-Cold	Cool - Warm[2]
Pedler Creek - STH 39	17.25	17.61	20.31	Cool-Cold	Cool-Cold	Cool - Warm
Rock Branch - Suthers Road	18.65	19.15	21.67	Cool-Cold	Cool-Cold	Cool - Warm
Sudan Branch - Roaster Road	18.87	19.36	22.20	Cool-Cold	Cool-Cold	Cool - Warm
Sudan Branch - Lost Gove Road	20.63	21.39	24.81	Warm	Cool-Cold	Cool - Warm
Trib (5037481) to Sudan Branch - CTH X	16.42	16.53	19.87	Cold	Cold	Cool - Warm

1) Based on a 2014 survey; 2) Based on a 2013 survey

Class and/or Subclass	June-Aug Mean	July Mean	Maximum Daily Mean
Coldwater	< 17.0	< 17.5	< 20.7
(Coolwater) Cold transition	17.0 - 18.7	17.5 - 19.5	20.7 - 22.6
(Coolwater) Warm transition	18.7 - 20.5	19.5 - 21.0	22.6 - 24.6
Warmwater	> 20.5	> 21.0	> 24.6

[1] From Lyons et al., 2009

Macroinvertebrates were collected at 28 sites in the watershed (Tables 7 and 8). The samples were analyzed and reported for the macroinvertebrate index of biotic integrity (MIBI) (Weigel, 2003) and the Hilsenhoff Biotic Index (HBI) (Hilsenhoff, 1987). The vast majority of MIBI scores and rankings were "poor" to "fair", with several tributaries in the "good" ranking. By contrast, most of the HBI scores/rankings were in the "good" category indicating slight to some organic loading.

Table 7: Macroinvertebrate score and condition in the Mineral Point Branch TWA.

WBIC	Waterbody Name	Station ID	Station Name	Sample Date	Score	Condition
927900	Mineral Point Br	253176	Mineral Point Branch - (Bridge) - N. Oak Park Rd	10/07/2015	1.54	Poor
927900	Mineral Point Br	253194	Mineral Point Branch E of Survey Rd	10/06/2015	4.24	Fair
931000	Unnamed	10040048	Unnamed Trib (931000) to Mineral Point Br at Survey Rd	10/06/2015	2.75	Fair
931200	Unnamed	10042383	Unnamed Trib (931200) to Mineral Point Br at Survey Rd	10/06/2015	4.070	Fair
930900	Unnamed	10043685	Unnamed Trib (930900) to Mineral Point Br at S. Barreltown Rd	10/06/2015	2.24	Fair
931300	Unnamed	10043686	Unnamed Trib (931300) to Mineral Point Br at Survey Rd	10/06/2015	3.82	Fair
930300	Unnamed	10043692	Unnamed Trib (930300) to Mineral Point Br upstrm of confl. with Mineral Pt Br.	10/07/2015	5.54	Good

Table 8: Macroinvertebrate Data for the Mineral Point and Sudan Branches Watershed

Station Name	MIBI Score/ranking	HBI Score/Ranking
Brewery Cr. - Dwnstrm Copper St.	3.19 (Fair)	4.47 (V. Good)
Brewery Creek - Ferndale Rd	1.61 (Poor)	4.93 (Good)
Brewery Creek - along recreational trail	1.28 (Poor)	5.19 (Good)
Unnamed Trib (928700) to Brewery Cr at Merry Christmas Ln	2.40 (Poor)	5.45 (Good)
Furnace Creek at CTH O	3.46 (Fair)	4.72 (Good)
Laxey Creek - CTH B	4.01 (Fair)	4.82 (Good)
Laxey Creek - Cave Rd	2.55 (Fair)	4.72 (Good)
Unnamed Trib (929800) - Bloomfield Rd.	1.53 (Poor)	4.65 (Good)
Mineral Point Branch - Survey Rd	4.24 (Fair)	5.26 (Good)
Mineral Point Branch - Mill Creek Road	0.60 (Poor)	5.59 (Fair)
Mineral Point Branch - N. Oak Park Rd	1.54 (Poor)	5.55 (Fair)
Mineral Point Branch - Farm Crossing at 0276 Pittz-Schaaf Rd	1.95 (Poor)	5.45 (Good)
Mineral Point Branch - Cth O	2.26 (Poor)	4.78 (Good)
Unnamed Trib (931000) to Mineral Point Br at Survey Rd	2.75 (Fair)	4.94 (Good)
Unnamed Trib (931200) to Mineral Point Br at Survey Rd	4.07 (Fair)	4.48 (V. Good)
Unnamed Trib (930900) to Mineral Point Br at S. Barreltown Rd	2.24 (Poor)	4.19 (V. Good)
Unnamed Trib (931300) to Mineral Point Br at Survey Rd	3.82 (Fair)	3.92 (V. Good)
Unnamed Trib (930300) to Mineral Point Br upstrm of confl. with Mineral Pt Br.	5.54 (Good)	4.98 (Good)
Peddler Creek - private drive off Wearne Rd	2.78 (Fair)	4.79 (Good)
Pedler Creek - STH 39	4.34 (Fair)	4.92 (Good)
Pedler Creek - downstream of Linden WWTP	1.42 (Poor)	4.96 (Good)
Rock Branch - Suthers Rd	3.11 (Fair)	5.12 (Good)
Unnamed Trib (928500) to Rock Br at Brecken Rd	2.95 (Fair)	5.50 (Good)
Sudan Br - Roaster Rd	4.46 (Fair)	5.19 (Good)
Sudan Branch - CTH E	3.17 (Fair)	4.61 (Good)
Sudan Branch - End of farm road off Stude Rd	2.81 (Fair)	4.97 (Good)
Unnamed Trib (5037481) to Sudan Br upstrm of confl. with Sudan Br	5.84 (Good)	5.91 (Fair)
Unnamed Trib (929400) to Sudan Br at CTH E	6.88 (Good)	5.03 (Good)

Discussion

Fish Community

Most of the streams in this HUC 10 are modelled to be cool-cold transitional headwaters or mainstem waters (Lyons, 2008). DNR has developed a method to determine whether or not the modeled natural community is accurate based on the fishery assemblage and climate conditions (Lyons, 2013). As reflected in Table 4, actual water temperature, the modelled natural community, and the verified natural community did not match up well. Temperature data collected by thermistors deployed throughout the watershed showed that actual water temperatures accurately reflected the modelled natural community at about 30% of the sites. The model overestimated water temperatures at about that same percentage of the sites – particularly in the smaller, groundwater fed headwater streams - and underestimated the temperatures in another 40% of sites, particularly on the mainstems of Mineral Point Branch and the lower portions of Laxey Creek and Sudan Branch.

Fish Assemblage

Actual water temperature data collected in the watershed shows summer temperatures to vary based on stream and position in the watershed. While many streams had water temperatures that were cold or cool transitional, in most cases, the thermal composition of species (cold, warm, or transitional) indicated these streams resemble cool-warm or warm systems (Ibid). There is a fair amount of diversity of nongame species in most of the streams and coldwater species are limited to certain streams or stretches of streams. Environmental degradation can sometimes explain the discrepancy between the modelled and actual community where there is a lack of intolerant species and a dominance of tolerant ones (Ibid).

For most systems in this HUC 10, the percentage of tolerant fish fall within expected ranges for cool-cold transitional systems, and therefore a degraded community is not the principle reason for the discrepancy. The discrepancy between the temperature data and the fishery community can happen for several other reasons: either the year of the thermal measurement wasn't representative of the long-term average, the modeled thermal values were inaccurate, or both (Lyons, personal communication, 2016). In this case, air temperatures during the 2015 "summer" season over which the thermisters were deployed were not considered abnormal as air temperatures were within the lower 10th and upper 90th percentile. The fishery is a long-term gauge of conditions in the stream and is therefore most important for bioassessment. That is not to say measured water temperatures are not useful, but for natural community determination and IBI purposes, and in the absence of moderate to severe environmental perturbation, the fishery assemblage trumps water temperature data (Ibid).

Trout were limited to certain streams and stretches of streams where stocking has been occurring. There were two notable exceptions to this where trout were found in the absence of stocking. Brook trout were found on Laxey Creek at CTH B, although brook trout have not been stocked in the creek since 1999 (Bradd Sims, personal communication). Brown trout were found in Brewery Creek even though the stream is not stocked. Conversely, Sudan Branch and Rock Branch are considered trout waters, and are currently stocked with brown trout. However, returns on trout were meager at best. Mottled sculpin, a native stenothermal coldwater indicator species were found in low numbers in Pedler Creek and Rock Branch, and in more modest numbers in the upper section of Sudan Branch. Even with the presence of this species, most of the fish in these three systems are cool transitional or warmwater species and the verified natural community is cool-warm.

Several unnamed tributaries and/or headwaters revealed the coldest temperatures of any streams in the watershed, yet did not contain any coldwater indicator species. This is not surprising considering they drain to relatively warmer systems that would not offer a source of coldwater species recruitment. For the most part, these headwaters streams are 1st through 3rd order streams and contained a subset of fish from the larger systems to which they drained. Water temperatures in these tributaries are generally in the "coldwater" thermal regime in that their mean temperatures remain below what is defined as cold in Lyons, et. al. (2009). This is typical for these perennial spring-fed streams. Species assemblages for these smaller systems were generally made up of brook sticklebacks, fantail and johnny darter, and occasionally creek chubs. Most of these are considered pioneer

species and can tolerate a variety of conditions and cooler water temperatures. Species diversity was consistent on the major streams such as Laxey Creek, Mineral Point Branch, and Sudan Branch. As is typical with most systems as one moves downstream, headwater species tend to disappear and are replaced by species which prefer larger water and more flow. However, the majority of sites were regularly made up of white suckers, creek chubs, central stoneroller, common shiner, hornyhead chub, fantail darter, and southern redbelly dace. Larger river species such as redhorse tended to be found in the lower half of Mineral Point Branch (downstream of Ludden Lake) and Sudan Branch (downstream of CTH E).

Of the game species, smallmouth bass were the most widely distributed, found in Laxey Creek, Mineral Point Branch, and Sudan Branch. It would appear Laxey Creek serves as a nursery stream for smallmouth, while Mineral Point and Sudan Branches hold good numbers of multi-year class fish. Catfish appear to be restricted to Mineral Point Branch downstream of Ludden Lake, but are found in good numbers, with a few stragglers making their way up to the lower reaches of Sudan Branch. In general, the size of channel catfish was notable, with fish larger than 18 inches being common. Walleye and northern pike were found in limited numbers in Mineral Point Branch.

Biotic Health and Water Condition

Stream biologic health as indicated by the Fish Index of Biotic Integrity (Fish IBI) varies by site, but generally shows good to excellent quality. As indicated earlier, most fisheries show the natural community to be cool-warm transitional. The IBIs for these systems range from 60-100. According to4431101 WisCALM (WDNR, 2013), streams that are considered headwaters (90th percentile exceedance flow $\leq$ 3 cubic feet per second) should be evaluated using the "Small and Intermittent Stream IBI" (Lyons, 2006). When this is applied to the streams where the verified community is confirmed as a headwater, most sites are between 60 (fair) and 100 (excellent). The exceptions to this were Brewery Creek at Copper Street, and two unnamed tributaries, WBIC =930900 and WBIC = 928500 where the small and intermittent stream IBI was "poor". Biologists ascertained that the depauperate fish community in Brewery Creek at Copper Street and the unnamed tributary (WBIC = 930900) was mainly attributed to the stream being small, with limited flow. The reason for a lack of fish in the unnamed tributary (WBIC = 928500) to Rock Branch was more unclear. According to biologists, the habitat was good and flow was adequate to support more fish. However, the (instantaneous) temperature was cold (12°C), which may have limited species diversity to some extent. Biologists noted many perched culverts on the tributaries to Mineral Point Branch along Survey Road and on an unnamed tributary (WBIC = 929400) along CTH E. However, the fishery assemblage of these tributaries, even upstream of the culverts, appears to resemble that of small, headwater streams and contain species of limited motility such as darters. Therefore the impact of these culverts appears minimal for these particular streams.

On the other end of the spectrum, the natural community verification process showed the fisheries community of Mineral Point Branch to resemble a warm mainstem or warm river downstream of the Ludden Lake dam. The warmwater IBI, when applied to these sections of Mineral Point Branch show an "excellent" assemblage of fish.

Ludden Lake

Lentic systems are rare in the driftless area of southwest Wisconsin and more specifically in the upper Pecatonica basin. For this reason, Ludden Lake is unique feature of this watershed. The lake is a shallow lowland reservoir that is an impoundment of Mineral Point Branch. Constructed in 1963, it was developed as a local recreational opportunity and residential development project (Sims, 2013).

Maximum depth of the lake has decreased from 14 feet in 1965 to 10 feet in 2013, presumably from excessive sediment losses from the upstream watershed. Total P and TSI indicate a eutrophic system. Low transparency caused by algal blooms and suspended sediment limits the growth of aquatic vegetation. The lake is regularly stocked with walleye, but also contains black crappie, bluegill, channel catfish, and carp, and the occasional largemouth bass, green sunfish, smallmouth bass, and white sucker (Ibid).

The most recent water chemistry data collected in 2013 and 2015 show the lake clearly exceeds the fish and aquatic life (FAL) standards and recreational thresholds for total phosphorus and chlorophyll a (Table 9). Therefore

the lake should be listed as impaired on the state's 303(d) list. The lake would also benefit from implementation of land use practices designed to mitigate soil loss from lands in the upstream watershed.

Table 9: Ludden Lake Water Chemistry (2013 and 2015 data).

Parameter	Mean (ug/L)	Min (ug/L)	Max (ug/L)	Confidence Interval 90% (lower)	Confidence Interval 90% (upper)	Chl a % Days Exceed	Confidence Interval (% days) 90% (lower)	Confidence Interval (% days) 90% (upper)
Total Phosphorus[1]	131	110	149	122.82	138.58	n/a	n/a	n/a
Chlorophyll a[2]	71.5	29.5	133	42.8	100.2	87.3	56.8	98.6
	1) TP standard = 40 ug/L (recreational); 100 ug/L (FAL)							
	2) Chl-a = 30% exceeds (recreational); 27 ug/L (FAL)							

The landscape of this watershed contains row crops on the hilltops and lesser sloped hillsides. Woodlands dot the steeper hillsides while many of the streams of this watershed flow through pastured meadows. Biologists noted, for the most part during 2015, pastures were not extensively overgrazed. There tended to be grass cover of 6 inches or more. However, there were exceptions to this as noted in individual stream narratives (Appendix B). Row crops become more prevalent in the broader valleys of Mineral Point Branch, downstream of STH 151. This is reflected in the habitat score which shows buffers to vary depending upon the stream and its place in the watershed. For instance, the tributaries to Mineral Point Branch along Survey Road are protected by meadow and presumably old pastureland that is now in set-aside. In contrast, the mainstem of Mineral Point Branch has little to no buffer from either row crops or pasturing. It is not surprising that there is a correlation between buffer and respective bank erosion score. There is also a further correlation between erosion score and the intensity of the grazing, as reflected in the biologist's notes. Sites within a riparian wooded corridor also tended to have steeply eroding banks.

The range of overall habitat scores ranged from 30 (fair) to 73 (good). The great majority of the "good" habitat scores ($\geq$50) were either unnamed tributary streams or in the headwaters of named streams. Mainstems of the major named tributaries tended to score between 35 and 48 (fair). Bank erosion and width/depth ratio were the driving factors which influenced the difference in the overall score the most while riparian buffer score, percent fine sediments, and fish cover score played a role to a lesser extent. Most sites did not have an overabundance of fine sediments, mostly due to the gradient which allows for scour of the bottom. Fish habitat was "good" at most sites and included nice riffle/run complexes, some wood and overhanging vegetation, and deep water in the corners and thalweg on the larger systems.

The macroinvertebrate community, as seen in Table 8, tends to reflect the land use and to some extent the overall habitat score. The vast majority of scores (25 of 28) are in the "fair" to "poor" range. The macroinvertebrate IBI has shown the combination of watershed land cover and local riparian and instream conditions strongly influence one another (Weigel, 2003). While watershed and local variables explain a significant portion of variance among sites, Weigel found that in the driftless region, localized stressors were of greater importance to explain the IBI than in other parts of the state. Livestock grazing measured disturbance intensity and indicated its proximity to the stream. A majority of stream sites had poor to fair buffer scores due to the prevalence of pasturing in stream valleys throughout the watershed. The headwaters of named streams and also unnamed tributaries tended to have higher MIBI scores. This may be a

Cows along Mineral Point Branch – North Oak Park Road
Photo by James Amrhein, Wisconsin DNR

reflection of the smaller watershed size for these systems, a better buffer (albeit coincidental) for these specific sites, or a combination of these factors. Either way, macroinvertebrate IBIs tended to decrease as one proceeded from upstream to downstream on many of the streams. Overall, macroinvertebrate scores were typical of streams in the driftless area south of the Military Ridge, which tend to be depressed. This is likely a reflection of the intensity of agriculture in the region combined with a vulnerable landscape (i.e. steep slopes, shallow soils, and highly erodible land). The MIBI scores for Brewery Creek may also be a reflection of the influence of mine waste in the area.

HBI scores were very consistent throughout the watershed with scores ranging from 3.92 (very good) to 5.91 (fair) with most scores between 4.5 and 5.5, or "good". This indicates there is minimal organic loading to these systems.

Growing season phosphorus concentrations were analyzed for two sites on Mineral Point Branch – North Oak Park Road and at CTH O. The site at North Oak Park Road was chosen because it is upstream of the confluence with Sudan Branch. Biologists noted that the concentrations of phosphorus at this site may have been influenced by the amount of cattle activity immediately above the sampling site on any given day (See figure at right). The CTH O site was chosen because it is below the confluence of Sudan Branch and other tributaries and represents the pour point of this watershed. It also had data collected in 2009 and 2010 so the 2015 data can be used for temporal comparison sake. As was shown in Table 3, median and mean phosphorus concentrations were almost identical for both sites. Save for 1 sample, all concentrations were at or above the state's water quality criteria of 0.075 mg/l. The entire length of Mineral Point Branch was added to the state's 303(d) list of impaired waters because of phosphorus in 2014. A comparison of the 2009/10 data with the more current data shows mean and median concentrations were higher in 2009/10 (Table 10) but not statistically different (p = 0.05).

Table 10: Comparison of Total Phosphorus Concentration in Mineral Point Branch at CTH O.

Month	2009/2010	2015
May	0.114	0.102
June	0.195	0.180
July	0.193	0.137
August	0.199	0.119
September	0.072	0.075
October	0.063	0.055
Average	0.139	0.111
Median	0.154	0.111

Management Actions

Management Priorities and Goals

Streams of the Mineral Point and Sudan Branches watershed are in good condition from a fisheries standpoint. The main stems of Sudan Branch and especially Mineral Point Branch contain a variety of species and can provide a reasonable angling opportunity.

There are impacts from nonpoint source pollution as shown by MIBIs and the habitat scores. These impacts are most notable in the bank erosion which has exacerbated the widening of streams and led to a depressed width-to-depth ratio score and rating. Managed grazing (appropriate numbers of livestock for the acreage), rotational grazing, and stream crossings should be employed in the riparian corridors to help maintain sod cover and help mitigate bank erosion and trampling. This would help reduce the rate of stream widening. In areas that are row cropped, buffers, cover crops, no-till farming and implementation of nutrient management plans would help reduce bank erosion and runoff of sediment and nutrients to the systems.

Monitoring and Assessment Recommendations

- Fisheries management should determine the reason for lack of trout returns in the upper Sudan Branch and in Rock Branch and to determine if it is practical to continue stocking efforts on these two streams.
- Fisheries management may want to consider the lower half of Laxey Creek as a managed smallmouth bass water (nursery stream) as it may be hospitable for some production of bass.
- DNR should seek opportunities to work collaboratively on projects which would benefit overall ecosystem health. Such opportunities include working with the Southwest Grasslands and Stream Conservation Area and Southwest Grasslands Bird Conservation Area. The department should work with groups to identify areas which would overlap as a priority for these programs, such as the upper Mineral Point watershed. These projects would also benefit Ludden Lake.
- Ludden Lake should be added to the state's 303(d) list of impaired waters because levels of total phosphorus and chlorophyll a exceed criteria and thresholds for shallow lowland lakes. The department should seek the aforementioned opportunities to work with partners to decrease soil and nutrient loss in the watershed upstream of Ludden Lake in order to improve water clarity, enhance macrophyte growth, and maintain the depth of the lake system which has been decreased over time due to sediment loads from upstream.
- The classification of Brewery Creek should be updated to reflect the biota using a contemporary classification system.
- The classification of Furnace Branch should be updated to reflect the current biota using a contemporary classification system.
- The department should revise the classification of Laxey Creek to remove the variance section at the headwater.
- Total phosphorus exceeds the state criteria of 0.075 mg/l and thus Mineral Point Branch will remain on the state's 303(d) list of impaired waters. The aforementioned nonpoint source best management practices would also help reduce phosphorus delivery to the stream. Fisheries management has several recommendations for Mineral Point Branch: no stocking of fish, maintaining the current size regulations, develop projects which would provide more habitat for smallmouth bass, especially the creation of deep pools and runs to hold adults year round. Below Ludden Lake specifically, fisheries management recommends looking at efforts to secure streambank easements.
- Ludden Lake should be added to the state's 303(d) list of impaired waters because levels of total phosphorus and chlorophyll a exceed criteria and thresholds for shallow lowland lakes. The department should seek the aforementioned opportunities to work with partners to decrease soil and nutrient loss in the watershed upstream of Ludden Lake in order to improve water clarity, enhance macrophyte growth, and maintain the depth of the lake system which has been decreased over time due to sediment loads from upstream.

- The classification of Brewery Creek should be updated to reflect the biota using a contemporary classification system.
  The classification of Furnace Branch should be updated to reflect the current biota using a contemporary classification system.
- The department should revise the classification of Laxey Creek to remove the variance section at the headwater.

Management Recommendations for DNR

- Fisheries management should determine the reason for lack of trout returns in the upper Sudan Branch and in Rock Branch and to determine if it is practical to continue stocking efforts on these two streams.
  Fisheries management may want to consider the lower half of Laxey Creek as a managed smallmouth bass water (nursery stream) as it may be hospitable for some production of bass.

Management Recommendations for External Parties

- DNR should seek opportunities to work collaboratively on projects which would benefit overall ecosystem health. Such opportunities include working with the Southwest Grasslands and Stream Conservation Area and Southwest Grasslands Bird Conservation Area. The department should work with groups to identify areas which would overlap as a priority for these programs, such as the upper Mineral Point watershed. These projects would also benefit Ludden Lake.
- There are a number of perched culverts on the tributaries that feed the upper Mineral Point Branch along Survey Road. The department should look for opportunities to work with the county and townships to properly replace these culverts.

Unnamed Stream, WBIC 929400, at CTH E illustrates a perched culvert.
Photo by James Amrhein, Wisconsin DNR.

Appendix A: References

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Appendix B: Stream Narratives

Brewery Creek

Brewery Creek is a 5 mile long stream located in southern Iowa County. It originates northeast of the Village of Mineral Point and flows southward to join Rock Branch. The combined flows are then called Furnace Branch which flows another 3 miles toward the southwest to join the Mineral Point Branch. Lead and zinc mining was prevalent in southwestern Wisconsin in the late 1800's and early 1900's. Mining waste severely polluted Brewery Creek. The few fish and macroinvertebrate species that were found were considered "tolerant" to pollution (Schlesser, 1990). The stream was considered "biologically dead" due to toxic metals and the smothering effect of ferric hydroxide precipitate (Marshall and Fix, 1995).

In 1992-1993, a major rehabilitation project took place which involved moving four roaster piles to a central containment area and re-routing the stream away from this containment site. Metals concentrations in the water column decreased by 80% and the stream no longer was rust colored (Ibid). While the stream responded favorably to this action, most of the fauna was still dominated by a few tolerant species. In 1998, the department placed Brewery Creek on its list of impaired, 303(d) waters. In 1998 and 1999, water samples from Brewery Creek were tested in laboratory biomonitoring assays using the cladaceran *Ceriodaphnia dubia* and fathead minnow (*Pimephales promelas*). Tests showed chronic toxicity in *C. dubia* (mean number of young significantly reduced) while other acute and chronic tests showed no significant difference between the test water and the control.

In 2009 biologists surveyed the stream to look at the fish and macroinvertebrate communities and water column metals concentrations 16 years after the project to determine if the stream continued to respond to the action. This 2009 study found concentrations of lead and zinc similar to those reported by Marshall (1995), but with zinc levels still considerably less than prior to the remediation project. From a biotic standpoint, biologists noted that the fishery of Brewery Creek seemed to have rebounded to some extent with an increase in diversity in the number of species and even the presence of brown trout with some evidence of natural reproduction (WDNR, 2009). The 2009 study recommended that temperature monitoring should be conducted and future fishery surveys should be completed to determine if the recovery of the fishery and presence of trout was just a spurious event or a trend.

The 2015 survey included temperature, chemical and biological monitoring. The temperature monitoring showed maximum daily mean temperatures remain below the threshold which defines cold water (Lyons, et. al., 2009). The fishery survey showed a similar representation of species as those found in 2009, with continued presence of trout and even young-of-the-year specimens. Since Brewery Creek is not stocked, it can only be surmised that these young fish were indigenous to this system. There was no increase in the density of trout and fewer individuals of 1+ year class were found in this survey.

The macroinvertebrate data was consistent with other streams in the watershed in that HBIs showed little organic loading, but the MIBI reflected land use and habitat perturbation. The poor MIBIs may also reflect the impacts of mining waste in the area.

As in 2009, water samples were taken at a site upstream of the remediation site and at two locations downstream and analyzed for lead and zinc. Toxicity tests were also performed on these waters. Just as in 2009, the water samples for the two downstream samples showed levels of Zn that exceed the acute toxicity criteria. Likewise, the two downstream samples showed acute and chronic toxicity in mean survival and neonate production, respectively, in bioassays conducted on *Ceriodaphnia dubia*. Growth of the algae *Selenastrum* was also significantly depressed in a chronic assay of the water samples. A reduction in fluorescence was noted in the

upstream sample relative to the lab control (424 vs. 374), but this reduction was not as significant as in the two downstream sites (424 vs. 6 and 10).

Biologists also noted the orange color of the water and major presence of iron precipitate on the substrate of the stream in the areas downstream of the mine site (See picture at right). This precipitate may be influencing the quality of the macroinvertebrate community as the MIBI score was better upstream of the impacted area and it also affects the aesthetic quality of the water. Biologists have responded to complaints from concerned citizens over the color of the water on several occasions over the past several years.

It would appear that in the 20+ years that have passed since the mine reclamation and stream relocation project, Brewery Creek has made moderate improvements in the fishery assemblage, but continues to be dominated by the tolerant species of white sucker and creek chub to the point of indicating human induced disturbance (Lyons, 2013). It is likely that nonpoint source pollution from both urban (village of Mineral Point) and rural sources impacts the stream to some extent. Raw banks contribute to the already moderate amounts of bed sediment, particularly as one moves downstream from Ferndale Road along the state trail and through pasturelands.

Iron Precipitate in Brewery Creek
Photo by Jim Amrhein

Given the efforts already undertaken 20 years ago, it is unlikely the impacts of toxicity from the mining can be mitigated. However, the fishery may show response if the stream banks can be stabilized and bottom sediments reduced. The priority of such an activity should be taken in the context of the perturbations and limitations likely caused by the continued leaching of mining waste to the system. While water temperatures may indicate a cold system, the species assemblage of Brewery Creek, an unnamed tributary (WBIC = 928700), and even Rock Branch, a designated trout stream, indicate the system to more likely be a cool-warm system, with occasional presence of brown trout in low numbers.

The classification of Brewery Creek should also be revisited. It is currently classified a variance water, but more recent fishery surveys have shown it to be a fish and aquatic life stream – albeit a disturbed one. The classification should be updated to reflect the biota using a contemporary classification system.

Marshall, Dave and S. Fix. 1995. Brewery Creek Water Quality Before and After Mining Waste Cleanup at Mineral Point, Wisconsin. Wisconsin Department of Natural Resources. Southern District Water Resources Management. December, 1995.

Schlesser, Roger. 1990. Brewery Creek at Mineral Point. Iowa County. Sugar-Pecatonica Basin Assessment. Mineral Point Roaster Piles. Bureau of Water Resources Management. Wisconsin Department of Natural Resources. June, 1990.

WDNR, 2009. Evaluation of Brewery Creek (WBIC = 928600), Iowa Co. Wisconsin, 16 Years after Mine Remediation Project. By James Amrhein. December, 2009.

Furnace Branch

This stream is formed by the confluence of Brewery Creek and Rock Branch. It flows 3 miles toward the southwest until it joins the Mineral Point Branch a mile south of the Iowa/Lafayette County line. It contains about a dozen transitional or warmwater fish species and can include a few stray gamefish like smallmouth bass and northern pike in its lower half. A stray brown trout may also be found, likely coming downstream from Rock Branch where they are stocked. For the most part; however, it is dominated by tolerant species such as white sucker and creek chubs, with some common shiner, hornyhead chubs and southern redbelly dace also present in moderate numbers.

Furnace Creek Meanders through the Driftless Area of Wisconsin

The department's administrative code NR104 lists "Brewery (Furnace) Creek" as a variance water "upstream from confluence with Mineral Point Branch" and notes, "the (above) limitation shall remain in effect until significant nonpoint source problems can be corrected." Furnace Branch is impacted by a high bed load of sediment and a lack of habitat, but is not currently on the state's 303(d) list of impaired waters. Based on the biota and appearance of the stream, it appears unlikely that Furnace Branch is impacted by the mine issues that plague Brewery Creek.

However, the department should consider doing a more thorough examination of the habitat to determine if Furnace Branch should be put on the state's 303(d) list of impaired waters. The department should also revisit the current classification of Furnace Creek as a variance water. The classification should be updated to reflect the current biota using a contemporary classification system.

Laxey Creek

This stream, formerly known as Pedler Creek, begins at Military Ridge, between Dodgeville and Edmund, and flows 10 miles toward the southwest were it joins Sudan Branch. The upper 0.7 miles is classified Limited Forage Fish, while the remainder is a default warmwater sport fishery. Bloomfield Healthcare and Rehabilitation Center, a nursing facility, discharges to the creek downstream of CTH CH. In 1989, it was recommended that the variance classification be lifted as biologists found good base flow from groundwater inputs and suitable to a good population of forage fish (Schlesser, 1989). The 2015 surveys showed the stream supports a diversity of transitional and warmwater species. An occasional smallmouth bass can be found in the lower half of the stream. One interesting finding from the 2015 survey was the presence of brook trout upstream of CTH B. These trout are apparently a remnant population that hangs on in the system despite the fact they haven't been stocked in the creek since 1999 (Bradd Sims, personal communication). A subsequent survey upstream and downstream of CTH CH in June of 2016 showed further presence of brook trout, especially upstream of CTH CH. Overall, however, the fishery assemblage resembles a cool-warm fishery and no other coldwater indicator species are present.

Laxy Creek, just northeast of Linden, Wisconsin. Photo by James Amrhein.

Most of the stream flows through a pastured riparian corridor. However, biologists noted the most of it was lightly pastured wet meadow that, while it cannot be counted as a buffer, for all intents, it served that purpose. There were some raw outside banks, but also many stable areas. The gradient of the stream helped keep the bottom clean and consisting of rubble/cobble, gravel and areas of broken bedrock. Overall habitat scores for the sites surveyed were good.

The surveys indicated that Laxey Creek is a good quality stream with a good diversity of non-game and some game species. While brook trout hang on in the headwaters without active management, the greater majority of the stream likely serves as a nursery tributary for smallmouth bass to the greater Sudan and Mineral Point watershed. Therefore it should be protected as such with grazing management to keep pastures in a condition of stable grasses. Fisheries management may want to consider the lower half of Laxey Creek as a managed smallmouth bass water (nursery stream). The department should also revise the classification of Laxey Creek to remove the variance section at the headwater.

Schlesser, Roger. 1989. Pedler Creek at Bloomfield Healthcare and Rehabilitation Center. Triennial Standards Review. Bloomfield Healthcare and Rehabilitation Center WWTP. Bureau of Water Resources Management. Southern District. July, 1989.

Mineral Point Branch

The flagship stream for the watershed begins on the Military Ridge just west of Dodgeville and flows 29 miles southerly into Lafayette County where it joins the Pecatonica River. A dam across the stream northwest of Mineral Point forms Ludden Lake, a 50 acre impoundment on the stream. Two fish species on the state's threatened and endangered list, the slender madtom and the Ozark minnow, have historically been found in this stream (Fago, 1982). There is no recent evidence, including this survey, to confirm these species still inhabit the stream.

Mineral Point Branch Above Ludden Lake
Photo by James Amrhein, Wisconsin DNR.

A 2014 smallmouth bass study conducted by fisheries management on Mineral Point Branch (Sims, 2014) showed the system is able to support a reproducing population of bass and provides limited angling opportunities below Ludden Lake on an annual basis. Upstream of Ludden Lake, habitat is limited for supporting a fishable bass population. However, the habitat and size of Mineral Point Branch seems to support reproduction for smallmouth coming upstream from the lake. Fisheries management has several recommendations for Mineral Point Branch. The department recommends: no stocking of fish, maintaining the current size regulations, develop projects which would provide more habitat for smallmouth bass, especially the creation of deep pools and runs to hold adults year round. Below Ludden Lake specifically, fisheries management recommends looking at efforts to secure streambank easements.

The stream is modelled to be a cool-cold headwater which graduates to a cool-cold mainstem with portions of cool-warm mainstem mixed in. As shown in Table 6 and Appendix C, temperatures in the upper portions of Mineral Point Branch, as indicated at Survey Road, had a mean temperature that remained below what is considered the upper threshold for a cold system (Lyons, et. al., 2009). Not surprisingly, temperatures downstream of Ludden Lake are considerably warmer, with daily mean temperatures routinely exceeding 25°C. Further downstream at CTH O, temperatures moderated somewhat with temperatures occasionally exceeding

25°C. Upstream of Ludden Lake and despite the lower temperatures, the fishery suggests a cool-warm transitional system and there are no coldwater indicator species. The temperatures downstream of Ludden Lake are indicative of a warm water fishery and are corroborated by the fish assemblage.

The landscape of this subwatershed is similar to that for the whole watershed. It contains row crops on the hilltops and lesser sloped hillsides. Woodlands dot the steeper hillsides while much of the stream flows through pastured meadows or row cropped fields and scattered woodlands. Row crops become more prevalent in the broader valleys of Mineral Point Branch, downstream of STH 151. This is reflected in the habitat score which shows buffers to vary depending upon the place in the watershed. For instance, the tributaries to Mineral Point Branch along Survey Road are protected by meadow and presumably old pastureland that is now in set-aside. In contrast, the mainstem of Mineral Point Branch has little to no buffer from either row crops or pasturing. It is not surprising that there is a correlation between buffer and respective bank erosion score. The width-to-depth ratio also tends to be depressed due to these stressors.

Mineral Point Branch at CTH 0
Photo by James Amrhein, Wisconsin DNR.

Despite these stressors, the fishery of Mineral Point Branch is robust. The health of the fishery, as indicated by the FIBI score, is excellent. There is a variety of non-game species present in good numbers. The majority of sites were regularly made up of common shiner, hornyhead chub, spotfin shiner, fantail and banded darter. Larger river species such as redhorse tended to be found in the lower ½ of Mineral Point Branch (downstream of Ludden Lake). Smallmouth bass are found throughout the system, but smaller numbers of fish and smaller size fish were found upstream of Ludden Lake. Downstream of Ludden Lake, Mineral Point Branch holds good numbers of fish in multiple year classes. Catfish appear to be restricted to Mineral Point Branch downstream of Ludden Lake, but are found in good numbers and of quality size with many specimens larger than 18 inches. Walleye and northern pike were found in limited numbers in Mineral Point Branch. Some of these fish are likely present due to stocking of Ludden Lake.

The macroinvertebrate community shows there is little organic pollution entering the water. However, similar to other streams in the watershed, the overall MIBI scores are depressed, likely an indication of the land use of the riparian corridor. The MIBI was highest at the uppermost sampled site at Survey Road, and then quickly degraded as one proceeded downstream. The unnamed tributaries that feed Mineral Point Branch generally had better MIBI scores. This may be due to their smaller watershed size, a better riparian buffer (albeit coincidental), or a combination of the two.

In 2014, Mineral Point Branch was placed on the state's 303(d) list of impaired waters because of total phosphorus concentrations in excess of the state's criteria of 0.075 mg/l. Sampling conducted on 2 sites on Mineral Point Branch in 2015 were similar in nature and confirmed the exceedance. Therefore the stream should remain on the impaired waters list.

The department should seek opportunities to work collaboratively on projects which would benefit water quality and overall ecosystem health. Such opportunities include working with the Southwest Grasslands and Stream Conservation Area and Southwest Grasslands Bird Conservation Area groups. The department should work with

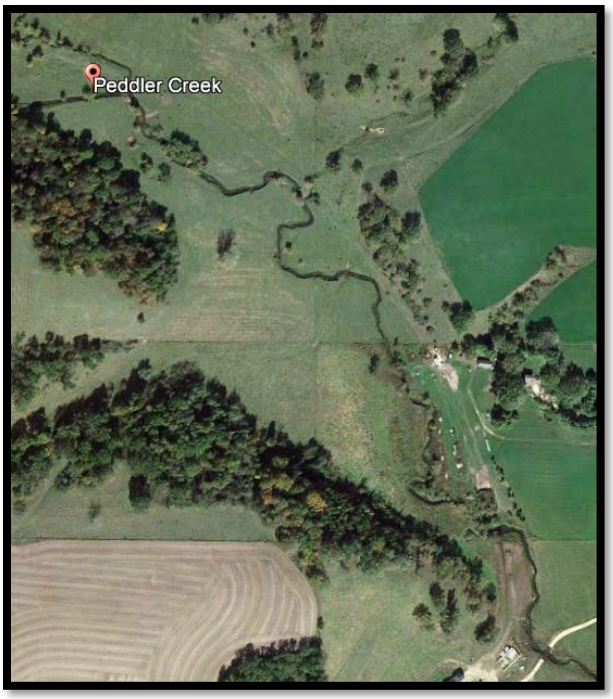
groups to identify areas which would overlap as a priority for these programs, such as the upper Mineral Point watershed. Lands under state ownership could be used as demonstration areas for proper grazing management.

There are a number of perched culverts on the tributaries that feed the upper Mineral Point Branch along Survey Road. The department should look for opportunities to work with the county and townships to properly replace these culverts.

Fago, Don. 1982. Distribution and Relative Abundance of Fishes in Wisconsin. 1. Greater Rock River Basin. Wisconsin Department of Natural Resources. Technical Bulletin No. 136.

Sims, Bradd. 2014. 2014 Smallmouth Bass Survey of the Mineral Point Branch, Iowa County, Wisconsin. Wisconsin Dept. of Natural Resources. Dodgeville Field Office.

Pedler Creek



This tributary to Sudan Branch receives effluent from the Village of Linden. It was formerly an unnamed tributary until the USGS formally changed the name to Pedler Creek in 2007. The former Pedler Creek was then changed to Laxey Creek (see Laxey Creek narrative above). This 4 mile long stream has its origin northeast of the Village of Linden. If flows southerly past the village and joins Sudan Branch.

The Linden area contains numerous historic mines and the leaching of metals from these mines may impact the water quality of Pedler Creek. In 1999 the Wisconsin State Laboratory of Hygiene reported toxicity of the samples in the Linden area was primarily caused by high levels of zinc. In 2014, the Linden wastewater treatment plant reported having issues meeting their permit because of a failed bioassay test of their effluent, and specifically in their reference site water. A subsequent investigation of several streams in the area showed that the toxicity was isolated to Pedler Creek and not a regional issue. A subsequent Toxicity Identification Evaluation (TIE) showed zinc again to be the factor. It was decided that the Linden WWTP will have to either use lab water or water from another nearby stream for their receiving water sample (Kari Fleming, personal communication).

Despite the metals toxicity and its impact on *Ceriodaphnia dubia* in the bioassay tests, this issue does not appear to be impacting the biota of Pedler Creek to any great extent. Macroinvertebrate IBIs varied widely and were actually highest in the middle section at STH 39. The “poor” MIBI downstream of the Linden WWTP is likely more an artifact of land use (pastureland) than the operation of the plant.

The fishery assemblage was dominated by creek chubs, a tolerant species, at all sites, but they did not exceed the threshold for human induced impairment. The stream does contain a good diversity of species and is one of the few streams in the watershed to contain mottled sculpin, a coldwater indicator species. Despite this, the fishery community more closely resembles a cool-warm transitional stream that shows excellent quality.

There are some nonpoint source issues similar to other sites in the watershed. Habitat is fair to good as the stream flows through riparian pastures. Bank erosion is an issue, but the stream has good gradient which allows for scouring of sediment, leaving a mostly rubble/cobble bottom with some sediment in runs and shallow pools.

As with most sites, the department and the county should look for opportunities to promote grazing management. Given the water temperatures and presence of mottle sculpin, fisheries management could also explore the opportunity to look at Pedler Creek as a coldwater (trout) resource. However, this opportunity should be taken in context of the size of the stream and opportunities for easement, and the success or failure of other trout stocking activities in the watershed.

Rock Branch

Rock Branch begins as a warmwater seepage stream south of STH 39, east of Mineral Point. As the stream flows southwestward, spring flows become the principal water source (WDNR, 1968). The stream flows 3 miles until it joins with Brewery Creek and becomes Furnace Branch. It is currently designated as a Class II trout water and receives annual stocking of about 500 fingerling brown trout.

While most of the species found in the stream represent a cool-warm fishery, surveys on the stream conducted from 2000 to 2011 showed the stream to sustain multiple year classes of brown trout and even some brook trout. A stream habitat project was conducted by a private landowner upstream from Suthers Road in 2009.

This most recent survey conducted in 2015 was different. A total of 3 brown trout were found at the 2 sites surveyed (Suthers Road and STH 23). It is unknown what has happened to the trout population since the last survey was conducted in 2011. The daily mean water temperature did exceed the 20.7°C threshold for coldwater as define by Lyons, et. al. (2009) on a dozen days over the summer period (Appendix C). However, mean temperatures remained in the range for a cool-cold system (Ibid). While the fish assemblage more closely resembles a cool-warm transitional system, it has been able to sustain some returns on trout over the years.

Given the time that has passed, it is unlikely the department would be able to determine if the loss of trout was from a possible major fish kill event. If one were to speculate that this was the case, the other species commonly inhabiting the stream seemed to have either not been affected or to have recovered from the event. The department should conduct further surveys, including temperature monitoring, in consecutive years to determine if 2015 was an anomaly or if it should re-evaluate stocking of this stream. If it is determined the stream can support trout, the department should pursue easements on the stream and/or stream rehabilitation projects.

WDNR, 1968. Surface Water Resources of Iowa County. Lake and Stream Classification Project. By Ron Piening and C.W. Threinen. Wisconsin Department of Natural Resources. Madison, WI.

Sudan Branch

The Sudan Branch, also known as the East Pecatonica River (not to be confused with the East Branch Pecatonica River), is the 2nd longest stream in the watershed and is a tributary to Mineral Point Branch. It begins on the Military Ridge between Edmund and Cobb and flows 18 miles toward the southeast. The upper 3 miles (upstream of CTH X) of Sudan Branch are designated as a Class II trout water. It is stocked annually with 250 – 1000 brown trout and has historically been stocked with walleye.

The Natural Communities Model (Lyons, 2008) indicates that Sudan Branch is purportedly a cool-cold transitional system. However, with the exception of the upper most sampled site at Whitson Road, the 2015 temperature monitoring and fisheries surveys showed it more closely resembles a cool-warm transitional or even a warm one. Mottled sculpin, a coldwater indicator species, was found in the upper 2 sites upstream of Roaster Road. Individual trout were found at 2 sites, but those were downstream of the designated trout water. There were no 1+ age trout in the "trout water" section that was surveyed. The young-of-the-year trout that were captured at Roaster Road were likely the fish stocked a couple of weeks prior to the survey.

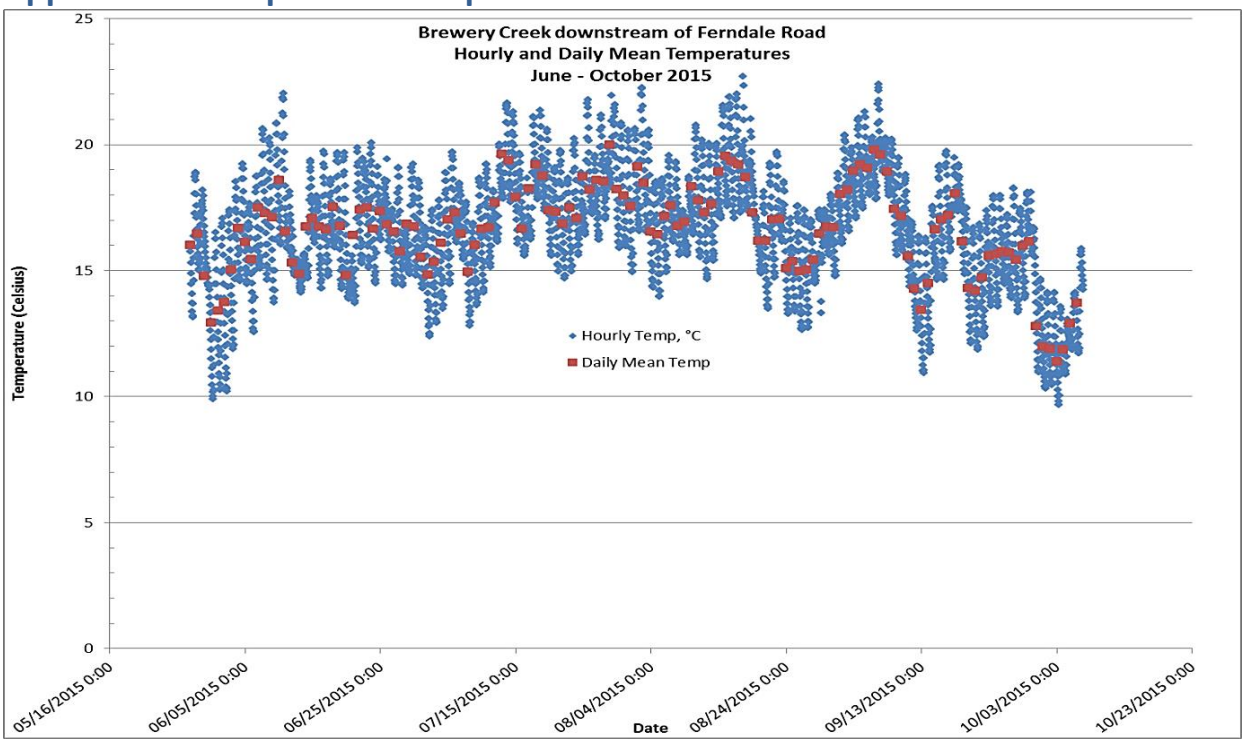
Not surprisingly, the fishery of the lower half of Sudan Branch resembles that of the upper half of Mineral Point Branch into which it flows. There are a variety of non-game species including white suckers and creek chubs, but also common shiner, central stoneroller, hornyhead chub and johnny darter. Redhorse are also found in the lower sites. Smallmouth bass were not found upstream of Roaster Road. Their numbers and size range increased as one proceeded downstream. A couple of rogue channel catfish, likely migrants from Mineral Point Branch, were found in the lower stations, and there was no evidence of walleyes in the 2015 surveys.

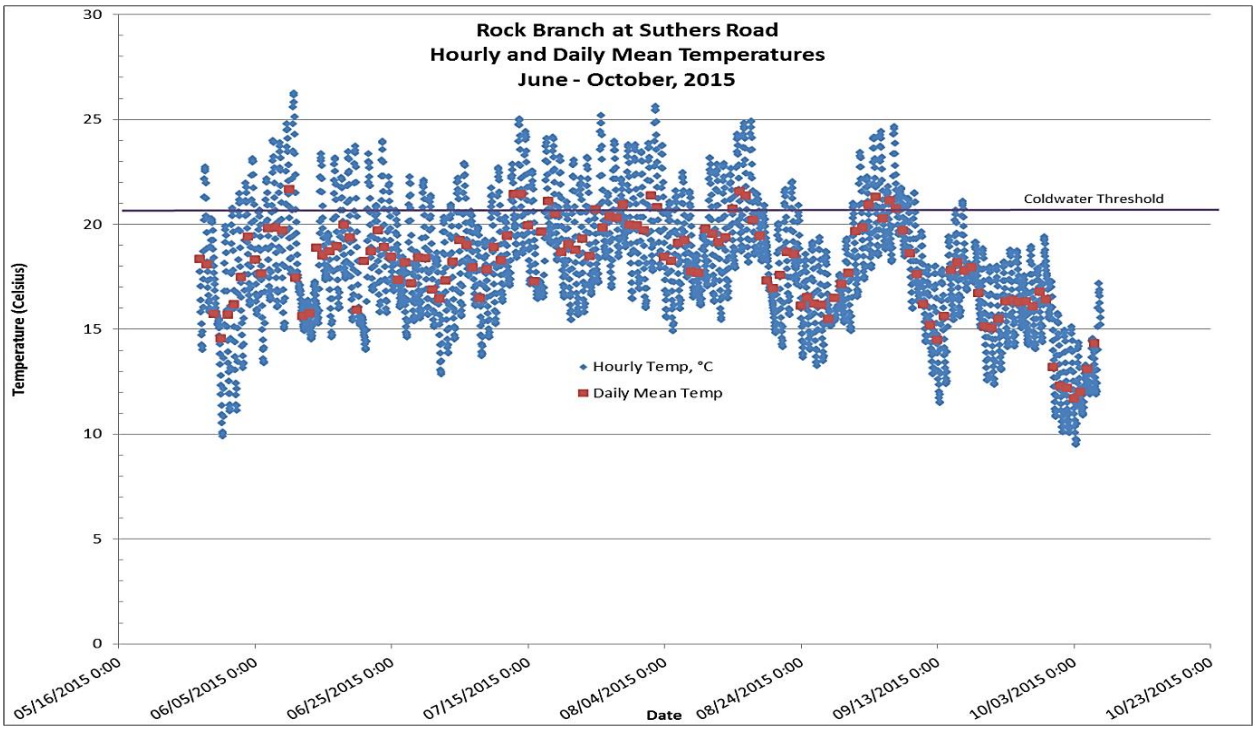
Sudan Branch, while a relatively large stream, lacks the depth of Mineral Point Branch to hold over large populations of river species such as catfish, buffalo, and drum. Even smallmouth bass likely migrate to the deeper holes of Mineral Point Branch during winter months. Still, Sudan Branch serves as a good nursery stream and can hold multi-year fish during certain times of the year. Overall fishery health, based on the IBI shows the stream to be "excellent".

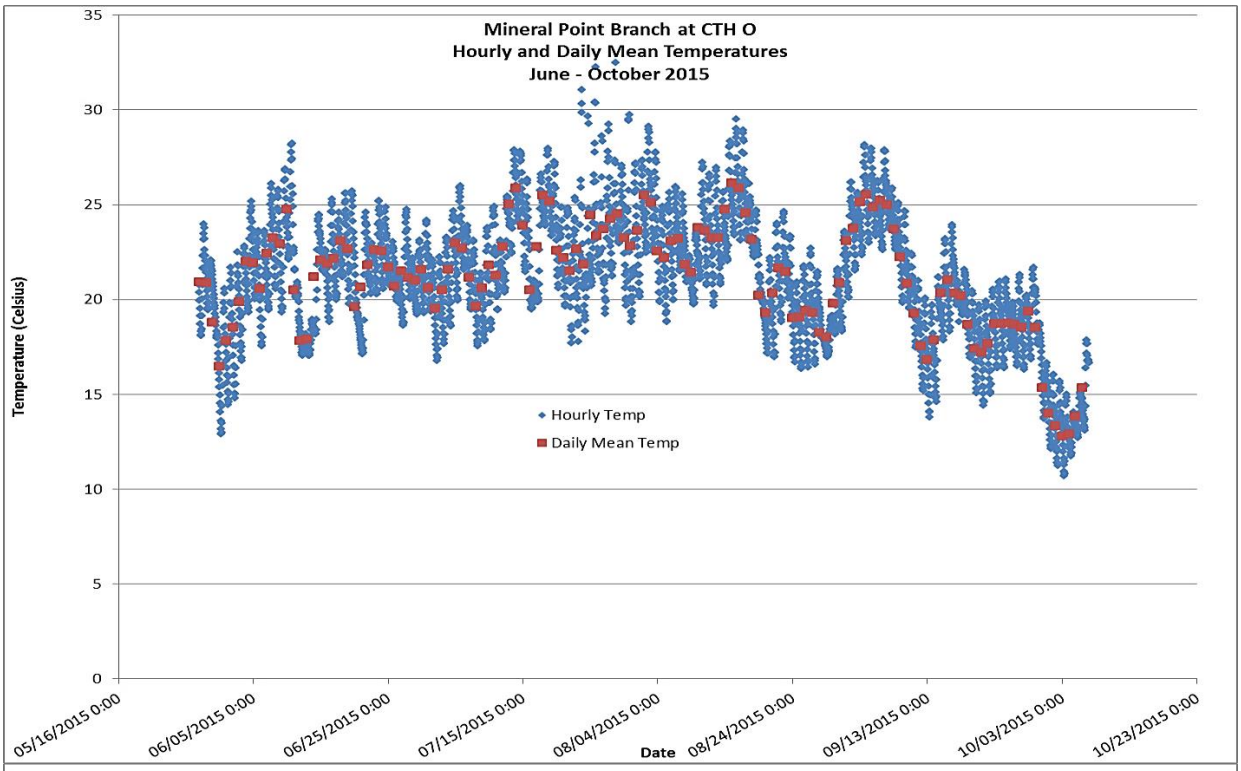
The stream flows through pasturelands for much of its length. Bank erosion and trampling are primary sources of sediment to the stream. Because of its good gradient, Sudan Branch has a hard bottom in riffles and in the thalweg. Silt is common in slow runs and other quiescent areas. The shallow bedrock formations offer hard substrate in many areas either through rubble/cobble or broken bedrock and lend themselves to the formation of nice riffle/run complexes. However, this formation also precludes the presence of deep pools. While width-to-depth ratios were fair to good, pasturing must be managed so that trampled banks are kept to a minimum in order to prevent stream widening. The department and county should look for opportunities to engage landowners in rotational grazing and installation of cattle crossings as well as other opportunities to reduce other sources of nonpoint source pollution such as runoff from barnyards or planting cover crops to reduce soil erosion from crop fields.

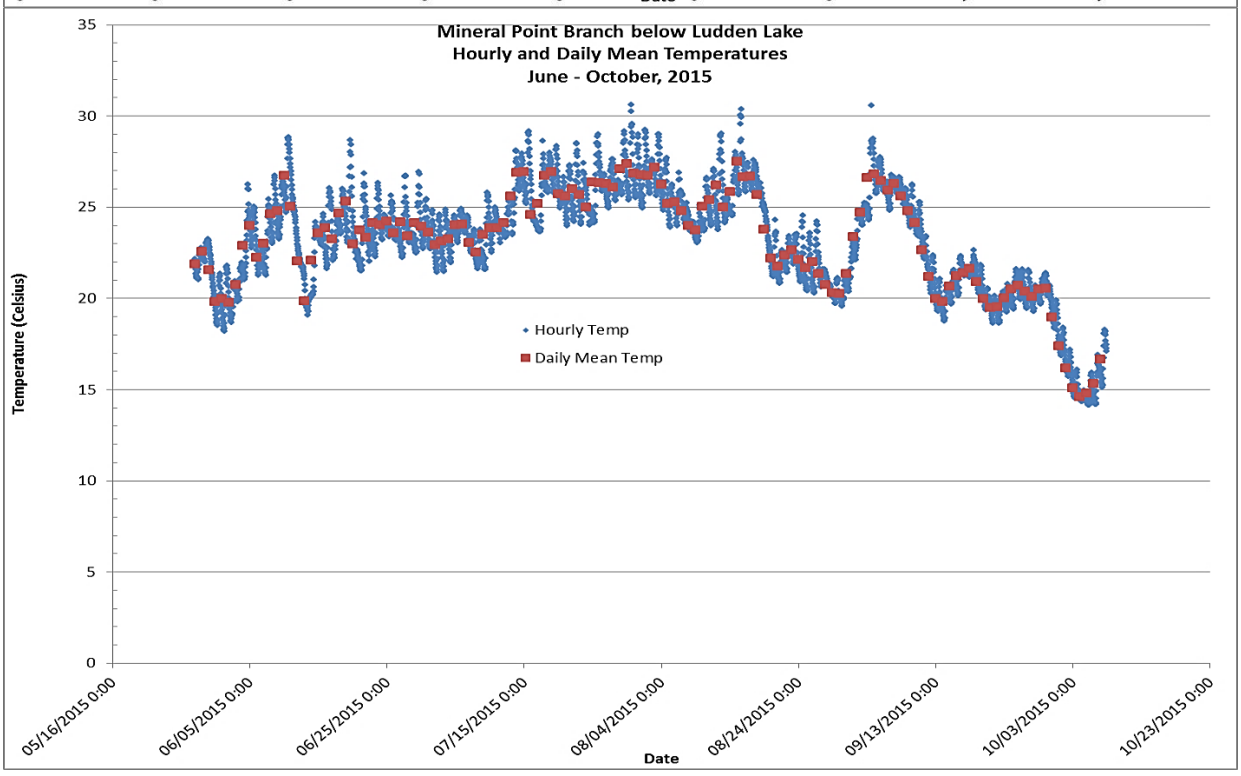
Ludden Lake. Photo by James Amrhein, Wisconsin DNR.

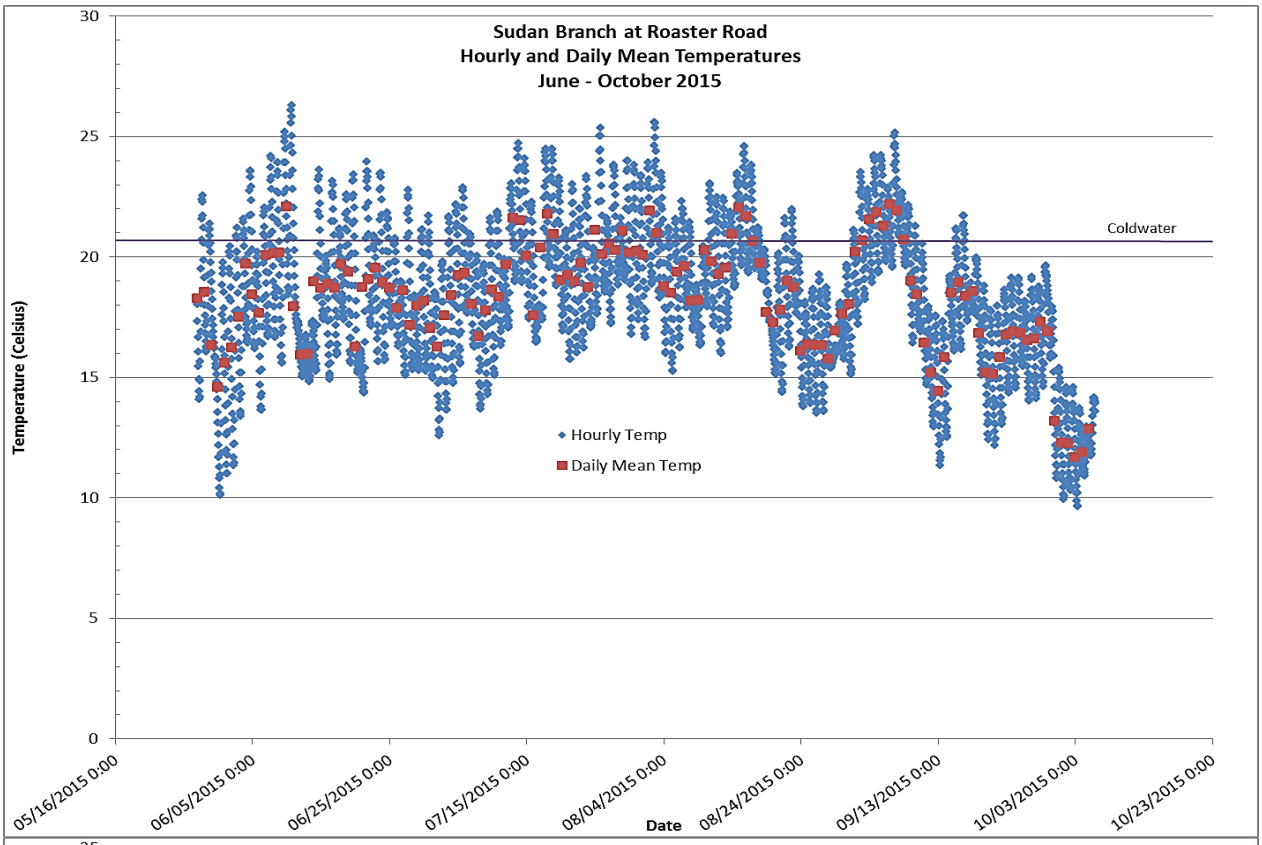
Appendix C: Temperature Graphs

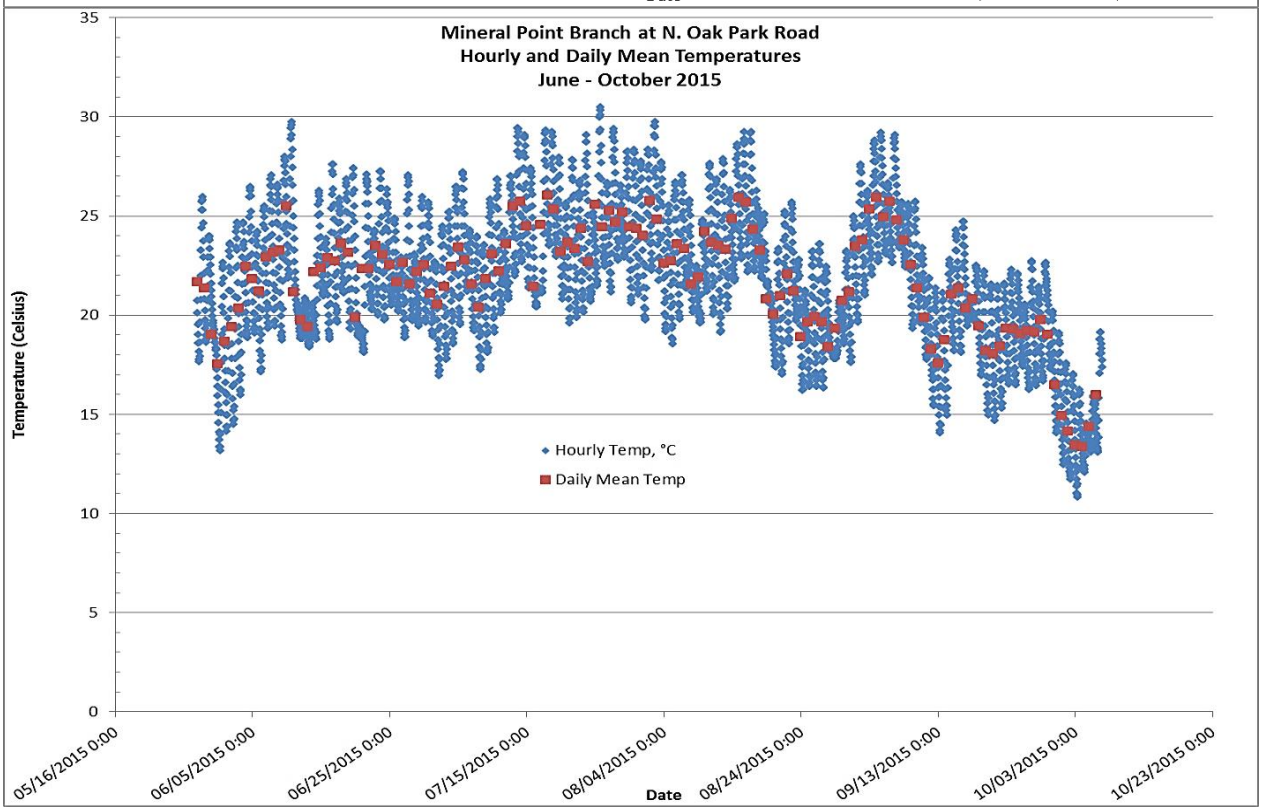


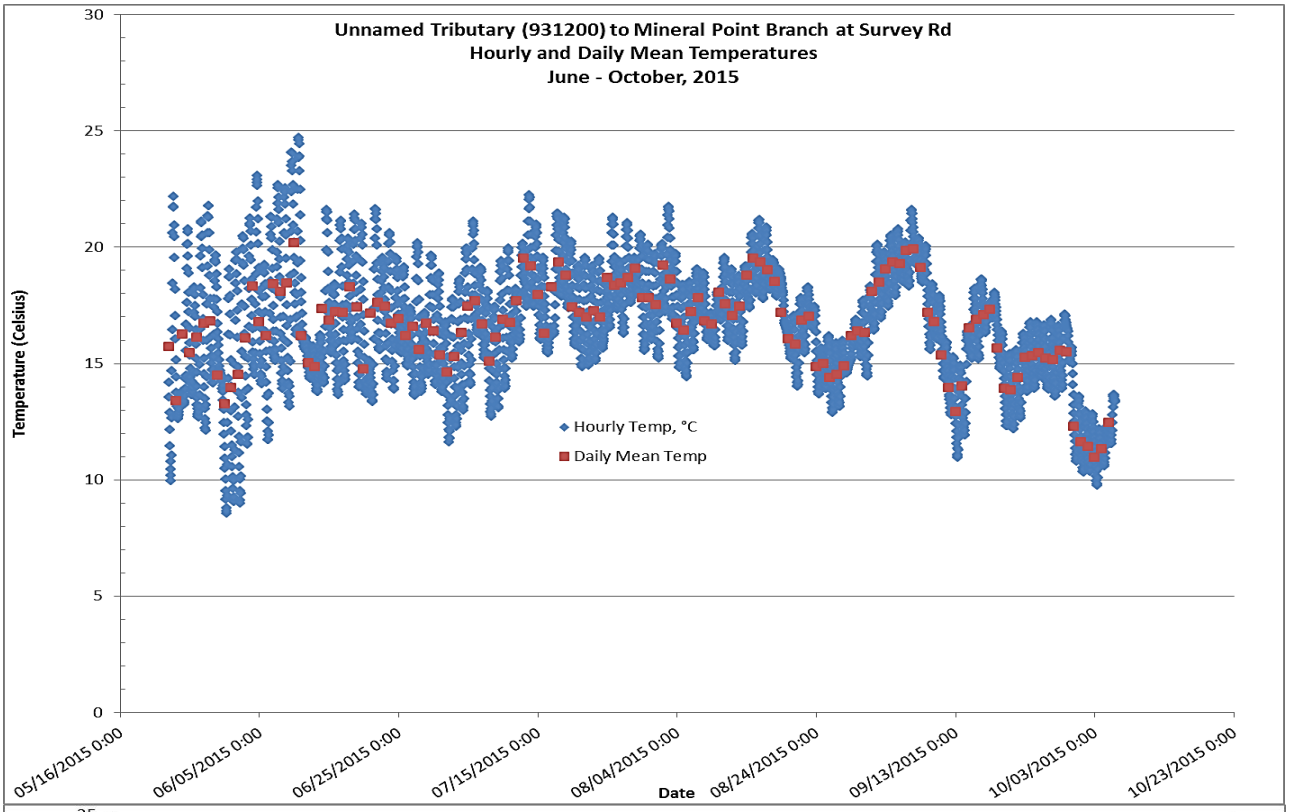


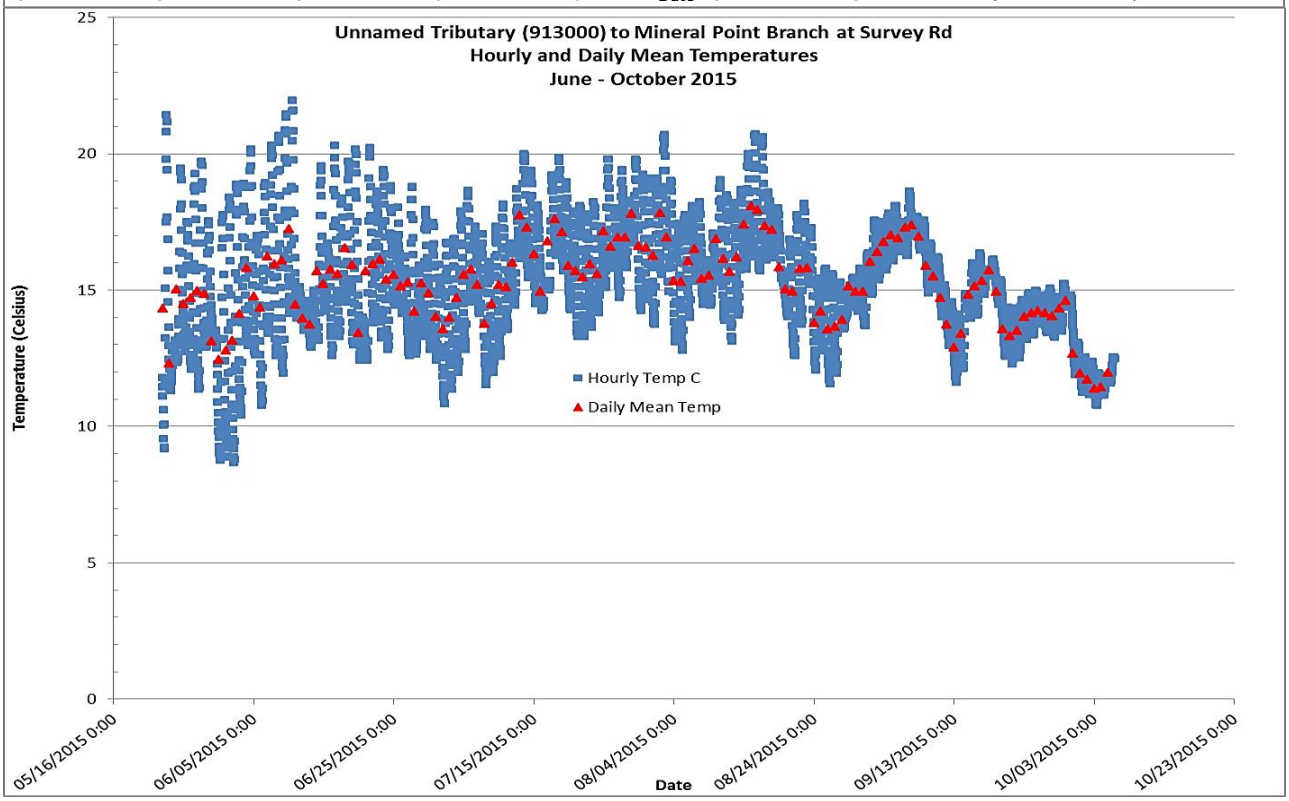

Mineral Point Branch at CTH O
Hourly and Daily Mean Temperatures
June - October 2015
Temperature (Celsius)
35
30
25
20
15
10
5
0
Hourly Temp
Daily Mean Temp
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00
Date

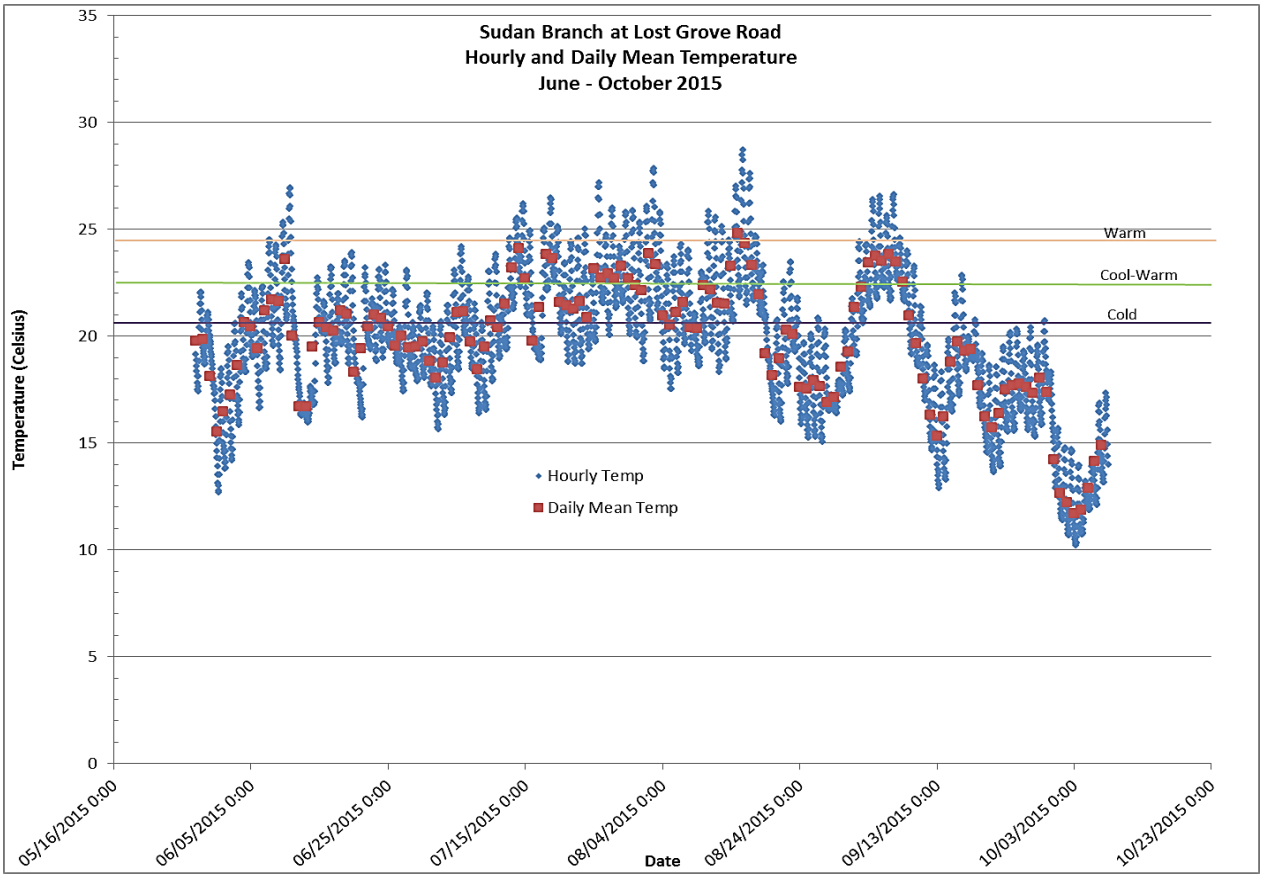

Mineral Point Branch below Ludden Lake
Hourly and Daily Mean Temperatures
June - October, 2015
Temperature (Celsius)
35
30
25
20
15
10
5
0
Hourly Temp
Daily Mean Temp
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00
Date


Sudan Branch at Roaster Road
Hourly and Daily Mean Temperatures
June - October 2015
Temperature (Celsius)
Coldwater
Hourly Temp
Daily Mean Temp
Date
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00


Mineral Point Branch at N. Oak Park Road
Hourly and Daily Mean Temperatures
June - October 2015
Temperature (Celsius)
Hourly Temp, °C
Daily Mean Temp
Date
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00


Unnamed Tributary (931200) to Mineral Point Branch at Survey Rd
Hourly and Daily Mean Temperatures
June - October, 2015
Temperature (Celsius)
Hourly Temp, °C
Daily Mean Temp
Date
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00


Unnamed Tributary (913000) to Mineral Point Branch at Survey Rd
Hourly and Daily Mean Temperatures
June - October 2015
Temperature (Celsius)
Hourly Temp C
Daily Mean Temp
Date
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00


Sudan Branch at Lost Grove Road
Hourly and Daily Mean Temperature
June - October 2015
Temperature (Celsius)
35
30
25
20
15
10
5
0
Warm
Cool-Warm
Cold
Hourly Temp
Daily Mean Temp
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
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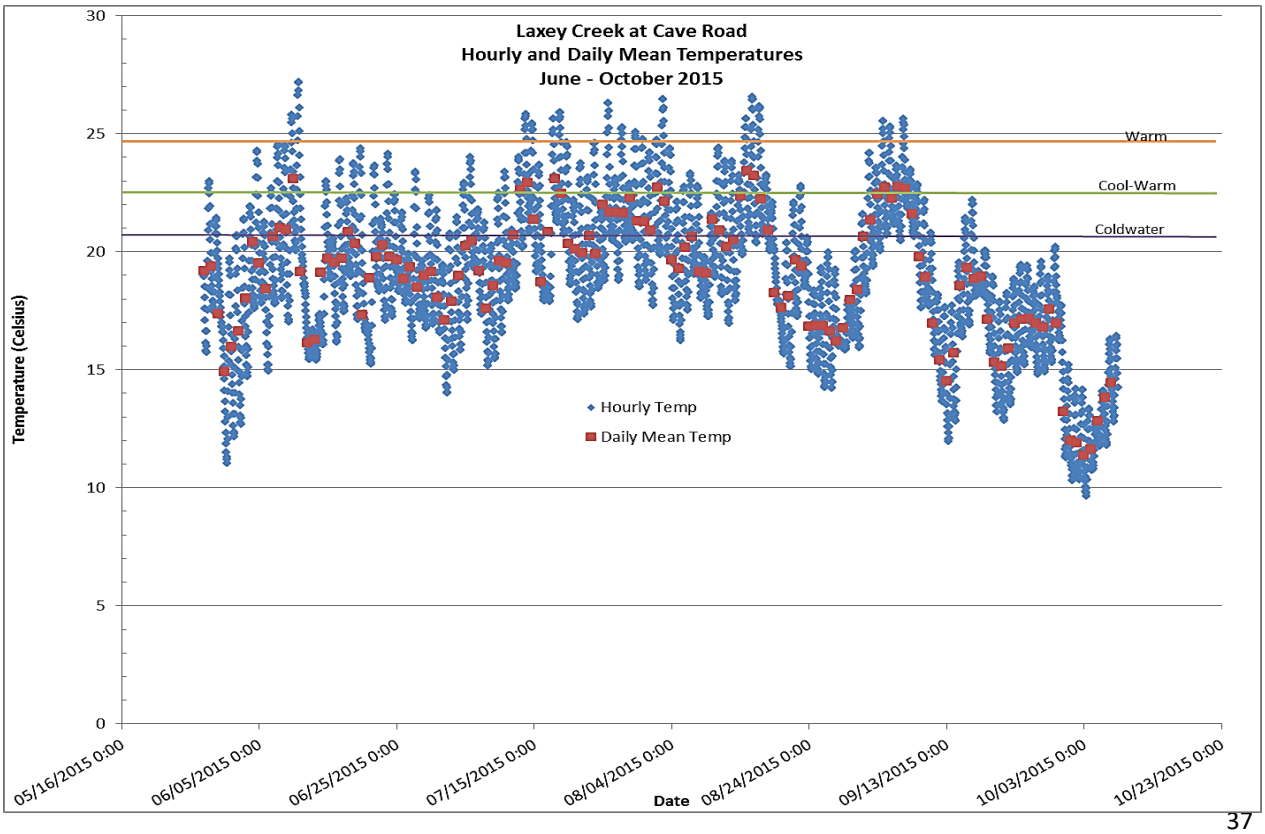
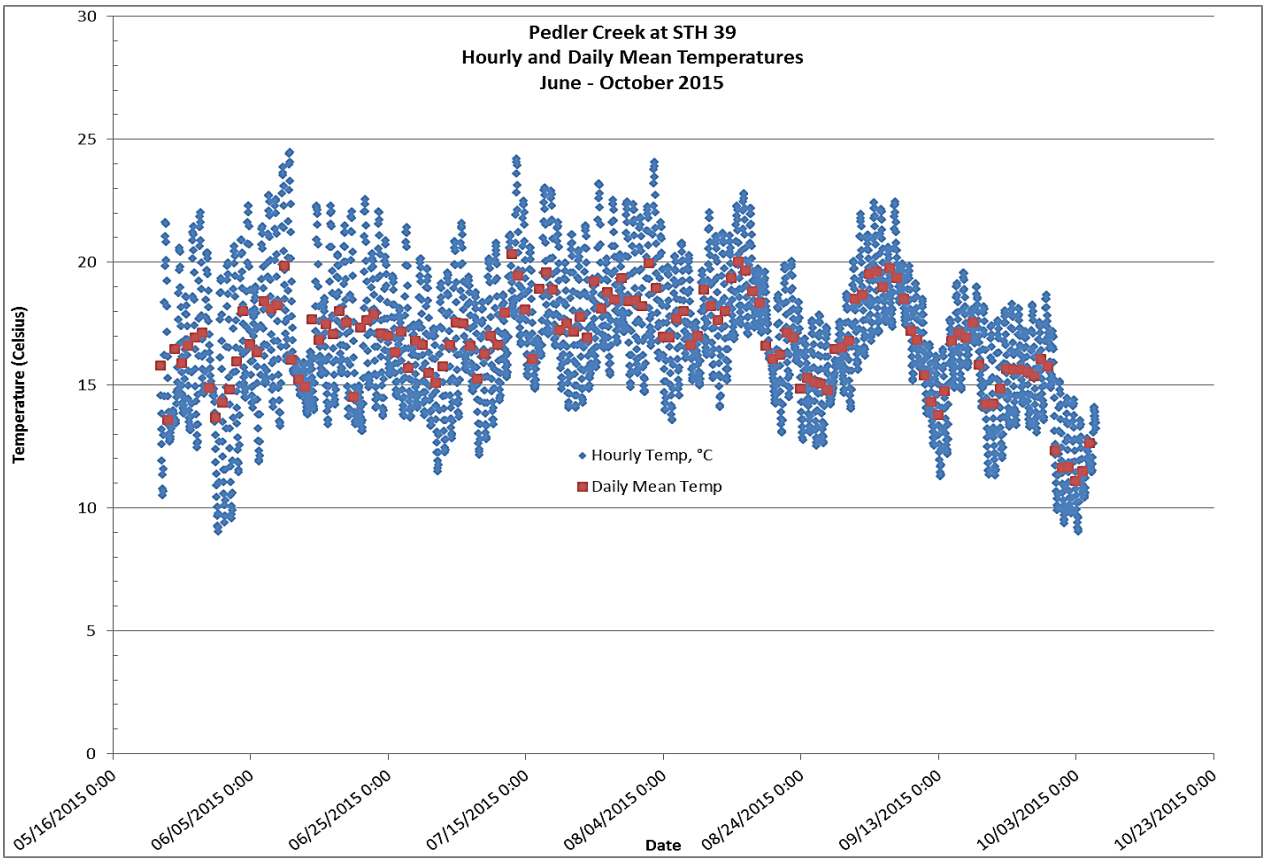
10/23/2015 0:00
Date


Laxey Creek at Cave Road
Hourly and Daily Mean Temperatures
June - October 2015
Temperature (Celsius)
30
25
20
15
10
5
0
Warm
Cool-Warm
Coldwater
Hourly Temp
Daily Mean Temp
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00
Date


Pedler Creek at STH 39
Hourly and Daily Mean Temperatures
June - October 2015
Temperature (Celsius)
30
25
20
15
10
5
0
Hourly Temp, °C
Daily Mean Temp
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
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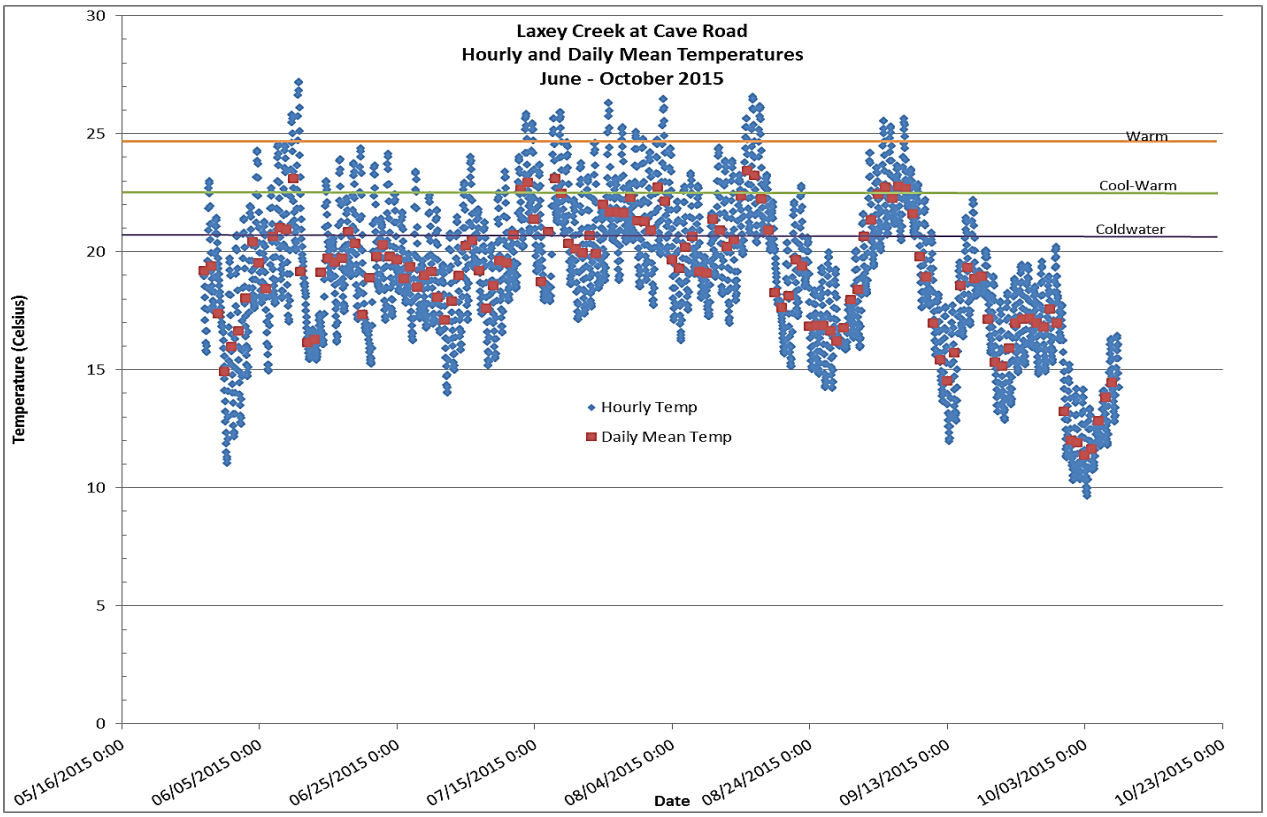
10/23/2015 0:00
Date


Laxey Creek at Cave Road
Hourly and Daily Mean Temperatures
June - October 2015
Temperature (Celsius)
30
25
20
15
10
5
0
Warm
Cool-Warm
Coldwater
Hourly Temp
Daily Mean Temp
05/16/2015 0:00
06/05/2015 0:00
06/25/2015 0:00
07/15/2015 0:00
08/04/2015 0:00
08/24/2015 0:00
09/13/2015 0:00
10/03/2015 0:00
10/23/2015 0:00
Date

Appendix D: Monitored Stations

WBIC	Waterbody Name	Station ID	Station Name	Earliest Fieldwork Date	Latest Fieldwork Date
930700	Ludden Lake	10002733	Ludden Lake	07/27/1999	03/16/2017
930700	Ludden Lake	253168	Ludden Lake - Deep Hole	04/06/1995	11/20/2016
927900	Mineral Point Br	10044948	Mineral Point Branch - at Highway 151	07/10/2016	07/10/2016
928000	Furnace Creek	10044949	Unnamed Tributary - Airport Road near County O	07/10/2016	07/10/2016
3000077	Laxey Creek	253026	Laxey Creek (formerly Peddler Creek) at County Farm Rd	04/24/1987	06/07/2016
927900	Mineral Point Br	253185	Mineral Point Branch - (Bridge) - N. Oak Park Rd	06/30/2003	10/20/2015
927900	Mineral Point Br	333207	Mineral Point Branch - Cth O (Bi)	05/10/1979	10/20/2015
929400	Unnamed	10043688	Unnamed Trib (929400) to Sudan Br at CTH E	05/29/2015	10/08/2015
929000	Sudan Br	10043927	Sudan Branch - End of farm road at 376 Stude Rd	08/04/2015	10/08/2015
3000077	Laxey Creek	10016876	Laxey Creek (formerly Pedler Cr) - Ups. Cave Rd	10/22/1986	10/08/2015
929000	Sudan Br	10043918	Sudan Branch - CTH E	08/03/2015	10/08/2015
928500	Unnamed	10043690	Unnamed Trib (928500) to Rock Br at Brecken Rd	06/01/2015	10/07/2015
928600	Brewery Creek	253200	Brewery Creek at Ferndale Rd	10/01/1987	10/07/2015
928200	Rock Br	10034365	Rock Branch at Suthers Rd	06/19/2015	10/07/2015
928600	Brewery Creek	10030385	Brewery Creek near Recreational Trail	06/19/2015	10/07/2015
928000	Furnace Creek	333206	Furnace Creek at CTH O	05/10/1979	10/07/2015
928600	Brewery Creek	10008015	Brewery Cr. Station 1 (N. Of Sth 23)	06/30/2009	10/07/2015
930300	Unnamed	10043692	Unnamed Trib (930300) to Mineral Pt Br upstrm of confl. with Mineral Pt Br.	06/01/2015	10/07/2015
928700	Unnamed	10043694	Unnamed Trib (928700) to Brewery Cr at Merry Christmas Ln	06/04/2015	10/07/2015
927900	Mineral Point Br	10043903	Mineral Point Branch - Farm Crossing at 0276 Pittz-Schaaf Rd	07/30/2015	10/07/2015
927900	Mineral Point Br	253176	Mineral Point Branch - (Bridge) - N. Oak Park Rd	06/30/2003	10/07/2015
930900	Unnamed	10043685	Unnamed Trib (930900) to Mineral Point Br at S. Barreltown Rd	05/28/2015	10/06/2015
929700	Peddler Creek	10032522	Peddler Creek at 0.6 miles E of Linden (private drive 2526 Wearne Rd)	05/29/2015	10/06/2015
929800	Unnamed	10016922	Trib. To Laxey Cr (formerly Pedler Cr). - Ups. Bloomfield Rd.	10/22/1986	10/06/2015

WBIC	Waterbody Name	Station ID	Station Name	Earliest Fieldwork Date	Latest Fieldwork Date
927900	Mineral Point Br	253194	Mineral Point Branch E of Survey Rd	06/19/2001	10/06/2015
3000077	Laxey Creek	10016924	Laxey Creek (formerly Pedler Cr) - Dwns. Cth B	10/22/1986	10/06/2015
931000	Unnamed	10040048	Unnamed Trib (931000) to Mineral Point Br at Survey Rd	06/03/2013	10/06/2015
931300	Unnamed	10043686	Unnamed Trib (931300) to Mineral Point Br at Survey Rd	05/28/2015	10/06/2015
931200	Unnamed	10042383	Unnamed Trib (931200) to Mineral Point Br at Survey Rd	05/28/2015	10/06/2015
5037481	Unnamed	10043687	Unnamed Trib (5037481) to Sudan Br upstrm of confl. with Sudan Br	05/29/2015	10/06/2015
929700	Peddler Creek	253023	Linden Branch (Pedler Cr) at Sth 39	06/03/2015	10/06/2015
NA	null	253024	Linden Branch Pecatonica R - Linden Stp	06/03/2015	10/06/2015
929000	Sudan Br	10011620	Sudan Br at Roaster Rd	07/14/2015	10/06/2015
927900	Mineral Point Br	10043802	Mineral Point Branch at Mill Creek Road	07/14/2015	10/06/2015
927900	Mineral Point Br	10042651	Mineral Point Br start of State Property off West Bennett Rd	08/21/2015	08/21/2015
927900	Mineral Point Br	10043978	Mineral Point Br - 20 m upstrm of confl. with Pecatonica R	08/21/2015	08/21/2015
929000	Sudan Br	10011836	Sudan Br - 50 Meters Upstream Lost Grove Rd	10/19/2004	08/04/2015
929000	Sudan Br	10043917	Sudan Branch - Farm lane (bridge) off Cave Rd	08/03/2015	08/03/2015
927900	Mineral Point Br	10028848	Mineral Point Branch At Oak Park Rd (Near County Line)	07/23/2008	07/31/2015
927900	Mineral Point Br	10043906	Mineral Point Branch - STH 39	07/30/2015	07/30/2015
929000	Sudan Br	10042381	Sudan Branch at Whitson Road	06/03/2015	07/09/2015
928200	Rock Br	10016288	Rock Br - 20 M Downstream From 1st Fenceline	11/15/2000	07/09/2015
3000077	Laxey Creek	10015967	Laxey Creek (formerly Pedler Cr) - Ups. Sth 39	10/22/1986	06/17/2015
928200	Rock Br	10016429	Rock Br - End Of Station 1 (STH 23)	11/15/2000	06/04/2015
5039109	Unnamed	10040035	Unnamed Trib (5039109) to Mineral Point Br at Tibbits Rd	05/29/2013	10/02/2013
930700	Ludden Lake	10020047	Ludden Lake -- Access	05/10/2005	09/30/2013
5576365, 929900	Unnamed, Unnamed	10037408	Unnamed Tributary (WBIC = 929900) to Peddler Creek at CTH Q	05/30/2012	09/25/2012
3000077	Laxey Creek	10032227	Downstream 10ft from Bloomfield Healthcare & Rehabiliatation Center WWTP outfall	12/02/2010	12/02/2010
3000077	Laxey Creek	10032226	Upstream 15ft from Bloomfield Healthcare & Rehabilitation Center WWTP outfall	12/02/2010	12/02/2010

WBIC	Waterbody Name	Station ID	Station Name	Earliest Fieldwork Date	Latest Fieldwork Date
928200	Rock Br	10008039	Rock Branch Station 1-Suthers Rd	11/15/2000	10/29/2009
889100	Pecatonica River	333085	Pecatonica River West Branch - Cth O	10/21/1980	10/29/2008
929200	Unnamed	10020844	Unnamed Tributary To Sudan Branch At Lost Grove Road	05/24/2007	10/25/2007
927900	Mineral Point Br	10011862	Mineral Point Br - 50m Below Hwy 39 Bridge	10/19/2004	10/19/2004
927900	Mineral Point Br	10011864	Mineral Point Br - N Oak Park Road Bridge	10/19/2004	10/19/2004
927900	Mineral Point Br	253175	Mineral Point Branch - Mineral Point Branch	05/23/2001	06/30/2003
927900	Mineral Point Br	253184	Mineral Point Branch - Mineral Point Branch	06/30/2003	06/30/2003
928600	Brewery Creek	10041069	Brewery Creek above Jackson St at Bicycle Bridge	06/20/1995	12/05/2000
928600	Brewery Creek	253040	Brewery Creek at Ferndale Road	04/07/1992	12/05/2000
928600	Brewery Creek	253069	Ivey Const Co Graysville Mine	11/15/2000	11/15/2000
928000	Furnace Creek	10008016	Furnace Creek Station 1	11/15/2000	11/15/2000
928200	Rock Br	253041	Rock Branch at Cth Dd	04/05/2000	11/06/2000

Bobolink on Fence, Mineral Point Creek, Photo by James Amrhein. Wisconsin DNR.

Appendix E: Watershed Report: Mineral Point and Sudan Branches [i]

WBIC	Waterbody Name	Start Mile	End Mile	Current Use	Attainable Use	Supporting Attainable Use	Designated Use	Impairments	Sources	Assessment	Impaired Water Status
928600	Brewery Creek	0	3.32	FAL	FAL	Not Supporting	LAL	Chronic Aquatic Toxicity	Industrial Discharge, Non-Point Source	Monitored	EAP Project
5038438	Brewery Creek	0	0.68	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
928600	Brewery Creek	3.32	6.17	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
928000	Furnace Creek	0	2	FAL	WWSF	Not Assessed	Default FAL	NA	NA	No Assessment on File	NA
928000	Furnace Creek	2	5	FAL	LAL	Not Assessed	Default FAL	NA	NA	No Assessment on File	NA
3000077	Laxey Creek	0	0.7	FAL	FAL	Not Assessed	Default FAL	NA	NA	No Assessment on File	NA
3000077	Laxey Creek	0.7	10	FAL	WWSF	Fully Supporting	Default FAL	NA	NA	Monitored	NA
930700	Ludden Lake	0	56.28	Reservoir	FAL	Supporting	Default FAL	NA	NA	Monitored	NA
927900	Mineral Point Branch	0	29	FAL	WWSF	Not Supporting	Default FAL	Impairment Unknown	Non-Point Source	Monitored	303d Listed
889100	Pecatonica River	0	102	FAL	FAL	Not Supporting	Default FAL	Impairment Unknown	Non-Point Source	Monitored	303d Listed
929700	Peddler Creek	0	4	FAL	WWSF	Not Assessed	Default FAL	NA	NA	No Assessment on File	NA
928200	Rock Branch	0	2.96	Cold (Class II Trout)	Cold (Class II Trout)	Fully Supporting	Cold	NA	NA	Monitored	NA
928200	Rock Branch	2.95	4.23	Cold (Class II Trout)	Cold (Class II Trout)	Not Assessed	Cold	NA	NA	No Assessment	NA

WBIC	Waterbody Name	Start Mile	End Mile	Current Use	Attainable Use	Supporting Attainable Use	Designated Use	Impairments	Sources	Assessment	Impaired Water Status
929000	Sudan Branch	0	12.78	FAL	WWSF	Not Assessed	Default FAL	NA	NA	No Assessment	NA
929000	Sudan Branch	12.78	17.66	Cold (Class II Trout)	Cold (Class II Trout)	Not Assessed	Cold	NA	NA	No Assessment	NA
928700	Trib To Brewery Creek	0	2.25	FAL	FAL	Not Supporting	LAL	Acute Aquatic Toxicity	Industrial DischargeNon-Point Source	Evaluated: Older Data	303d Listed
928500	Trib to Rock Br	0	4.42	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
929400	Trib to Sudan Br	0	3.42	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
929800	UnTrib to Laxey Creek (Pedler Creek)	0	3.67	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
5039109	UnTrib to Mineral Point Br	0	1.68	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA
931000	UnTrib to Mineral Point Br Survey Rd	0	3.92	FAL	FAL	Supporting	Default FAL	NA	NA	Monitored	NA
929900	Un Trib to Peddler Creek	0	4.53	FAL	FAL	Supporting	Default FAL	NA	NA	Monitored	NA
5037481	UnTrib Sudan Br	0	0.42	FAL	FAL	Not Assessed	Default FAL	NA	NA	Not Assessed	NA

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

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