Ho-Chunk Nation

Clean Water Act Section 106 Program
Assistance Agreement I-05E00738

Combined Two Year
Water Quality Assessment Report

Monitoring Period January 1, 2018-December 31, 2019

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1. Program Background

The Ho-Chunk Nation (Nation) is unique from most other Native American tribes in that it does not have one large contiguous reservation. In turn, the Ho-Chunk Nation Division of Environmental Health (DEH) surface water program focuses on the Territory of the Ho-Chunk Nation. The Ho-Chunk Nation Territory is comprised of 14,904 acres with 4,713 acres held in fee-simple by the Nation and the remaining 10,191 acres held in Trust by the United States for the benefit of the Nation or the People (individual trust allotments). The Territory is located in 23 counties of Wisconsin, Minnesota and Illinois. Current tribal enrollment is 7,854 with approximately 70% of members living in Wisconsin.

Tribal members utilize water resources for everyday needs including recreation, cultural practices and as a source of food. The Ho-Chunk Nation continually works to preserve the culture of their people and is therefore dedicated to protecting and improving the quantity and quality of water resources within the Territory. Program activities under the 106 Program are limited to the water resources that are directly associated with Trust land or influence the quality and quantity of the water resources associated with those lands. Table 1 is a water atlas summarizing these resources.

Table 1 Atlas Table of Ho-Chunk Nation Trust Water Resources	
Total Number of Stream Miles	19.0
Total Number of Lake/Pond Acres	20.1
Total Number of Wetland Acres	1,104

The Nation is in the process of transitioning multiple fee-simple parcels into Trust status under the Bureau of Indian Affairs fee-to-trust process. The tribe does not incorporate these parcels into 106 program activities until such time as these parcels are accepted in Trust by the Secretary of the Interior on behalf of the Ho-Chunk Nation. The Nation then proceeds with updating the 106 program eligibility documents accordingly.

The DEH has been managing the EPA CWA Section 106 Program since the Nation first became eligible for funding in FY06. The DEH has successfully managed the program through seven two-year grant periods and is currently administering the first year of assistance agreement I-05E00738 which covers program activities for calendar year 2020.

2. Purpose of Monitoring Program

The Nation has become increasingly concerned with surface water quality in recent years due to the increase in row crop agriculture, cranberry cultivation, sand mining, large-scale pipeline and utility projects and overall shifts to more intensive land-uses within the watersheds containing tribal lands and waters.

Currently, the Nation lacks the necessary data to establish a baseline of surface water quality from which to measure changes in future water quality. Based on the lack of chemical, habitat and biological information pertaining to tribal water resources the following monitoring program objectives and goals have been identified:

- Establish a baseline of chemical water quality for the surface waters on selected tribal lands.
- Determine biological community composition by surveying fish and sampling macroinvertebrates.
- Complete habitat assessments and begin to develop relationships with observed biological communities and chemical water quality data.
- Determine extent to which surface water quality is changing over time.
- Identify problem areas with poor surface water quality and/or the potential to degrade surface water quality.
- Identify areas that need protection and what that level of protection would be.
- Determine wetland location by reviewing available data and conducting site visits.
- Establish a baseline of floristic quality to measure changes in wetland quality.
- Determine wetland functional value.

3. Monitoring Framework

The Ho-Chunk Nation monitoring program includes program activities in the areas of baseline water quality monitoring and inventory and assessment of wetland resources. In addition, synoptic studies are incorporated into monitoring when needed and as budget and staffing allow.

Baseline Water Quality Monitoring

Monitoring includes field measurement and laboratory analysis of chemical water quality parameters, stream habitat assessments and biological monitoring. Funding was used to monitor nine fixed stations on a quarterly basis during the 2018-2019 monitoring period. In addition, (2) Rotating Year 2 stations and (6) Rotating Year 3 stations were monitored in 2018 along with (6) Rotating Year 4 stations in 2019.

Inventory and Assessment of Wetland Resources

Monitoring program activities related to wetland inventory and assessment includes determining wetland location by reviewing available information such as the county soil survey, Wisconsin Wetland Inventory and aerial photographs. Field visits are then conducted to document wetland indicators so that an accurate wetland boundary can be flagged and mapped. Wetlands are then classified using the *Classification of Wetlands and Deepwater Habitats of the United States* (U.S. Fish and Wildlife Service, 1979), commonly referred to as the Cowardin classification system. Wetlands are also classified using the Eggers and Reed classification, *Wetland Plants and Plant Communities of Minnesota and Wisconsin, Version 3.2 July 2015.*

Wetland assessments may also be performed using several methods including the*: Floristic Quality Assessment Methodology for Wisconsin, WDNR Wetland Rapid Assessment Methodology-User Guidance Document Version 2.0* for evaluating wetland functional values and metrics from the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands, 1989.*

4. Monitoring Locations

Table 2 identifies the monitoring locations for the period of January 1, 2018-December 31, 2019.

Table 2 Monitoring Locations				
Station ID	**Station Name**	**Station Type**	**Latitude**	**Longitude**
310700HCN02	Middle Branch Embarrass R.	Fixed	44.8513	89.1622
1182400HCN03	Kickapoo R. (Bridge 8)	Fixed	43.6652	90.5861
1182400HCN04	Kickapoo R. (Bridge 14)	Fixed	43.6224	90.6289
1195400HCN01	Indian Creek	Fixed	43.6324	90.6142
1196900HCN01	Billings Creek	Fixed	43.6771	90.5840
1198200HCN01	unnamed (Hay Valley)	Fixed	43.6786	90.6064
1714200HCN01	Morrison Creek	Fixed	44.3539	90.7641
1714300HCN01	Dickey Creek	Fixed	44.3536	90.7614
1715800HCN01	Valentine Creek	Fixed	44.3541	90.7540
1654900HCN01	unnamed creek (Wo gis na pi)	Rotating Yr 2	43.8825	90.9115
allot1045HCN01	unnamed creek (Blackhawk)	Rotating Yr 2	43.7466	91.2872
1326700HCN01	Mill Creek	Rotating Yr 3	44.0520	90.4441
1326700HCN02	Mill Creek (Miers/Anderson)	Rotating Yr 3	44.0403	90.4178
1327200HCN01	unnamed (Mill Creek trib.)	Rotating Yr 3	44.0610	90.4903
5025163HCN01	unnamed (Smoke)	Rotating Yr 3	44.0060	90.3800
5024814HCN01	unnamed (Greendeer)	Rotating Yr 3	44.0240	90.4002
5024918HCN01	unnamed (Shaw)	Rotating Yr 3	44.0197	90.3928
1304900HCN01	unnamed (M. Decorah)	Rotating Yr 4	43.8440	90.0694
1360800HCN01	Elm Creek	Rotating Yr 4	44.4121	89.9552
1366300HCN01	Hemlock Creek	Rotating Yr 4	44.4191	90.0412
5026569HCN01	unnamed (A. Decorah)	Rotating Yr 4	43.8635	90.0711
1351400HCN01	Bingham Creek	Rotating Yr 4	44.0371	89.7227
1367000HCN01	unnamed (Manly)	Rotating Yr 4	44.4110	90.0439
1259400HCN01	unnamed (Pine Glen)	Rotating Yr 4	43.3936	89.7560
Wetland Sites	**Parcel Name**	**Acres**	**Latitude**	**Longitude**
	Sacred Earth (Badger)	80.0	43.3821	89.7648
	Decorah, W.	40.0	43.8599	90.4031
	Mooney	20.0	43.8648	90.0577
	Decorah, A.	10.0	43.8636	90.0684
	Decorah, M.	7.5	43.8456	90.0689
	Decorah, N.	7.5	43.7821	90.0626
	Boss Thunder	7.5	43.8598	90.0351
	Whitegull	2.52	44.0289	90.4072
	Deer, P.	4.96	44.0273	90.4051
	Deer, Haas	5.03	44.0282	90.4034
	Deer, C.	4.98	44.0263	90.4068
	Deer, D.	5.18	44.0274	90.4056
	Bernhardt	10.10	44.0501	90.4442
	Deer, M.	7.58	44.0276	90.4068
	Deer, M.	10.08	44.0266	90.4038
	Greendeer	40.36	44.0235	90.4002
	Shaw	102.20	44.0200	90.3973
	Johnson	2.97	44.0621	90.4911

5. Monitoring and Assessment Parameters

Baseline Chemical Water Quality Monitoring

Different types of water quality data have been collected and included in this assessment. For the purpose of this assessment, baseline chemical water quality data is in tabular format for field and

laboratory parameters. Table 3 is a complete list of all field and lab parameters that were monitored during the assessment period. This section is followed by a brief description of several of the core parameters included in this assessment.

Table 3 Field and Lab Parameters

Matrix	Parameter	Comments
Water	Temperature	Field Measurement
Air	Temperature	Field Measurement
Water	pH	Field Measurement
Water	Dissolved Oxygen	Field Measurement
Water	Specific Conductance	Field Measurement
Water	Salinity	Field Measurement
Water	Turbidity	Field Measurement
Water	Discharge	Field Measurement
Water	Chloride	Sample analyzed by contracted laboratory
Water	Nitrite + Nitrate-nitrogen	Sample analyzed by contracted laboratory
Water	Ammonia-nitrogen	Sample analyzed by contracted laboratory
Water	Kjeldahl nitrogen	Sample analyzed by contracted laboratory
Water	Soluble reactive phosphorus	Sample analyzed by contracted laboratory
Water	Phosphorus (total)	Sample analyzed by contracted laboratory
Water	Sulfate	Sample analyzed by contracted laboratory
Water	Alkalinity (total)	Sample analyzed by contracted laboratory
Water	Total Suspended Solids	Sample analyzed by contracted laboratory
Water	Chlorophyll a,b,c	Sample analyzed by contracted laboratory
Water	Total Coliform	Sample analyzed by DEH
Water	*E.coli*	Sample analyzed by DEH

Temperature

Temperature governs the type of aquatic life that can exist in a stream. Fish and other aquatic organisms have specific temperature range requirements for survival and various life cycle functions. Temperature also affects water chemistry such as the rate of chemical reactions. Certain compounds are more toxic to aquatic life at higher temperature. The saturation content of a constituent in water is also affected by temperature. For example, oxygen is dissolved more readily in cold water than warm water. The thresholds identified in this document are based on the stream temperature classifications of cold-water, warm-water sport fishery, warm-water forage fishery and warm-water limited aquatic life.

Dissolved Oxygen

Oxygen is required for respiration in fish and other aquatic organisms. The microscopic bubbles of oxygen gas in water are called dissolved oxygen (DO). Fish and other organisms require different amounts of oxygen to survive and thrive minimum. In addition, oxygen is also used for the decomposition of organic matter and other biological processes. Therefore, degraded oxygen levels also indicate contamination when high levels of organic matter, such as manure, are present.

pH

The pH is a measurement of the concentration of hydrogen ions. The pH scale is logarithmic and ranges from 0 to 14 with 0 being the most acidic and 14 the most basic. The pH of most natural

waters ranges between 6.5- 8.5. However, in the Black River Falls and Dells Dam area the natural waters can sometimes have a pH less than 6.0. The pH of water determines the solubility (amount that can be dissolved in the water) and biological availability (amount that can be utilized by aquatic life) of chemical constituents such as nutrients (e.g., phosphorus, nitrogen, and carbon) and heavy metals (e.g., lead, cadmium, copper). For example, in addition to determining how much and what form of phosphorus is most abundant in the water, pH also determines whether aquatic life can use it. Heavy metals tend to be more toxic at lower pH because they are more soluble and more bioavailable. The impairment threshold for pH is a value outside the range of 6.0 to 9.0 or if the change is greater than 0.5 units outside the natural seasonal maximum and minimum.

Turbidity

Turbidity is a measurement of the water clarity. Turbidity is caused by sediment entering the water column and in some cases is caused but excessive nutrients causing algal growth. The threshold for turbidity is based on the EPA reference criteria identified in the document titled: *Ambient Water Quality Criteria Recommendations Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion VII. 2000. US Environmental Protection Agency*. The values listed are specific to the appropriate sub-ecoregion identified in the document.

Specific Conductance

Specific conductance is a measure of the drop in voltage caused by the resistance of the water. Each stream tends to have a relatively constant range of conductivity. Significant changes in conductivity can be an indicator that a discharge or some other source of pollution has entered a stream.

Nutrients

Nutrients are essential for growth. Streams often contain excessive levels of nutrients, which results in additional algae and other plant growth. The main nutrients of concern are phosphorus and nitrogen, and both elements can be found in several forms. Phosphorus can be measured as total phosphorus (TP) or soluble reactive phosphorus (SRP). SRP typically represents the bioavailable form of phosphorus. SRP is also called orthophosphate. Nitrogen can be measured as total nitrogen (TN), Kjeldahl nitrogen (TKN), nitrate+nitrite and ammonia nitrogen. TKN represents the fraction of TN that is unavailable for growth or bound up in organic form, it also includes ammonium. The remaining fractions, nitrate-nitrite and ammonia represent bioavailable forms of nitrogen. Phosphorus and nitrogen in excess amounts can accelerate eutrophication, causing dramatic increases in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations. The threshold values listed for nutrients are based on the EPA reference criteria identified in the document titled: *Ambient Water Quality Criteria Recommendations Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Nutrient Ecoregion VII. 2000. US Environmental Protection Agency*. The values listed are specific to the appropriate sub-ecoregion identified in the

document. In addition, the State of Wisconsin has passed a phosphorus rule that established a value of 0.075 mg/L of total phosphorus for most streams.

Bacteriological

Coliform bacteria are a commonly used indicator of the sanitary quality of foods and water. Coliforms are abundant in the feces of warm-blooded animals, but are also found in the aquatic environment, soil and on vegetation. While coliforms are themselves not normally causes of serious illness, they are easy to culture and their presence is used to indicate that other pathogenic organisms of fecal origin may be present. *E. coli* bacteria have been commonly found in recreational waters and their presence is used to indicate the presence of recent fecal contamination, but *E. coli* presence may not be indicative of human waste. *E. coli* are harbored in all warm-blooded animals, birds and mammals alike. *E. coli* bacteria have also been found in fish and turtles.

The Nation analyzes bacteriological surface water samples using the IDEXX Colilert Quanti-tray enumeration method. Traditional membrane filtration tests for bacterial water quality generally count colonies of bacteria and report the value as colony forming units (CFU). The newer defined substrate tests, such as Colilert, report values as a most probable number (MPN). MPN is a statistical representation of what level of Total Coliforms or *E.coli* are likely present in a sample. For the purpose of this assessment, the terms CFU and MPN are used interchangeably. Threshold values for Total coliforms are based on NR102.04(6) that states: *As bacteriological guidelines, the membrane filter fecal coliform count may not exceed 200 colonies per 100 ml as a geometric mean and may not exceed 400 colonies per 100 ml in more than 10% of all samples during any month. Samples shall be required at least 5 times per month.* It should be noted that comparison of sample results to these threshold values is limited because of the small number of samples the Nation collects at any given sampling station. The percent exceedance listed in the table for each station is the comparison of sample results to the 400 colonies per 100mL threshold.

<u>Biological Monitoring</u>

In the past, chemical criteria and related monitoring have been the traditional mechanism employed by agencies responsible for protecting aquatic life and assessing the condition of surface waters. Significant improvements in water quality have been made in the last several decades utilizing this approach.

However, human actions impact a wider range of water resource attributes than water chemistry alone can measure. The degradation of surface waters can be attributed to a multitude of sources including: chemical pollutants from municipal and industrial point source discharges; agricultural runoff of pesticides, nutrients, and sediment; hydrologic alteration from stream channelization, dams, and artificial drainage; and habitat alteration from agricultural, urban, and residential development.

Biological communities are subjected to the cumulative effects of all activities and are continually integrating environmental conditions over time. They represent the condition of their aquatic environment.

Biological monitoring is often able to detect water quality impairments that other methods may miss or underestimate. It provides an effective tool for assessing water resource quality regardless of whether the impact is chemical, physical, or biological in nature. To ensure the integrity of surface waters, we must understand the relationship between human induced disturbances and their effect on aquatic resources.

Macroinvertebrates

Macroinvertebrate surveys are conducted closely following the *Guidelines for Collecting Macroinvertebrate Samples from Wadable Streams*, published by the Wisconsin Department of Natural Resources (Wisconsin Department of Natural Resources, 2000). Data collection activities associated with macroinvertebrate sampling are outlined under the approved QAPP titled*: Quality Assurance Project Plan Habitat Assessment and Biological Monitoring of Surface Waters,* Ho-Chunk Nation Clean Water Act Section 106 Grant# I-E0073801-1, dated March 7, 2011.

Macroinvertebrates (inverts) are organisms that are large (macro) enough to be seen with the naked eye and lack a backbone. They inhabit all types of waters, from fast flowing streams to ponds with standing water. Aquatic macroinvertebrates are good indicators of stream quality because they are affected by the physical, chemical, and biological conditions of the stream. Inverts can't escape pollution and show the effects of short and long term pollution that other traditional water chemistry assessments may fail to detect.

Some of the common macroinvertebrate metrics are provided below. In many cases there are no strict rules available to assign qualitative designations to a sample metric. That is, it is difficult to say one value is "bad" while another is "good". Judgements under such circumstances remain subjective and open to debate. Nevertheless, the metric may be valuable in making *relative* comparisons of water resource quality among streams (or among stations within streams) *or* in identifying possible pollution sources (Lillie, 2003).

The Hilsenhoff Biotic Index (HBI) and Family Level Biotic Index (FBI) represent the average weighted pollution tolerance value of all arthropods present in a sample (excluding organisms either too immature or damaged to allow for correct identification and organisms which have not been assigned a pollution tolerance value). The HBI is a well-tested metric that has been incorporated into national protocols for rapid bioassessment (Plafkin, 1989). For HBI determinations, identification is carried to the lowest possible taxonomic level necessary to assign a pollution tolerance value. In many cases this means that identification at the genus level is sufficient to assign tolerance values. All FBI determinations are made at the family level. The relation of HBI values to water quality is presented in the table below. Also, the metric HBI Max-10 is the HBI index allowing a maximum of 10 of each species to be counted.

Water Quality Ratings for HBI Values taken from (Hilsenhoff, 1987)

HBI Value	**Water Quality Rating**	**Degree of Organic Pollution**
≤ 3.50	Excellent	None Apparent
3.51-4.50	Very Good	Possible Slight
4.51-5.50	Good	Some
5.51-6.50	Fair	Fairly Significant

6.51-7.50	Fairly Poor	Significant
7.51-8.50	Poor	Very Significant
8.51-10.00	Very Poor	Severe

It is extremely important to emphasize that the HBI and FBI are indices of *organic* pollution and are based on a community's response to the combination of high organic loading and decreased dissolved oxygen levels. The HBI or the FBI was not intended for use outside the purpose of detecting or monitoring organic pollution. It should also be noted that the FBI was designed as a rapid field assessment tool and can be less precise than the HBI. Generally the FBI underestimates the severity of pollution in highly polluted streams and overestimates the degree of impact in clean streams (Hilsenhoff, 1988a). The water quality index for the FBI is provided below.

Water Quality Ratings for FBI Values taken from (Hilsenhoff, 1988a)

FBI Value	Water Quality Rating	Degree of Organic Pollution
≤ 3.75	Excellent	Organic pollution unlikely
3.76-4.25	Very Good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly Poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.0	Very Poor	Severe organic pollution likely

Index of Biotic Integrity (IBI)

IBI Value	Management Recommended	Condition Gradient
7.5-10.0	Consider Outstanding and Exceptional Listing	Excellent
5.0-7.4	Maintain Condition	Good
2.6-4.9	Restoration	Fair
0-2.6	Consider Impairment Listing	Poor

Richness measures represent the number of distinctly different taxa found in a sample. A richness value does not represent the total number of taxa at a site, but rather it is a relative measure or index. Often it is only necessary to process a small fraction of a sample to compute an HBI value. The remainder of the sample is not included in the calculations and any information regarding additional taxa present at the site is lost. This is not intended to be a criticism of the HBI but is reflective of the established laboratory procedures and the need to keep processing costs down. The loss of information is an unfortunate by-product of the established fixed count laboratory procedure. This has significant ramifications with respect to calculations and the use of other metrics derived from the sample. Consequently, the data derived from the HBI subsamples represent relative measures per total number of specimens examined.

Although high taxa richness is generally associated with good water quality, low taxa richness does not necessarily indicate poor water quality, nor does high richness always indicate good water quality. Some habitats such as small cold headwater streams or mineral poor waters may naturally have low numbers of taxa density per unit area.

Fish and Habitat

Fish community and habitat information is collected at stream monitoring sites for the purpose of assessing water quality and classifying streams based on an Index of Biotic Integrity (IBI). Stations are established during the April quarterly water quality sampling event where sampling reaches are measured and marked off for future monitoring. Fish are typically sampled in July and August using electrofishing methods. All fish are collected, regardless of size, identified and returned to the stream after appropriate measurements are collected.

The Ho-Chunk Nation 106 Program uses an ETS backpack electrofishing unit and an ETS tote barge unit depending on the stream size, accessibility and site conditions. Fish surveys are conducted closely following the *Guidelines for Assessing Fish Communities of Wadable Streams in Wisconsin*, published by the Wisconsin Department of Natural Resources (2001). Stream habitat assessments are conducted closely following the *Guidelines for Evaluating Habitat of Wadable Streams*, published by the Wisconsin Department of Natural Resources (2002). Data collection activities associated with fish and habitat surveys are outlined in the approved QAPP titled*: Quality Assurance Project Plan Habitat Assessment and Biological Monitoring of Surface Waters,* Ho-Chunk Nation Clean Water Act Section 106 Grant# I-E0073801-1, dated March 7, 2011.

The Index of Biotic Integrity (IBI) is used to classify each of the streams. The exact method used will be dependent on the maximum daily mean temperatures measured with the temperature data loggers placed in the stream. The streams will either be classified as warm-water or cold-water. Warm-water streams have a maximum daily mean temperature greater than 24°C and cold-water streams have a maximum daily mean temperature less than 22°C. If the maximum daily temperature is between 22°C and 24°C, the stream is considered to be cool-water. An index has not been established for cool-water streams, so the cold-water IBI is applied to these streams. The maximum IBI score for both cold-water and warm-water streams is 100, indicating excellent biotic integrity, and the minimum score is 0, indicating very poor biotic integrity. Tables 4 and 5 provide the rating and interpretation of IBI scores for warm-water and cold-water streams.

Table 4 Guidelines for interpreting cold-water biotic integrity index (IBI) scores, modified from (Karr, 1986) and (Lyons, 1992a)

Fish IBI Score	Integrity Rating	Interpretation and fish community attributes
100-90	Excellent	Comparable to the best situations with the least human disturbance: mottled or slimy sculpins are usually common; intolerant, native stenothermal cool-water species such as lampreys or redside dace may also be present; brook trout are the primary top carnivores and are present in good numbers; exotic salmonids are absent or uncommon; tolerant species may be present in low to moderate numbers.
80-60	Good	Evidence for some environmental degradation and reduction in biotic integrity: either brook trout or sculpins may be uncommon or absent; exotic salmonids often dominate, keeping the abundance of top carnivores high; tolerant species may be common but do not dominate.
50-30	Fair	The stream reach has experienced moderate environmental degradation, and biotic integrity has been significantly reduced: total species richness is often relatively high, but intolerant and native stenothermal cold-water .species are uncommon or absent, native stenothermal cool-water species and exotic salmonids may be moderately common, but

		tolerant eurythermal species or warm-water species or both are usually more abundant.
20-10	Poor	Major environmental degradation has occurred, and biotic integrity has been severely reduced: total species richness may be relatively high, but intolerant species, top carnivores, and salmonids are absent: a few native stenothermal cool-water species such as brassy minnows or brook sticklebacks may persist in low numbers; tolerant eurythermal species or warm-water species or both dominate.
0 or no score	Very Poor	Human disturbance and environmental degradation have decimated the natural cold-water fish assemblage of the reach: either only warm-water and tolerant species remain, or fish abundance is so low (<25 individuals captured) that the IBI cannot be calculated.

Table 5 Guidelines for interpreting warm-water biotic integrity index (IBI) scores, modified from (Karr, 1986)

Fish IBI Score	Integrity Rating	Interpretation and fish community attributes
100-65	Excellent	Comparable to the best situations with minimal human disturbance; all regionally expected species for habitat and stream size, including the most intolerant forms, are present with a full array of age and size classes; balanced trophic structure.
64-50	Good	Species richness somewhat below expectation, especially due to the loss of the most intolerant forms; some species, especially top carnivores, are present with less than optimal abundances or size/age distributions; trophic structure shows some signs of imbalance.
49-30	Fair	Signs of additional deterioration include decreased species richness, loss of intolerant forms, reduction in simple lithophils, increased abundance of tolerant species, and/or highly skewed trophic structure (e.g., increasing frequency of omnivores and decreased frequency of more specialized feeders); older age classes of top carnivores rare or absent.
29-20	Poor	Relatively few species; dominated by omnivores, tolerant forms, and habitat generalists; few or no top carnivores or simple lithophilous spawners; growth rates and condition factors sometimes depressed; hybrids sometimes common.
19-0	Very Poor	Very few species present, mostly exotics or tolerant forms or hybrids; few large or old fish; DELT fish (fish with deformities, eroded fins, lesions, or tumors) sometimes common.
No Score	Very Poor	Thorough sampling finds few or no fish; impossible to calculate IBI. <50 individuals captured

6. Monitoring Schedule

Table 6 provides a summary of the monitoring schedule including dates, frequency and monitoring activity performed.

Table 6 Sampling Schedule				
Station ID	**Station Name (type)**	**Monitoring Dates**	**Frequency**	**Monitoring Activity**
310700HCN02	Middle Branch Embarrass R.	1/24/18, 4/18/18, 7/21/18, 10/8/18 1/14/19, 4/2/19, 7/22/19, 10/7/19 6/26/19 9/9/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1182400HCN03	Kickapoo R.(Bridge 8)	1/24/18, 4/18/18, 7/21/18, 10/10/18, 1/15/19, 4/17/19, 7/24/19, 10/28/19 7/18/18 5/14/18	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1182400HCN04	Kickapoo R.(Bridge 14)	1/24/18, 4/18/18, 7/21/18, 10/10/18, 1/15/19, 4/17/19, 7/24/19,10/28/19 7/18/18 5/14/18	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1195400HCN01	Indian Creek	1/24/18, 4/18/18, 7/21/18, 10/10/18, 1/15/19, 4/17/19, 7/24/19, 10/28/19 8/15/18 5/24/18	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1196900HCN01	Billings Creek	1/24/18, 4/18/18, 7/21/18, 10/10/18, 1/15/19, 4/17/19, 7/24/19, 10/28/19 8/16/18 5/24/18	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1198200HCN01	unnamed (Hay Valley)	1/24/18, 4/18/18, 7/21/18, 10/10/18, 1/15/19, 4/17/19, 7/24/19, 10/28/19 8/15/18 5/24/18	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1714200HCN01	Morrison Creek	1/24/18, 4/18/18, 7/21/18, 10/8/18 1/14/19, 4/2/19, 7/23/19, 10/7/19 10/17/19 9/10/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing visit, No survey Invert Sampling
1714300HCN01	Dickey Creek	1/24/18, 4/18/18, 7/21/18, 10/8/18 1/14/19, 4/2/19, 7/23/19, 10/7/19 10/17/19 9/10/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing visit, No survey Invert Sampling
1715800HCN01	Valentine Creek	1/24/18, 4/18/18, 7/21/18, 10/8/18 1/14/19, 4/2/19, 7/23/19, 10/7/19 10/17/19 9/9/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1654900HCN01	unnamed (Wo gis na pi)	1/8/18	Quarterly	Water Quality Monitoring
allot1045HCN01	unnamed (Blackhawk)	1/8/18	Quarterly	Water Quality Monitoring
1326700HCN01	Mill Creek	1/9/18, 4/23/18, 7/23/18, 10/9/18 8/15/18 5/22/18	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1326700HCN02	Mill Creek (Miers/Anderson)	1/9/18, 4/23/18, 7/23/18, 10/9/18 8/15/18 5/22/18	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1327200HCN01	unnamed (Mill Crk trib.)	1/9/18, 4/23/18, 7/23/18, 10/9/18 8/15/18 5/22/18	Quarterly Single Visit Single Visit	Water Quality Monitoring No Sample 1/9/18 (channel frozen) E-fishing Survey Invert Sampling
5025163HCN01	unnamed (Smoke)	1/9/18, 4/23/18, 7/23/18, 10/9/18 8/15/18 5/22/18	Quarterly Single Visit Single Visit	Water Quality Monitoring No Sample 1/9/18 (channel dry) No Sample 7/23/18 (channel dry) E-fishing Survey (channel dry) Invert Sampling
5024814HCN01	unnamed (Greendeer)	1/9/18, 4/23/18, 7/23/18, 10/9/18	Quarterly	Water Quality Monitoring No Sample 1/9/18 (channel frozen) No Sample 7/23/18 (channel dry) No Sample 10/9/18 (area inundated)

		8/15/18 5/24/18	Single Visit Single Visit	E-fishing Survey (channel dry) Invert Sampling
5024918HCN01	unnamed (Shaw)	1/9/18, 4/23/18, 7/23/18, 10/9/18 8/15/18 5/24/18	Quarterly Single Visit Single Visit	Water Quality Monitoring No Samples or measurements (channel dry during all visits) E-fishing Survey (channel dry) Invert Sampling (channel dry)
1304900HCN01	unnamed (M. Decorah)	1/16/19, 4/1/19, 7/23/19, 10/8/19 9/23/19 9/12/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1360800HCN01	Elm Creek	1/14/19, 4/2/19, 7/22/19, 10/7/19 10/17/19 9/5/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1366300HCN01	Hemlock Creek	1/14/19, 4/2/19, 7/22/19, 10/7/19 6/27/19 9/5/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-Fishing Survey Invert Sampling
5026569HCN01	unnamed (A. Decorah)	1/16/19, 4/1/19, 7/23/19, 10/8/19 9/23/19 9/12/19	Quarterly Single Visit Single Visit	Water Quality Monitoring No Sample 1/16/19 (channel frozen) No Sample 7/23/19 (unavailable water) No Sample 10/8/19 (unavailable water) E-fishing Survey (unavailable water) Invert Sampling (unavailable water)
1351400HCN01	Bingham Creek	1/16/19, 4/1/19, 7/23/19, 10/8/19 9/25/19 9/4/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1367000HCN01	unnamed (Manly creek)	1/14/19, 4/2/19, 7/22/19, 10/7/19 9/25/19 9/5/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1259400HCN01	unnamed (Pine Glen creek)	1/16/19, 4/1/19, 7/23/19, 10/8/19 9/23/19 9/12/19	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
Wetland Sites	**Parcel Name**	**Monitoring Dates**		**Monitoring Activity**
	Sacred Earth (Badger)	9/12/18, 9/26/18		Delineate, Classify, Map
	Decorah, W.	9/11/18-9/12/18		Delineate, Classify, Map
	Mooney	9/10/18-9/11/18		Delineate, Classify, Map
	Decorah, A.	9/10/18		Delineate, Classify, Map
	Decorah, M.	9/12/18		Delineate, Classify, Map
	Decorah, N.	9/11/18		Delineate, Classify, Map
	Boss Thunder	9/11/18		Delineate, Classify, Map
	Whitegull	7/23/19-7/24/19		Determination Completed
	Deer, P.	7/23/19-7/24/19		Delineate, Classify, Map
	Deer, Haas	7/23/19-7/24/19		Delineate, Classify, Map
	Deer, C.	7/23/19-7/24/19		Delineate, Classify, Map
	Deer, D.	7/23/19-7/24/19		Delineate, Classify, Map
	Bernhardt	7/23/19-7/24/19		Delineate, Classify, Map
	Deer, M.	7/23/19-7/24/19		Delineate, Classify, Map
	Deer, M.	7/23/19-7/24/19		Delineate, Classify, Map
	Greendeer	7/23/19-7/24/19		Delineate, Classify, Map
	Shaw	7/23/19-7/24/19		Delineate, Classify, Map
	Johnson	7/23/19-7/24/19		Delineate, Classify, Map

7. Monitoring Results

The following section summarizes the results of the baseline water quality monitoring that was conducted during 2018-2019 for the stations identified in Table 2. The (9) fixed stations were monitored quarterly during the months of January, April, July and October during this period.

The final monitoring event for Rotating Y2 stations was completed in January 2018. Rotating Y3 stations were also monitored quarterly during the months of January, April, July and October 2018 with Rotating Y4 stations being monitored quarterly during the same months in 2019.

MIDDLE KICKAPOO RIVER WATERSHED

Fixed stations 1182400HCN03, 1182400HCN04, 1196900HCN01, 1195400HCN01 and 1198200HCN01 are associated with the Middle Kickapoo River Watershed. This area of Vernon County is part of the unglaciated region of southwest Wisconsin known as the "Driftless Area". Nonpoint sources of pollution in the watershed include runoff from agricultural fields and barnyards, stream bank erosion, roadways and potentially construction site runoff. Pollutants from nonpoint sources are carried to the stream or groundwater through the action of storm runoff, snow melt and seepage. Common water resource issues in the watershed include extreme flooding, sedimentation, organic loading and elevated water temperature, nutrient and bacteria levels. The watershed experienced significant rain prior to the October 2018 sampling event resulting in near bank full conditions at most stations. It should be noted that stations 1182400HCN01 and 1182400HCN02, shown on the map, are prior monitoring stations that were not visited during 2018-2019.

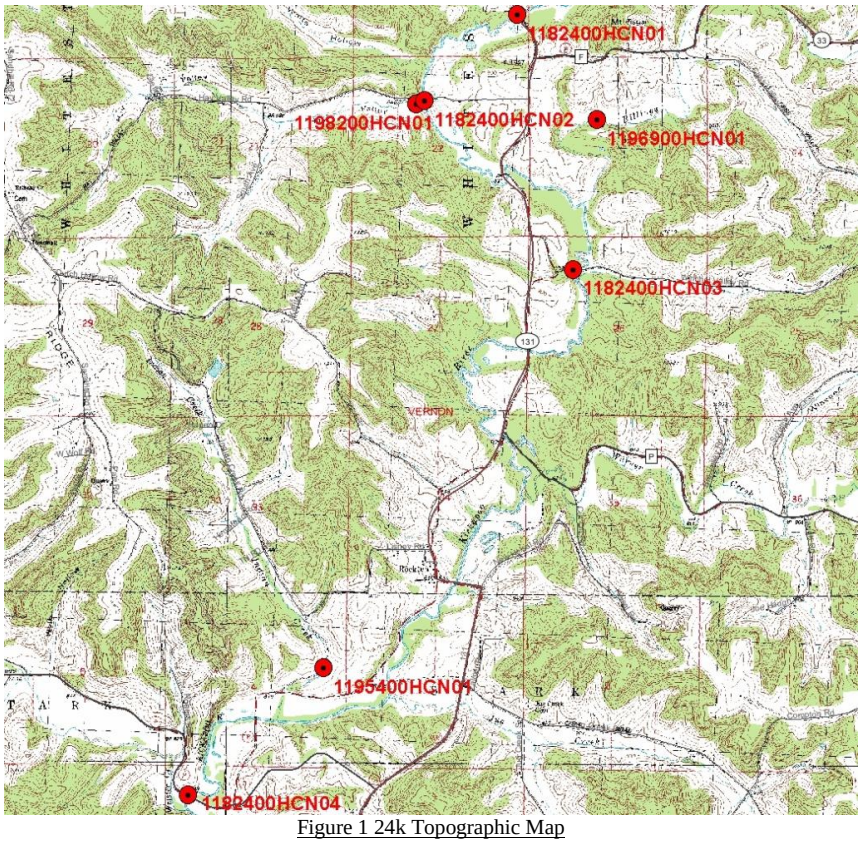

Figure 1 24k Topographic Map

1182400HCN03 KICKAPOO RIVER (BRIDGE 8)

Station 1182400HCN03 is accessed from Winchell Valley Road and is located directly upstream from Bridge 8.

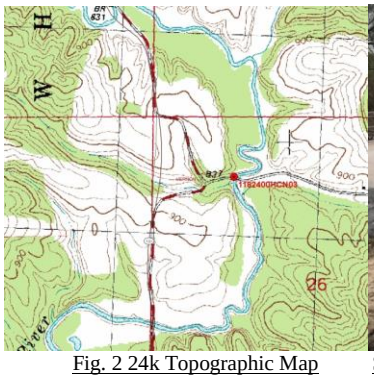

Fig. 2 24k Topographic Map

Station Photo downstream Bridge 8, October 10, 2018
Water elevation approx.10 feet above normal

Station 1182400HCN03 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total coliform and *E.coli*. Table 7 provides basic statistics for laboratory and core field parameters.

Table 7 **Station ID** **1182400HCN03**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	6.01	12.48	9.69	6.0	0
pH	None	8	7.1	8.44	7.98	6.0-9.0	0
Specific conductance	uS/cm	8	244.1	501.3	421.2		
Temperature, water	deg C	8	-0.1	18.72	9.73	22.8	0
Turbidity	NTU	8	4.01	851	134	3.38	100
Alkalinity, total	mg/l	8	106	252	207		
Chloride	mg/l	8	5.2	9.69	8.21		
Sulfate	mg/l	8	5.68	12.6	10.12		
Total suspended solids	mg/l	8	8.2	724	165		
Ammonia-nitrogen	mg/l	8	0.046	0.278	0.1093		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.86	2.08	1.46	1.73	25
Kjeldahl nitrogen	mg/l	8	0.224	4.85	1.34	0.15	100
Phosphorus	mg/l	8	0.045	1.93	0.361	0.070/0.075	63
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.031	1.14	0.240		
Escherichia coli	MPN/100ml	8	90.8	>2419.6	823.3		
Total Coliform	MPN/100ml	8	90.8	>2419.6	2074.3	400	88

Parameters of notable concern include:

- Turbidity ranging from 4.01 – 851 NTUs
- Total Suspended Solids ranging from 8.2 – 724 mg/L
- Kjeldahl Nitrogen (TKN) ranging from 0.224 – 4.85 mg/L
- Nitrate of Nitrite ranging from 0.86 – 2.08 mg/L
- Total Phosphorus ranging from 0.045 – 1.93 mg/L
- Total Coliforms samples 90.8 >2,419.6 MPN/100mL
- E.coli ranging from 90.8 – >2,419.6 MPN/100mL

No dissolved oxygen, temperature or pH values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, all sampling

events produced results above the threshold for Kjeldahl nitrogen and Turbidity. Five Total P values were above the EPA reference criteria of 0.070 mg/L and the State of Wisconsin standard of 0.075 mg/L. Two samples were above the EPA reference criteria of 1.73 mg/L for nitrate+nitrite. The threshold applied to Total coliform is based on the State of WI standard that states samples may not exceed 200 colonies per 100 ml as a geometric mean and may not exceed 400 colonies per 100 ml in more than 10% of all samples during any month. Samples shall be required at least 5 times per month. It should be noted that comparison of sample results to these threshold values is limited because of the small number of samples the Nation collects at any given sampling station. However, the Total coliform threshold of 400 cfu/mL was exceeded in seven samples.

Macroinvertebrate sampling was also completed at station 1182400HCN03. Table 8 provides a summary of the macroinvertebrate metrics.

Table 8 Macroinvertebrate Data Station 1182400HCN03

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/24/2018	4.00	3.976	4.51	3.864	1.474	11	10

The macroinvertebrate IBI condition gradient rating at station 1182400HCN03 is “fair” and efforts should focus on restoration. The HBI water quality rating for this station is “very good” suggesting possible slight organic pollution. The FBI value rating was “very good” also suggesting possible slight organic pollution at this station. The diversity index and richness values indicated a somewhat low level of diversity at this station.

An electrofishing survey was completed at station 1182400HCN03 using a DC electrofishing tote barge system. A temperature data logger was deployed in the stream from 5/24/18 to 11/15/18 to collect hourly temperature readings in order to determine the correct assessment tool to apply to the sampling reach. The temperature profile concluded the use of the warm-water IBI for fish. It should be noted that the previous assessment completed in 2016 used the cold-water IBI. The daily mean maximum temperature was 2.99 C° higher in 2018 compared to 2016. Table 9 provides a summary of the fish data.

Table 9 Fish Data Station 1182400HCN03

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/18/2018	warm-water	24.85	Not Calculated	Very Poor	<50 individuals captured

The fish survey resulted in less than 50 individuals being captured, therefore the IBI score was not calculated and the default rating of Very Poor was assigned. (12) Individuals comprising four native species were captured with White suckers being the dominant species encountered.

In summary, water quality at station 1182400HCN03 should be considered fair based on the information collected during 2018-2019. Water quality appears to be negatively impacted by non-point source runoff. These impacts are exacerbated during extreme storm events as

observed in October 2018 when water clarity was poor due to high levels of total suspended solids and many parameters exceeded the identified threshold values.

1182400HCN04 MIDDLE KICKAPOO RIVER (BRIDGE 14)

Station 1182400HCN04 is accessed from CTH P and is located directly upstream of Bridge 14. This station is situated at the southernmost extent of the Ho-Chunk Nation Kickapoo Trust lands and is used to monitor water quality as it leaves the trust parcel.

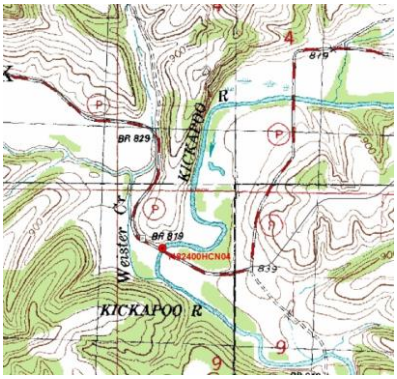

Fig 3. 24k Topographic Map

Station Photo Facing upstream October 10, 2018

Station 1182400HCN04 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli.* Table 10 provides basic statistics for laboratory and core field parameters.

Table 10 **Station ID** **1182400HCN04**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	6.1	12.56	9.58	6.0	0
pH	None	8	6.89	8.39	7.96	6.0-9.0	0
Specific conductance	uS/cm	8	229.2	500.7	417.2		
Temperature, water	deg C	8	-0.1	19.37	10.02	22.8	0
Turbidity	NTU	8	4.18	972	162	3.38	100
Alkalinity, total	mg/l	8	106	254	206		
Chloride	mg/l	8	5.02	8.98	7.75		
Sulfate	mg/l	8	5.31	13	10.13		
Total suspended solids	mg/l	8	7.8	804	208		
Ammonia-nitrogen	mg/l	8	0.031	0.194	0.0956		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.807	1.94	1.37	1.73	13
Kjeldahl nitrogen	mg/l	8	0.26	4.6	1.48	0.15	100
Phosphorus	mg/l	8	0.045	2	0.478	0.070/0.075	63
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.034	1.25	0.264		
Escherichia coli	MPN/100ml	7	143	>2419.6	795.4		
Total Coliform	MPN/100ml	7	34.8	>2419.6	1980.8	400	86

Parameters of notable concern include:

- Turbidity ranging from 4.18 – 972 NTU
- Total Suspended Solids ranging from 7.8 – 804 mg/L

- Kjeldahl Nitrogen (TKN) ranging from 0.26 – 4.6 mg/L
- Nitrate of Nitrite ranging from 0.807 – 1.94 mg/L
- Total Phosphorus ranging from 0.045 – 2.0 mg/L
- Total Coliforms samples 34.8 ->2,419.6 MPN/100mL
- E.coli ranging from 143 - >2,419.6 MPN/100mL

No dissolved oxygen, pH or temperature values exceeded the established threshold criteria. . Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, all four samples produced results above the threshold for turbidity and Kjeldahl nitrogen. Five Total P values were above the EPA reference criteria of 0.070 mg/L and the State of Wisconsin standard of 0.075 mg/L. One value was above the threshold for nitrate +nitrite. The threshold applied to Total coliform is based on the State of WI standard that states samples may not exceed may not exceed 400 colonies per 100 ml in more than 10% of all samples during any month. Samples shall be required at least 5 times per month. It should be noted that comparison of sample results to these threshold values is limited because of the small number of samples the Nation collects at any given sampling station. However, the Total coliform threshold of 400 cfu/mL was exceeded in six samples.

Macroinvertebrate sampling was not completed at station 1182400HCN04 because of high water and unsafe wading conditions during the spring sampling period. An electrofishing survey was completed at station 1182400HCN04 using a DC electrofishing tote barge system. A temperature data logger was deployed in the stream from 5/24/18 to 11/15/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the warm-water IBI for fish. It should be noted that the previous assessment completed in 2016 used the cold-water IBI. The daily mean maximum temperature was 2.86 C° higher in 2018 compared to 2016. Table 11 provides a summary of the fish data.

Table 11 Fish Data Station 1182400HCN04

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/18/2018	warm-water	24.705	Not Calculated	Very Poor	<50 individuals captured

The fish survey resulted in less than 50 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. (11) Individuals comprising four native species and one non-native species (Brown trout) were captured with Longnose dace minnow being the dominant species encountered.

In summary, water quality at station 1182400HCN04 should be considered fair based on the information collected during 2018-2019. Water quality appears to be negatively impacted by non-point source runoff. These impacts are exacerbated during extreme storm events as observed in October 2018 when water clarity was poor due to high levels of total suspended solids and many parameters exceeded the identified threshold values.

1195400HCN01 Indian Creek

Indian Creek flows in a southeasterly direction for 2.2 miles before reaching the Kickapoo River south of Rockton. This stream has a gradient of 59 feet per mile and drains forested hillsides with some ridge top agriculture. Indian Creek is currently a warm-water forage fishery. Station 1195400HCN01 is located east of the multi-use path that was formerly Indian Creek Road and approximately 400 feet downstream of the Indian Creek multi-use bridge. Reaches of Indian Creek under state jurisdiction are designated with the default Fish and Aquatic Life use by the WDNR because it does not have a specific use subcategory designation.

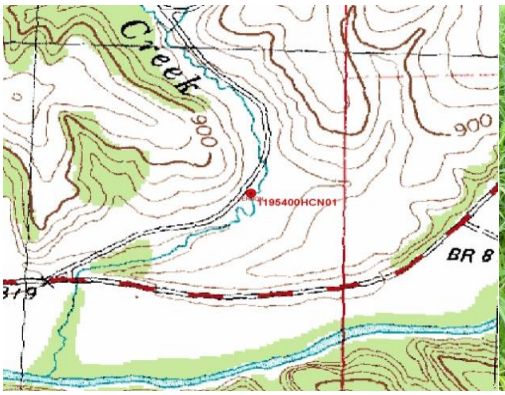

Fig. 4 24k Topographic Map


Station Photo Facing upstream

Station 1195400HCN01 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 12 provides basic statistics for laboratory and core field parameters.

Table 12 **Station ID** **1195400HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.21	12.17	10.68	6.0	0
pH	None	8	7.33	8.61	8.12	6.0-9.0	0
Specific conductance	uS/cm	8	349.6	512.1	448.9		
Temperature, water	deg C	8	0.1	16.92	8.71	22.8	0
Turbidity	NTU	8	2.86	20.2	9.43	3.38	75
Alkalinity, total	mg/l	8	177	263	234		
Chloride	mg/l	8	3.36	4.8	3.82		
Sulfate	mg/l	8	6.23	11.9	9.75		
Total suspended solids	mg/l	8	2.83	62.2	21		
Ammonia-nitrogen	mg/l	8	0.034	0.119	0.0749		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.512	1.29	0.904	1.73	0
Kjeldahl nitrogen	mg/l	8	0.171	1.32	0.47	0.15	100
Phosphorus	mg/l	8	0.039	0.191	0.077	0.070/0.075	25/25
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.029	0.138	0.058		
Escherichia coli	MPN/100ml	7	42.6	>2419.6	1089.4		
Total Coliform	MPN/100ml	7	172.9	>2419.6	1822.8	400	86

Parameters of notable concern include:

- Turbidity ranging from 2.86 – 20.2 NTU
- Total Suspended Solids ranging from 2.83 – 62.2 mg/L

- Kjeldahl Nitrogen (TKN) ranging from 0.171 – 1.32 mg/L
- Total Coliforms samples 172.9 - >2,419.6 MPN/100mL
- E.coli ranging from 42.6 – >2,419.6 MPN/100mL
- Total phosphorus ranging from 0.039 – 0.191 mg/L

No dissolved oxygen, temperature or pH values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, all samples produced results above the threshold for Kjeldahl nitrogen and six samples were above the threshold for turbidity. The Total coliform threshold of 400 cfu/mL was exceeded in six samples. 25% of Total phosphorus values exceeded the EPA reference criteria for Ecoregion VII sublevel ecoregion 52 and the State of WI standard of 0.075 mg/L.

Macroinvertebrate sampling was also completed at station 1195400HCN01. Table 13 provides a summary of the macroinvertebrate data.

Table 13 Macroinvertebrate Data Station 1195400HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/24/2018	2.518	3.516	7.45	2.554	1.659	18	15

The IBI condition gradient rating at station 1195400HCN01 is "good" to "excellent" and efforts should focus on maintaining this condition. The HBI water quality rating for this station is "excellent" with no apparent organic pollution. The FBI value rating was also "excellent" indicating that organic pollution was unlikely. The diversity index and richness values indicate a healthy diversity at this station.

An electrofishing survey was completed at station 1195400HCN01 using a DC electrofishing ETS Backpack system. A temperature data logger was deployed in the stream from 5/24/18 to 11/15/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. It should be noted that the previous assessment completed in 2016 also used the cold-water IBI and daily mean maximum temperatures were within <1.0 C° during both years. Table 14 provides a summary of the fish data.

Table 14 Fish Data Station 1195400HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/15/2018	cold-water	20.377	0	Very Poor	No cool or cold-water species present

The fish survey resulted in (51) individuals being captured. The station was rated Very Poor because no cool or cold water species were encountered and the vast majority of species captured were tolerant species.

In summary, water quality at station 1195400HCN01 is generally fair to good based on information collected during 2018-2019. Water quality appears to be somewhat negatively impacted by non-point source runoff, but significantly less than observed at the Kickapoo River

stations. Indian Creek water quality is also influenced by multiple beaver dams above and below the sampling station that impede fish movement and affect stream temperature and movement of sediment within this system.

1196900HCN01 Billings Creek

Billings Creek begins in south central Monroe County and then flows into north central Vernon County. This stream flows in a southwesterly direction for 11.3 miles before reaching the Kickapoo River south of Ontario. Billings Creek has a gradient of 35 feet per mile and drains forested hillsides and agricultural lands in both valley and ridgetop settings. Billings Creek is a Class II trout stream for its entire length. Station 1196900HCN01 is located south of CTH F approximately 1.1 miles downstream of the CTH F bridge crossing.

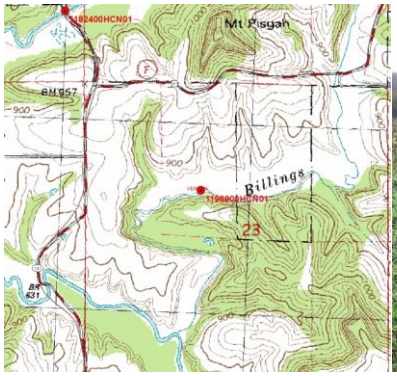

Fig 5. 24k Topographic Map

Station Photo Facing upstream October 10, 2018

Station 1196900HCN01 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 15 provides basic statistics for laboratory and core field parameters.

Table 15 **Station ID** **1196900HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	7.94	11.96	10.30	6.0	0
pH	None	8	7.36	8.37	7.90	6.0-9.0	0
Specific conductance	uS/cm	8	400.4	508	467.5		
Temperature, water	deg C	8	-0.1	19.3	9.44	22.8	0
Turbidity	NTU	8	0.85	38.8	9.64	3.38	63
Alkalinity, total	mg/l	8	195	261	240		
Chloride	mg/l	8	5.9	6.7	6.39		
Sulfate	mg/l	8	7.1	11.3	9.91		
Total suspended solids	mg/l	8	4.25	123	25		
Ammonia-nitrogen	mg/l	8	0.04	0.116	0.0756		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.905	1.82	1.43	1.73	25
Kjeldahl nitrogen	mg/l	8	0.195	1.48	0.53	0.15	100
Phosphorus	mg/l	8	0.033	0.406	0.095	0.070/0.075	25/25
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.017	0.295	0.068		
Escherichia coli	MPN/100ml	8	155.3	>2419.6	865.8		
Total Coliform	MPN/100ml	8	365.4	>2419.6	1946.2	400	88

Parameters of notable concern include:

- Turbidity ranging from 0.85 – 38.8 NTUs
- Total Suspended Solids ranging from 4.25 – 123 mg/L
- Kjeldahl Nitrogen (TKN) ranging from 0.195 – 1.48 mg/L
- Total Coliforms samples 365.4 ->2,419.6 MPN/100mL
- E.coli ranging from 155.3 – >2,419.6 MPN/100mL
- Total phosphorus values 0.033 – 0.406 mg/L

No dissolved oxygen, temperature or pH values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, all samples produced results above the threshold for Kjeldahl nitrogen and five samples exceeded the threshold for turbidity. The Total coliform threshold of 400 cfu/mL was exceeded in the all seven samples. 25% of samples exceeded both the EPA and State of WI reference criteria for Total phosphorus.

Macroinvertebrate sampling was also completed at station 1196900HCN01. Table 16 provides a summary of the macroinvertebrate data.

Table 16 Macroinvertebrate Data Station 1196900HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/24/2018	3.60	3.978	3.40	3.450	2.153	17	17

The IBI condition gradient rating at station 1196900HCN01 is "fair" and management efforts should consider restoration. The HBI water quality rating for this station is "very good" with possible slight organic pollution. The FBI value rating was "excellent" indicating that organic pollution was unlikely. The diversity index and richness values indicated a somewhat diverse macroinvertebrate community at this station.

An electrofishing survey was completed at station 1196900HCN01 using a DC electrofishing tote barge system. A temperature data logger was deployed in the stream from 5/24/18 to 11/15/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. It should be noted that the previous assessment completed in 2016 also used the cold-water IBI and the daily mean maximum temperature was 1.99 C° higher in 2018. Table 17 provides a summary of the fish data.

Table 17 Fish Data Station 1196900HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/16/18	cold-water	22.473	40	Fair	Brown trout only salmonid present

The survey resulted in (57) individuals being captured and the temperature regime indicated use of the cold-water IBI. The corresponding IBI rating was fair with 47% of species being cool or cold-water. Brown trout was the only salmonid present with multiple size classes encountered.

In summary, water quality at station 1196900HCN01 is generally fair to good based on information collected during 2018-2019. Water quality is negatively impacted by non-point source agricultural runoff, with conditions similar to the Kickapoo River stations during extreme run-off events. Total phosphorus, organic nitrogen, total suspended solids and bacteriological values often exceed reference criteria following a runoff event. However, the waterway is still supportive of a cold-water fishery.

1198200HCN01 unnamed (Hay Valley Rd.)

Hay Valley Rd. Creek is a 3.03 mile stream that drains forested hillsides with agricultural uses in both valleys and ridgetop settings. Hay Valley Creek is a Class I Trout Water that joins the Kickapoo River just below Bridge 6. Station 1198200HCN01 is located south of Hay Valley Road approximately 0.1 miles upstream of the confluence with the Kickapoo River.

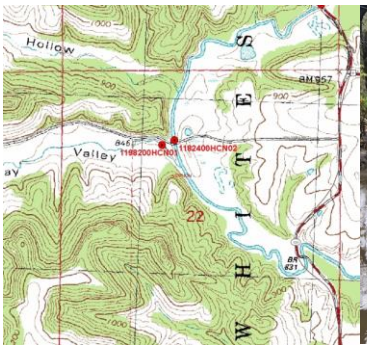

Fig. 6 24k Topographic Map

Station Photo facing upstream October 10, 2018

Station 1198200HCN01 was visited on (8) sampling events to monitor baseline water quality during 2016-2017. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 18 provides basic statistics for laboratory and core field parameters.

Table 18 **Station ID** **1198200HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.25	11.62	10.42	6.0	0
pH	None	8	7.36	8.43	8.06	6.0-9.0	0
Specific conductance	uS/cm	8	352.6	477	437.3		
Temperature, water	deg C	8	3.6	16.8	10.16	22.8	0
Turbidity	NTU	8	4.66	46	12.57	3.38	100
Alkalinity, total	mg/l	8	171	246	227		
Chloride	mg/l	8	3.27	4.36	3.72		
Sulfate	mg/l	8	6.33	11.3	9.62		
Total suspended solids	mg/l	8	0.835	162	41		
Ammonia-nitrogen	mg/l	8	0.035	0.102	0.0683		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.577	1.18	0.925	1.73	0
Kjeldahl nitrogen	mg/l	8	0.1	1.14	0.33	0.15	88
Phosphorus	mg/l	8	0.031	0.403	0.094	0.070/0.075	25/13
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.019	0.169	0.051		
Escherichia coli	MPN/100ml	8	28.5	>2419.6	590.9		
Total Coliform	MPN/100ml	8	160.7	>2419.6	1449.2	400	75

Parameters of notable concern include:

- Total Suspended Solids ranging from 0.835– 162 mg/L
- Kjeldahl Nitrogen (TKN) values ranging from 0.1 – 1.14 mg/L
- Total Coliforms samples 160.7 - >2,419.6 MPN/100mL
- E.coli samples 28.5- >2,419.6 MPN/100mL
- Turbidity 4.66 – 46 NTUs
- Total Phosphorus 0.031 - 0.403 mg/L

No dissolved oxygen, temperature or pH values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, seven samples produced results above the thresholds for Kjeldahl nitrogen and 100% exceeded the turbidity threshold. The Total coliform threshold of 400 cfu/mL was exceeded in 75% of samples. The EPA and State of WI threshold values for Total phosphorus were exceeded in 25% and 13% of samples respectively.

Macroinvertebrate sampling was also completed at station 1198200HCN01. Table 19 provides a summary of the macroinvertebrate data.

Table 19 Macroinvertebrate Data Station 1198200HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/24/2018	3.52	3.649	7.71	3.68	1.594	14	12

The IBI condition gradient rating at station 1198200HCN01 is “excellent” and efforts should focus on maintaining this condition. The HBI water quality rating for this station is “very good” with possible slight organic pollution. The FBI value rating was “excellent” suggesting that organic pollution was unlikely. The diversity index and richness values indicated a somewhat diverse community of aquatic life.

An electrofishing survey was completed at station 1198200HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 5/24/18 to 11/15/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. It should be noted that the previous assessment completed in 2016 also used the cold-water IBI and the daily mean maximum temperature was 2.85 C° higher in 2018. Table 20 provides a summary of the fish data.

Table 20 Fish Data Station 1198200HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/15/2018	cold-water	19.464	Not calculated	Very Poor	No cool or coldwater species present

The fish survey resulted in less than 25 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. However, (24) individual fish were captured with 25% being cool or cold-water species and 33% of the salmonids being native

Brook trout. Brook trout were previously captured during surveys in 2009 and 2014 but were absent in survey years 2007, 2012 and 2016.

In summary, water quality at station 1198200HCN01 is generally fair to good based on information collected during 2018-2019. Water quality appears to be negatively impacted by non-point source runoff, but significantly less than observed at the Kickapoo River stations. Water quality is also influenced by multiple beaver dams above and below the sampling station that impede fish movement and affect stream temperature and movement of sediment within this system.

Black River Basin

The Black River Basin is one of three distinct main stem river basins including the Black, Buffalo and Trempealeau Rivers which drain to the Mississippi River. This basin is part of the Great Western Rivers area of Wisconsin that contains forested hillsides with agricultural uses in both valleys and ridgetop settings. The Driftless terrain drains to the Mississippi's wide floodplains that can be viewed for miles from the region's steep bluff overlooks. Fixed Stations 1714200HCN01, 1714300HCN01 and1715800HCN01 and Rotating Basin Year One sites are associated with the Morrison Creek and O'Neill Cunningham 24k WDNR watersheds. Major portions of Morrison Creek watershed were logged in the late 1800's. Dense stands of large pines survived on islands in the extensive wetland areas of this watershed until the lumbermen found ways to access and transport the large logs using railways.

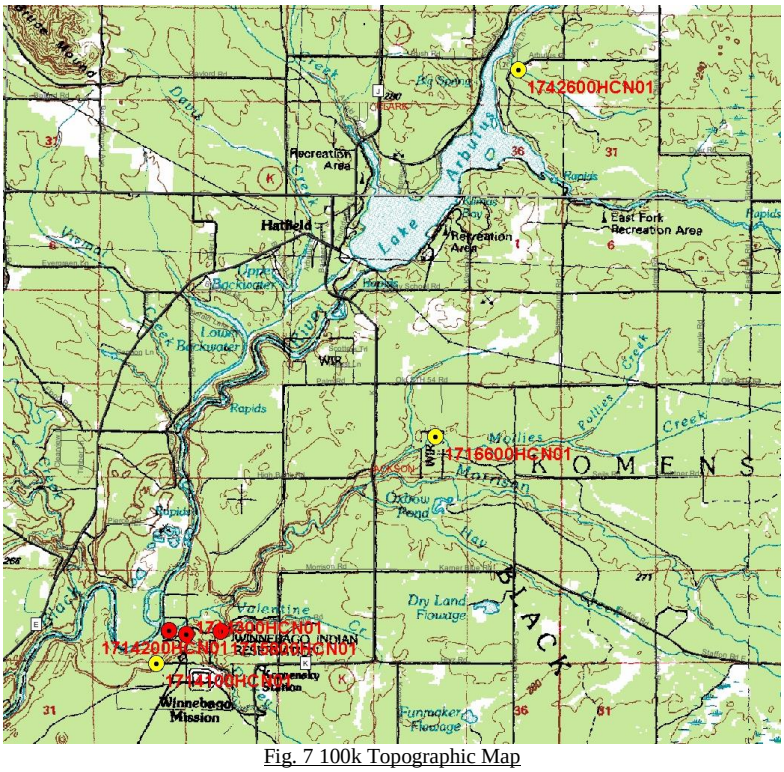

Fig. 7 100k Topographic Map

Forest and wetland dominate the Morrison Creek watershed landscape. The majority of the Black River State Forest lies within this watershed as do many Ho-Chunk Nation parcels.

Cranberries are the major crop in the Morrison Creek watershed and many streams have been impounded to divert water for cranberry operations. Since most of the streams in this watershed historically contained forage fisheries, thermal changes in streams resulting from the discharge of impounded water are not considered a major problem. Only Valentine, Clear and portions of Levis Creek are classified trout streams.

The O'Neill and Cunningham Creeks watershed, located in Clark County, is approximately 162 square miles. Low base flow and gradient, as well as flashy flows during rain events, characterize the streams in the O'Neill and Cunningham Creeks watershed. These conditions greatly influence the fisheries in these streams. All streams support at least a forage fishery. Some streams can support a sport fishery, if water levels are adequate. The majority of the historically forested areas were converted to agricultural use as mechanized agriculture took hold in the area.

1714200HCN01 Morrison Creek

Morrison Creek begins in the far eastern portion of the watershed and flows west for 30 miles through Potter's Flowage, the Black River State Forest and Ho-Chunk land before entering the Black River. The lower eight miles of Morrison Creek contain sport fish. A warm water forage fishery inhabits the remaining 22 miles of the creek. Numerous cranberry operations are established on streams that contribute flow to Morrison Creek. Manipulation of water levels in these tributaries for cranberry production may affect the flow and water quality in Morrison Creek. Station 1714200HCN01 is located 0.2 miles west of Pettibone Pass Rd. and is accessed via the Black River canoe launch road. The site is approximately 0.35 miles above the confluence with the Black River.

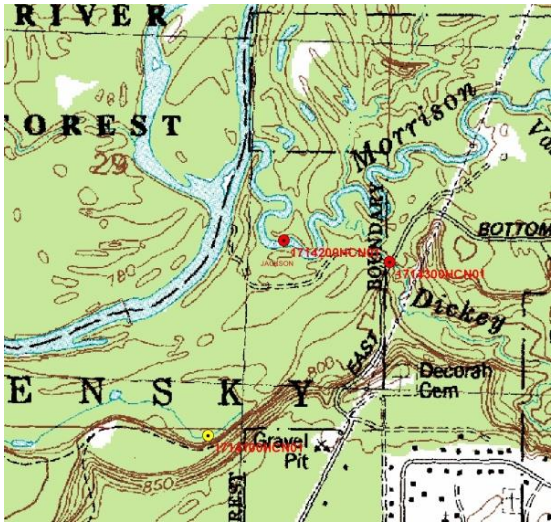

Fig. 8 24k Topographic Map


Station Photo Facing upstream

Station 1714200HCN01 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 21 provides basic statistics for laboratory and core field parameters.

Table 21 Station ID 1714200HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.09	12.93	11.24	5.0	0
pH	None	8	4.85	6.46	5.47	6.0-9.0	75
Specific conductance	uS/cm	8	16.7	38.2	25.6		
Temperature, water	deg C	8	0	24.85	9.74	31.7	0
Turbidity	NTU	8	1.11	9.2	3.20	0.84	100
Alkalinity, total	mg/l	8	0.5	4.5	1.5		
Chloride	mg/l	8	1.25	3.74	2.28		
Sulfate	mg/l	8	0.75	4.73	2.24		
Total suspended solids	mg/l	8	0.5	10.3	4.8		
Ammonia-nitrogen	mg/l	8	0.0135	0.146	0.0861		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.0125	0.105	0.052	0.13	0
Kjeldahl nitrogen	mg/l	8	0.498	0.906	0.679	0.33	100
Phosphorus	mg/l	8	0.022	0.042	0.030	0.02875/0.075	50/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.006	0.017	0.013		
Escherichia coli	MPN/100ml	8	1	139.6	40.3		
Total Coliform	MPN/100ml	8	15.8	>2419.6	1371.5	400	63

Parameters of notable concern include:

- Turbidity ranging from 1.11 – 4.06 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.498 - 0.906 mg/L
- Total Phosphorus ranging from 0.022 - 0.042 mg/L.
- Total Coliforms ranging from 15.8 - >2,419.6 MPN/100mL.

No dissolved oxygen or temperature values exceeded the established threshold criteria. The pH threshold was exceeded in 75% of samples but low pH values are a normal condition in this watershed. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples produced results above the threshold for Kjeldahl nitrogen and turbidity. 50% of samples were above the EPA threshold for Total Phosphorus but none exceeded the WDNR Total phosphorus threshold. The Total coliform threshold of 400 cfu/mL was exceeded in 63% of samples.

Macroinvertebrate sampling was also completed at station 1714200HCN01. Table 22 provides a summary of the macroinvertebrate data.

Table 22 Macroinvertebrate Data Station 1714200HCN01							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/10/2019	1.41	2.24	3.99	2.74	1.875	18	17

The IBI condition gradient rating at station 1714200HCN01 is “poor”. The HBI water quality rating for this station is “excellent” with no apparent organic pollution. The FBI value rating is also “excellent” suggesting that organic pollution was unlikely. The diversity index and richness values indicated a somewhat diverse community of aquatic life.

An electrofishing survey was not completed at station 1714200HCN01 due to high water during the initial sampling visit and the unavailability of staff for subsequent survey attempts. In

summary, water quality at station 1714200HCN01 is good based on the limited information collected during 2018-2019. Morrison Creek may be influenced to some degree by upstream cranberry operations that are highly dependent on the management of water for irrigation and crop harvest.

1714300HCN01 Dickey Creek

Dickey Creek is currently a warm water forage fishery. Elevated water temperatures due to upstream impoundments, low gradient and a shifting sand substrate limit the stream as a potential sport fishery. The Dickey Creek watershed is located entirely within the Black River State Forest with few identifiable nonpoint sources. Three waterfowl production ponds located upstream of the sampling station result in water temperatures that are generally too warm to support a cold-water fishery. Station 1714300HCN01 is located approximately 50 feet upstream of the Pettibone Pass Road crossing.

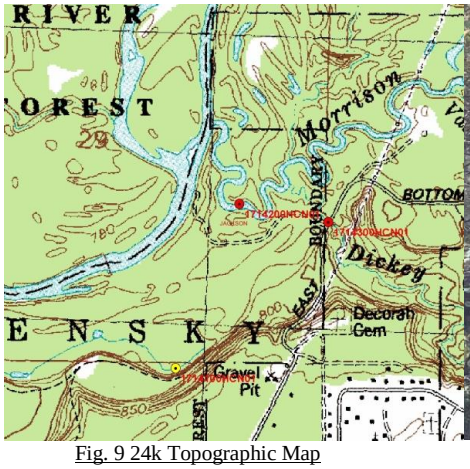

Fig. 9 24k Topographic Map

Station Photo facing upstream October 17, 2019

Station 1714300HCN01 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids and Total Coliforms/*E.coli*. Table 23 provides basic statistics for laboratory and core field parameters.

Table 23 **Station ID** **1714300HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	7.87	12.86	11.24	5.0	0
pH	None	8	4.86	6.56	5.63	6.0-9.0	75
Specific conductance	uS/cm	8	25.1	59.1	41.1		
Temperature, water	deg C	8	0.09	23.1	9.41	31.7	0
Turbidity	NTU	8	1.14	9.8	2.75	0.84	100
Alkalinity, total	mg/l	8	0.5	7.25	2.48		
Chloride	mg/l	8	2.78	8.85	6.18		
Sulfate	mg/l	8	0.75	3.97	2.10		
Total suspended solids	mg/l	8	2.1	7.39	3.96		
Ammonia-nitrogen	mg/l	8	0.032	0.195	0.0849		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.018	0.152	0.070	0.13	25

Kjeldahl nitrogen	mg/l	8	0.354	0.8	0.583	0.33	100
Phosphorus	mg/l	8	0.013	0.032	0.022	0.02875/0.075	25/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.003	0.018	0.010		
Escherichia coli	MPN/100ml	8	0.5	419.8	86.8		
Total Coliform	MPN/100ml	8	49.2	>2419.6	1404.1	400	63

Parameters of notable concern include:

- Turbidity ranging from 1.14 – 9.8 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.354 - 0.8 mg/L
- Nitrate + nitrite ranging from 0.018 - 0.152 mg/L
- Total Coliforms ranging from 49.2 - >2,419.6 MPN/100mL.
- E.coli samples 0.5 – 419.8 MPN/100mL

No dissolved oxygen or temperature values exceeded the established threshold criteria. The pH threshold was exceeded in 75% of samples due to pH values below 6.0 but low pH values are a normal condition in this watershed. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples produced results above the threshold for Kjeldahl nitrogen and turbidity. The Nitrate of nitrite threshold was exceeded in 25% of samples. The EPA reference criteria for Total phosphorus was exceeded on two occasions but did not exceed the State of Wisconsin standard. The threshold applied to Total coliform is based on the State of WI standard that states samples may not exceed 200 colonies per 100 ml as a geometric mean and may not exceed 400 colonies per 100 ml in more than 10% of all samples during any month. Samples shall be required at least 5 times per month. It should be noted that comparison of sample results to these threshold values is limited because of the small number of samples the Nation collects at any given sampling station. However, the Total coliform threshold of 400 cfu/mL was exceeded in 63% of samples collected. The July sampling event exceeded the EPA reference criteria

Macroinvertebrate sampling was also completed at station 1714300HCN01. Table 24 provides a summary of the macroinvertebrate data.

Table 24 Macroinvertebrate Data Station 1714300HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/10/2019	1.73	2.47	5.22	2.47	2.17	27	27

The IBI condition gradient rating at station 1714300HCN01 was “good” and efforts should be made to maintain that condition. The HBI water quality rating for this station is “excellent” with no apparent organic pollution. The FBI value rating is also “excellent” suggesting that organic pollution was unlikely. The diversity index and richness values indicated a diverse community of aquatic life.

An electrofishing survey was not completed at station 1714300HCN01 due to a large beaver dam that caused inundated conditions in the sampling reach. Water depth was approximately three feet above normal. In summary, water quality at station 1714300HCN01 is fair to good based on the limited information collected during 2018-2019. Dickey Creek water quality and biological

populations are likely influenced by upstream impoundments that influence water temperature, sediment transport and fish movement.

1715800HCN01 Valentine Creek

This three mile long Class I trout stream is a tributary to Morrison Creek and located near the confluence with the Black River. Valentine Creek flows through mostly undeveloped land that is part of the Black River State Forest and Ho-Chunk trust lands. Station 1715800HCN01 is located directly upstream of the Pettibone Pass (formerly Bottom Rd.) road culvert.

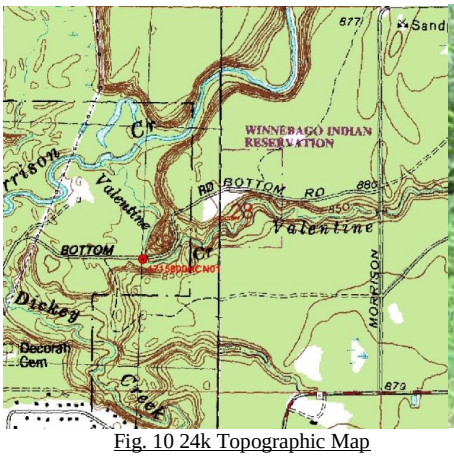

Fig. 10 24k Topographic Map

Station Photo Facing upstream

Station 1715800HCN01 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 25 provides basic statistics for laboratory and core field parameters.

Table 25 **Station ID** **1715800HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.73	12.69	11.35	6.0	0
pH	None	8	4.9	7.3	6.05	6.0-9.0	50
Specific conductance	uS/cm	8	44	57.5	51.2		
Temperature, water	deg C	8	1.41	19.2	8.35	22.8	0
Turbidity	NTU	8	0.38	5.1	1.56	0.84	88
Alkalinity, total	mg/l	8	0.5	8.18	3.35		
Chloride	mg/l	8	5.97	10.6	8.89		
Sulfate	mg/l	8	0.75	3.76	2.58		
Total suspended solids	mg/l	8	0.5	1.67	1.13		
Ammonia-nitrogen	mg/l	8	0.034	0.147	0.0750		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.0125	0.175	0.072	0.13	13
Kjeldahl nitrogen	mg/l	8	0.202	0.579	0.427	0.33	63
Phosphorus	mg/l	8	0.006	0.02	0.014	0.02875/0.075	0/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.003	0.01	0.008		
Escherichia coli	MPN/100ml	8	0.5	343	61.9		
Total Coliform	MPN/100ml	8	12.2	>2419.6	1144.2	400	63

Parameters of notable concern include:

- Nitrate of nitrite ranging from 0.0125 – 0.175 mg/L
- Total Coliforms ranging from 12.2- >2,419.6 MPN/100mL
- Kjeldahl nitrogen values from 0.202 – 0.579 mg/L
- Turbidity values ranging from 0.38 – 5.1 NTUs

No dissolved oxygen or temperature values exceeded the established threshold criteria. The pH threshold was exceeded in 50% of samples but low pH is a normal condition within this watershed. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, one sample produced results above the threshold for nitrate+nitrite and 63% exceeded the Kjeldahl threshold. The Total coliform threshold of 400 cfu/mL was exceeded in 63% of samples. Total coliform is likely attributable to common wildlife in the area since Valentine Creek is within a low-developed and non-agricultural watershed. There are also no known private on-site wastewater treatment systems with the potential to affect water quality in Valentine Creek.

Macroinvertebrate sampling was also completed at station 1715800HCN01. Table 26 provides a summary of the macroinvertebrate data.

Table 26 Macroinvertebrate Data Station 1715800HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/9/2019	3.10	2.99	7.30	3.50	2.84	31	30

The IBI condition gradient rating at station 1715800HCN01 was “good” and efforts should be made to maintain that condition. The HBI water quality rating for this station is “excellent” with no apparent organic pollution. The FBI value rating is also “excellent” suggesting that organic pollution was unlikely. The diversity index and richness values indicated a diverse community of aquatic life.

An electrofishing survey was completed at station 1715800HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 4/18/18 to 10/8/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. Table 27 provides a summary of the fish data.

Table 27 Fish Data Station 1715800HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
10/27/19	cold-water	18.13	80	Good	24 Brook trout captured

Photos from 2019 electrofishing, left photo showing multiple age classes of native Brook trout, right photo mature Brook trout

The fish survey resulted in (27) individuals being captured with (24) being native Brook trout. The remaining species included Creek chub, White sucker and Central mudminnow. The IBI score was 80 with an IBI rating of good.

In summary, water quality at station 1715800HCN01 continues to be excellent based on the information collected during 2018-2019. Valentine Creek can serve as a reference stream in the area because it is a headwater stream within a primarily undeveloped watershed. Although this station is within Ho-Chunk trust land, the majority of the stream is located on land owned by the State of Wisconsin. The WDNR has subsequently classified the segment under state jurisdiction as an Exceptional Resource Water (ERW) because of water quality condition. Valentine Creek is also classified as a Class I trout water because it supports naturally reproducing Brook trout.

Middle and South Branches Embarrass River Watershed

The Middle and South Branch of the Embarrass River Watershed covers 251 square miles and is located in Shawano, Marathon and Langlade counties. The Middle Branch of the Embarrass River winds for 52 miles in this watershed. It should be noted that stations 310700HCN01 and 312800HCN01 depicted on the map below were not sampled during the reporting period and are not scheduled for sampling in upcoming years.

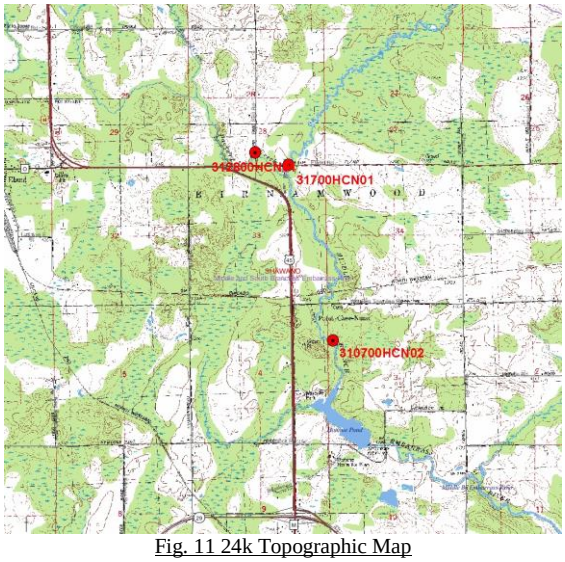

Fig. 11 24k Topographic Map

310700HCN02 Middle Branch Embarrass River

Station 310700HCN02 is located approximately 0.43 miles upstream of Homme Pond. The station is located on the Ho-Chunk Nation Christiansen parcel directly east of the Ho-Chunk North Ancillary Casino. This segment of the river is designated as Class II trout water by the WDNR.

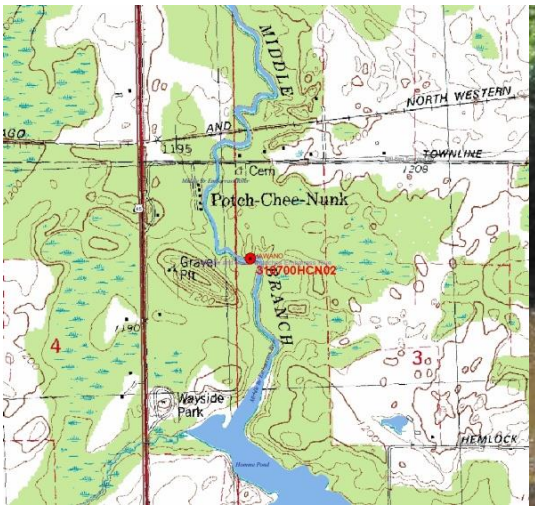

Fig. 12 24k Topographic Map

Station Photo Facing upstream

Station 310700HCN02 was visited on (8) sampling events to monitor baseline water quality during 2018-2019. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 28 provides basic statistics for laboratory and core field parameters.

Table 28 **Station ID** **310700HCN02**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	7.82	12.68	10.94	6.0	0
pH	None	8	7.11	8.21	7.71	6.0-9.0	0
Specific conductance	uS/cm	8	176.9	476	356.9		
Temperature, water	deg C	8	0	19.4	7.35	22.8	0
Turbidity	NTU	8	1.02	7.2	2.49	0.84	100
Alkalinity, total	mg/l	8	84.7	230	150.8		
Chloride	mg/l	8	5.48	14.4	10.15		
Sulfate	mg/l	8	0.75	8.86	5.03		
Total suspended solids	mg/l	8	0.5	15	4.5		
Ammonia-nitrogen	mg/l	8	0.036	0.317	0.0965		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.104	3.04	1.33	0.13	88
Kjeldahl nitrogen	mg/l	8	0.363	1.14	0.758	0.33	100
Phosphorus	mg/l	8	0.009	0.062	0.038	0.02875/0.075	75/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.011	0.034	0.021		
Escherichia coli	MPN/100ml	8	3	1986.3	312.9		
Total Coliform	MPN/100ml	8	82.1	>2419.6	1045.5	400	50

Parameters of notable concern include:

- Turbidity ranging from 1.02 – 7.2 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.363– 1.14 mg/L
- Nitrate+Nitrite ranging from 0.104 – 3.04 mg/L.
- Total Phosphorus ranging from 0.009 - 0.062 mg/L.
- Total Coliforms values ranging 82.1 - >2,419.6 MPN/100mL.

No temperature, pH or dissolved oxygen values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples were above the threshold values for turbidity and Kjeldahl nitrogen with 88% of samples above the nitrate + nitrite threshold. 75% of Total P values were above the EPA reference criteria but none exceeded the State of Wisconsin standard of 0.075 mg/L. The Total coliform single sample maximum threshold of 400 cfu/mL was exceeded in 50% of samples.

Macroinvertebrate sampling was also completed at station 31700HCN02. Table 29 provides a summary of the macroinvertebrate data.

Table 29 Macroinvertebrate Data Station 310700HCN02

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/9/2019	3.04	2.68	7.50	3.56	2.16	21	20

The IBI condition gradient rating at station 310700HCN02 was “excellent”. The HBI water quality rating for this station is “excellent” with no apparent organic pollution. The FBI value rating is also “excellent” suggesting that organic pollution was unlikely. The diversity index and richness values indicated a diverse community of aquatic life.

An electrofishing survey was completed at station 310700HCN02 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 5/9/18 to 10/8/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. Table 30 provides a summary of the fish data.

Table 30 Fish Data Station 310700HCN02

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
6/26/19	cold-water	23.17	50	Fair	38 fish captured, 16% cold-water sp.

The fish survey resulted in (38) individuals being captured with (6) being native Brook trout. The remaining species included White sucker, Blackside darter, Longnose dace, Golden shiner, Central mudminnow and Northern hog sucker. The IBI score was 50 with an IBI rating of fair.

In summary, water quality at station 310700HCN02 is considered very good based on the information collected during 2018-2019. Although this station is within Ho-Chunk trust land, much of the stream flows through private land upstream. The WDNR has subsequently classified this segment and upstream portions an Outstanding Resource Water because of high water

quality and as a Class II trout stream since it is capable of supporting trout but unable to sustain natural reproduction.

LITTLE LACROSSE RIVER WATERSHED

The Little La Crosse River Watershed is the largest in the La Crosse River basin covering 240 square miles. Approximately one third of the watershed lies in La Crosse County with the balance in Monroe County. It includes all streams draining to the La Crosse River between the Lake Neshonoc dam in West Salem and the Perch Lake dam in Sparta. Major tributaries are Dutch, Burns, Big, Fish, Farmers Valley and Beaver Creeks, as well as the Little La Crosse River. Approximately 30 miles of Class I, 54 miles of Class II and 22 miles of Class III trout water, including the La Crosse River between Rockland and Sparta, exist in the Little La Crosse River Watershed.

This watershed contains approximately the same amount of wooded hillsides as agricultural fields, with some wetlands located adjacent to the La Crosse River. Agricultural land is found both in the valleys and ridge tops in the Little La Crosse River watershed. However, due to the steep hills and narrow valleys, many valley farms contain limited tillable acreage. Consequently, riparian corridors of many streams in the watershed contain cultivated fields and barnyards. Storm water runoff from these fields and barnyards can contribute sediment, nutrients, and bacteria to streams, all of which eventually reach Lake Neshonoc.

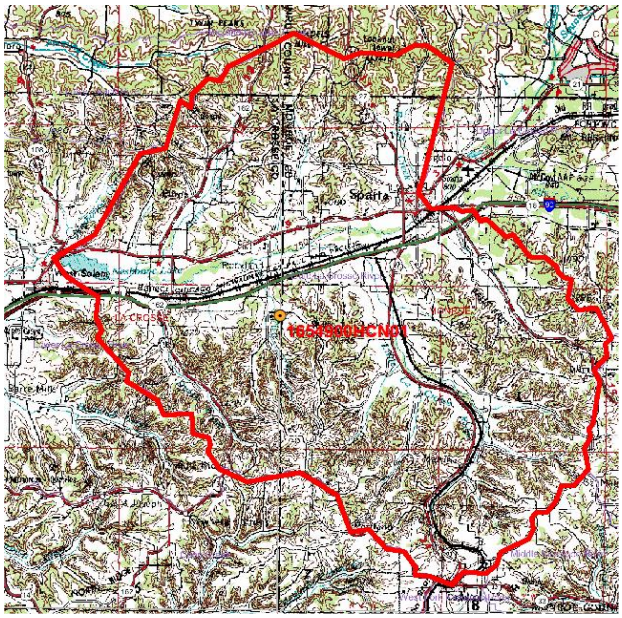

Fig. 13 100k Little La Crosse River Watershed

RB2 Station 1654900HCN01 unnamed (Wo gis na pi)

This unnamed creek flows approximately 3.5 miles northwest before joining with Fish Creek at the western boundary of the Ho-Chunk Nation trust parcel. Fish Creek is classified as a Class III trout stream in La Crosse County. Fish Creek and this unnamed tributary are spring fed streams that drain steep forested hillsides and agricultural valley land. These streams are known to be impacted by suspended sediments, bank erosion, nutrients and high bacteria counts. Sampling station 1654900HCN01 is located directly upstream of the field road culvert on the Ho-Chunk

Nation Wo gis na pi trust parcel. Long-term hourly temperature monitoring conducted by the Ho-Chunk Nation concluded that the stream is a cool water system and likely capable of supporting trout species.

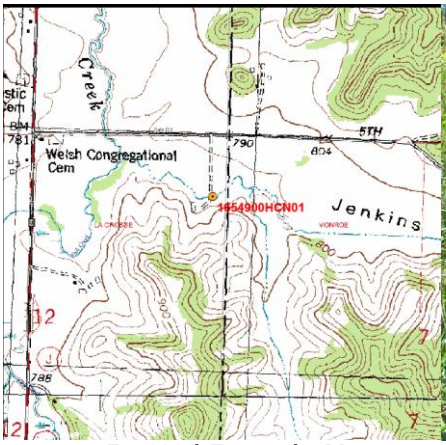

Fig. 14 24k Topographic Map


Station Photo facing upstream

Station 1654900HCN01 was visited on (1) sampling event in January 2018 to monitor baseline water quality. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 31 provides basic statistics for laboratory and core field parameters.

Table 31 **Station ID** **1654900HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	1		10.59		6.0	0
pH	None	1		7.84		6.0-9.0	0
Specific conductance	uS/cm	1		479.2			
Temperature, water	deg C	1		5.9		22.8	0
Turbidity	NTU	1		12.87		3.38	100
Alkalinity, total	mg/l	1		217			
Chloride	mg/l	1		6.22			
Sulfate	mg/l	1		16.1			
Total suspended solids	mg/l	1		45.5			
Ammonia-nitrogen	mg/l	1		0.459			
Inorganic nitrogen (nitrate and nitrite)	mg/l	1		4.31		1.73	100
Kjeldahl nitrogen	mg/l	1		0.651		0.15	100
Phosphorus	mg/l	1		0.088		0.070/0.075	100/100
Soluble Reactive Phosphorus (SRP)	mg/l	1		0.074			
Escherichia coli	MPN/100ml	1		48.8			
Total Coliform	MPN/100ml	1		>2,419.6		400	100

Parameters of notable concern include:

- Total suspended solids value of 45.5 mg/L
- Turbidity value of 12.87 NTU
- Kjeldahl Nitrogen (TKN) value of 0.651 mg/L
- Nitrate+Nitrite value of 4.31 mg/L

- Total phosphorus value of 0.088 mg/L
- Total coliform value >2,419.6 MPN/100mL

No dissolved oxygen, pH or temperature values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, the January 2018 sample exceeded the turbidity, Kjeldahl nitrogen and nitrate + nitrite thresholds. The sample also exceeded both the EPA and State thresholds for Total P and Total coliform.

Macroinvertebrate and electrofishing sampling was not completed at station 1654900HCN01 in 2018. This station is scheduled for sampling again in 2022.

In summary, water quality at station 1654900HCN01 is considered fair based on the limited information collected during 2018. Although this station is within Ho-Chunk trust land, much of the stream flows through private land in an agricultural dominated watershed. Non-point source run-off during storm events results in elevated levels of suspended solids and nutrients and contributes to bank erosion and sedimentation.

MISSISSIPPI RIVER (Reno) WATERSHED

RB2 Station allot1045HCN01unnamed (Blackhawk Hopinka)

This unnamed first order stream originates from drainage and springs within the Blackhawk Hopinka allotment parcel. This coldwater stream then flows approximately 0.5 miles east before entering the backwaters of the Mississippi River in the area known as Lawrence Lake. The mid-section of the stream flows through a small wooded subdivision of approximately 20 homes before crossing Hwy 26 and entering the backwater wetland complex of Lawrence Lake. The sampling site is located 20 feet upstream of the two culverts on Brookwood Drive.

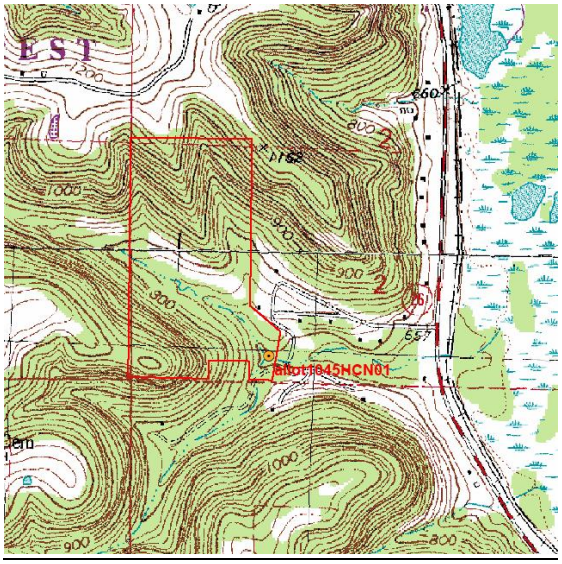

Fig. 15 24k Topographic Map

Station allot1045HCN01 was visited on (1) sampling event in January 2018 to monitor baseline water quality. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total

suspended solids, Total Coliforms and *E.coli*. Table 32 provides basic statistics for laboratory and core field parameters.

Table 32 Station ID allot1045HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	1		10.35		6.0	0
pH	None	1		7.69		6.0-9.0	0
Specific conductance	uS/cm	1		491.2			
Temperature, water	deg C	1		9.1		22.8	0
Turbidity	NTU	1		0.37		3.38	0
Alkalinity, total	mg/l	1		241			
Chloride	mg/l	1		5.47			
Sulfate	mg/l	1		12.4			
Total suspended solids	mg/l	1		21.5			
Ammonia-nitrogen	mg/l	1		0.064			
Inorganic nitrogen (nitrate and nitrite)	mg/l	1		2.0		1.73	100
Kjeldahl nitrogen	mg/l	1		Not Detected		0.15	0
Phosphorus	mg/l	1		0.01		0.070/0.075	0/0
Soluble Reactive Phosphorus (SRP)	mg/l	1		0.011			
Escherichia coli	MPN/100ml	1		Not Detected			
Total Coliform	MPN/100ml	1		980.4		400	100

Parameters of notable concern include:

- Nitrate+Nitrite value of 2.0 mg/L
- Total Coliform value of 980.4 MPN/100mL
- Total suspended solids value of 21.5 mg/L

No dissolved oxygen, temperature, pH or turbidity values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, the January 2018 sample exceeded the nitrate + nitrite reference criteria. The Total coliform threshold of 400 cfu/ml was exceeded but it is likely this exceedance was the result of wildlife and not human or agricultural sources.

Macroinvertebrate and electrofishing sampling was not completed at station allot1045HCN01 in 2018. This station is scheduled for sampling again in 2022.

In summary, water quality at station allot1045HCN01 is considered excellent based on the limited amount of information collected during 2018. This unnamed stream may serve as a reference stream in the area because it is a headwater stream and is primarily undeveloped upstream of the sampling station and residential subdivision.

<u>UPPER LEMONWEIR RIVER WATERSHED</u>

Stations 1326700HCN01, 1326700HCN02, 1327200HCN01, 5024814HCN01, 5024918HCN01 and 5025163HCN01are located in the Upper Lemonweir River HUC-10 watershed. All streams in the watershed ultimately drain to the Lemonweir River. Numerous impoundments are found throughout the watershed, some of which are used for cranberry production and others are

managed for wildlife production or fishing. Land adjacent to many flowages is county, state or federally owned. The Upper Lemonweir River Watershed is located in the driftless region of the state, which was covered at one time by glacial melt water, also known as Glacial Lake Wisconsin. Evidence of the ancient lakebed in this watershed is found in the extensive acreage of wetlands. Forests also account for a large portion of land cover in the watershed.

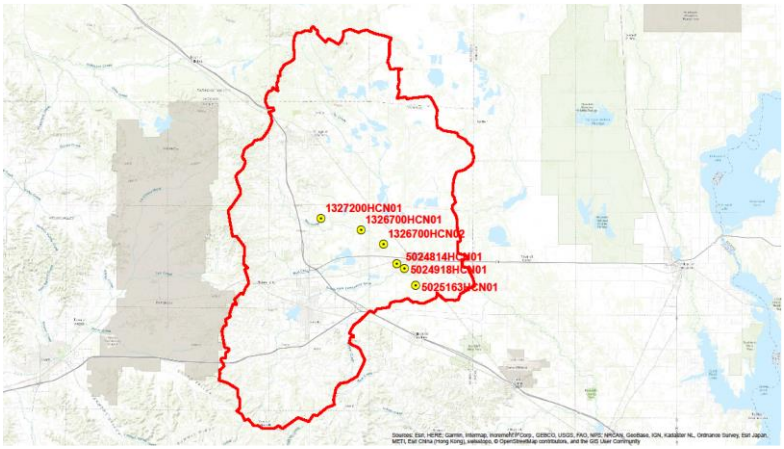

Fig. 16 24k Topographic Map

RB3 Station 1326700HCN01 Mill Creek

Mill Creek, located in northeast Monroe County, flows in a southeasterly direction for nearly 10 miles before reaching the East Fork of the Lemonweir River near Wyeville. Upstream of HWY 12 for five miles, Mill Creek is a Class I trout stream and designated as an Exceptional Resource Water (ERW). Downstream of HWY 12 to the Water Mill Pond, Mill Creek is a Class II trout stream. Below the Water Mill Pond, Mill Creek is not a classified trout stream. Mill Creek provides water for two cranberry operations and has been ditched in its lower reaches. The WDNR has not assigned a specific designated use for those portions of Mill Creek under state jurisdiction and therefore the default designated use of Fish and Aquatic Life (FAL) has been assigned. The default FAL states that the waters are considered fishable and swimmable. The sampling station for Mill Creek is located approximately one mile downstream of the Water Mill Pond in the area that has been ditched and is not classified as trout stream.

Fig. 17 24k Topographic Map

Station 1326700HCN01 was visited during (4) sampling events in January, April, July and October 2018 to monitor baseline water quality. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 33 provides basic statistics for laboratory and core field parameters.

Table 33 Station ID 1326700HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	4	7.66	11.33	9.69	5.0	0
pH	None	4	6.11	8.27	6.93	6.0-9.0	0
Specific conductance	uS/cm	4	118.4	153.7	136.8		
Temperature, water	deg C	4	1.8	24.66	11.41	31.7	0
Turbidity	NTU	4	2.6	37.2	13.79	0.84	100
Alkalinity, total	mg/l	4	28.3	30.1	29.3		
Chloride	mg/l	4	12.8	14.6	14.03		
Sulfate	mg/l	4	3.62	6.91	4.95		
Total suspended solids	mg/l	4	1.6	36.7	13.7		
Ammonia-nitrogen	mg/l	4	0.075	0.393	0.186		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	1.25	4.13	2.02	0.13	100
Kjeldahl nitrogen	mg/l	4	0.54	1.45	1.064	0.33	100
Phosphorus	mg/l	4	0.078	0.216	0.134	0.02875/0.075	100/100
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.063	0.219	0.114		
Escherichia coli	MPN/100ml	4	6.3	>2,419.6	Not Calculated		
Total Coliform	MPN/100ml	4	665.3	>2,419.6	Not Calculated	400	100

Parameters of notable concern include:

- Turbidity ranging from 2.6-37.2 NTU
- Kjeldahl Nitrogen (TKN) ranging from 0.54- 1.45 mg/L
- Nitrate+Nitrite ranging from 1.25-4.13 mg/L
- Total phosphorus values ranging from 0.078-0.216 mg/L
- Total Coliform values ranging from 665.3- >2,419.6 MPN/100mL

No dissolved oxygen, pH or temperature values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all four samples exceeded the turbidity, Kjeldahl nitrogen, nitrate + nitrite and Total phosphorus reference criteria. All samples also exceeded the State of Wisconsin Total P standard of 0.075 mg/L. The Total coliform threshold of 400 cfu/ml was exceeded in all samples.

Macroinvertebrate sampling was also completed at station 1326700HCN01. Table 34 provides a summary of the macroinvertebrate data.

Table 34 Macroinvertebrate Data Station 1326700HCN01							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/22/2018	7.472	7.048	4.26	7.633	2.502	33	26

The IBI condition gradient rating for Mill Creek at station 1326700HCN01 is “fair” and management actions should consider restoration to improve the water quality conditions. The HBI water quality rating is “fairly poor” indicating a significant degree of organic pollution. The FBI value rating was “very poor” suggesting that severe organic pollution is likely. The diversity index and richness values indicated a fairly diverse community of species that are tolerant of degraded water quality.

An electrofishing survey was completed at station 1326700HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream on 4/23/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. Unfortunately, the logger was missing when the cinder block anchor was recovered during the site visit 10/9/18. Regardless, the stream is known to be a warm-water system and therefore the warm-water IBI for fish was applied. Table 35 provides a summary of the fish data.

Table 35 Fish Data Station 1326700HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/15/2018	warm-water	Not Determined	Not Calculated	Very Poor	<50 individuals captured

The fish survey resulted in less than 50 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. Four individual fish of two species were captured including Golden shiner and Brown bullhead.

In summary, water quality at station 1326700HCN01 should be considered poor based on the information collected during 2018. Water quality is negatively impacted by channelization, non-point source runoff and impoundments. These impacts result in degraded habitat, poor water clarity, elevated stream temperature and high levels of nutrients.

RB3 Station 1326700HCN02 Mill Creek

Station 1326700HCN02 is located on tribal trust land downstream of station 1326700HCN01. This segment of Mill Creek has been severely altered by historic ditching that was done for agricultural purposes to promote cultivation of cranberries and traditional row crops in marginal areas. This sampling station is located approximately 0.24 miles upstream of the State Highway 173 road crossing.

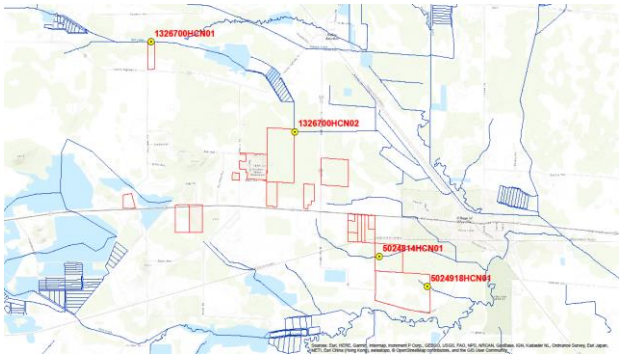

Fig. 18 24k Topographic Map

Station 1326700HCN02 was visited during (4) sampling events in January, April, July and October 2018 to monitor baseline water quality. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli. Table 36 provides basic statistics for laboratory and core field parameters.

Table 36 **Station ID** **1326700HCN02**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	4	6	9.15	7.23	5.0	0
pH	None	4	4.6	6.23	5.50	6.0-9.0	75
Specific conductance	uS/cm	4	36.2	110.5	72.8		
Temperature, water	deg C	4	0.7	20.34	11.31	31.7	0
Turbidity	NTU	4	2.04	6.9	3.81	0.84	100
Alkalinity, total	mg/l	4	1.52	23.2	10.7		
Chloride	mg/l	4	3.83	12.2	7.99		
Sulfate	mg/l	4	Not Detected	8.99	Not Calculated		
Total suspended solids	mg/l	4	3.5	8.6	6.3		
Ammonia-nitrogen	mg/l	4	0.061	0.276	0.128		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.115	0.587	0.33	0.13	75
Kjeldahl nitrogen	mg/l	4	0.627	1.48	0.898	0.33	100
Phosphorus	mg/l	4	0.051	0.115	0.07	0.02875/0.075	100/25
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.018	0.081	0.042		
Escherichia coli	MPN/100ml	4	6.3	1732.9	825.8		
Total Coliform	MPN/100ml	4	58.4	>2,419.6	Not Calculated	400	75

Parameters of notable concern include:

- Turbidity ranging from 2.04-6.9 NTU
- Kjeldahl Nitrogen (TKN) ranging from 0.627- 1.48 mg/L
- Nitrate + Nitrite ranging from 0.115 – 0.587 mg/L
- Total phosphorus values ranging from 0.051-0.115 mg/L
- Total Coliform values ranging from 58.4- >2,419.6 MPN/100mL

No dissolved oxygen or temperature values exceeded the established threshold criteria. 75% of samples exceeded the pH threshold but low pH values are common in this watershed. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all four samples exceeded the turbidity, Kjeldahl nitrogen and Total phosphorus reference criteria. Three samples exceeded the EPA reference criteria for Nitrate + Nitrite. One sample exceeded the State of Wisconsin Total P standard of 0.075 mg/L. The Total coliform threshold of 400 cfu/ml was exceeded in 75% of samples.

Macroinvertebrate sampling was also completed at station 1326700HCN02. Table 37 provides a summary of the macroinvertebrate data.

Table 37 Macroinvertebrate Data Station 1326700HCN02							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/22/2018	7.170	5.268	5.26	7.209	1.438	18	18

The IBI condition gradient rating for Mill Creek at station 1326700HCN02 is "good" and management actions should be aimed at maintaining and improving this condition. The HBI water quality rating is "fairly poor" indicating a significant degree of organic pollution. The FBI value rating was "poor" indicating a very substantial degree of organic pollution. The diversity index and richness values indicated a limited range of aquatic life.

An electrofishing survey was completed at station 1326700HCN02 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 4/23/18 to 10/9/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. Table 38 provides a summary of the fish data.

Table 38 Fish Data Station 1326700HCN02

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/15/2018	Cold-water	22.18	Not Calculated	Very Poor	No fish captured or observed

This segment of Mill Creek had minimal flow during the visit with only small pockets of water. Conditions did not allow fish passage and the segment lacked available water to support fish populations. Sampling efforts focused on these very small non-contiguous pockets of water and no fish were captured or observed during the August survey. No discharge measurements were taken because the cross section was too shallow for equipment to obtain velocity readings.
In summary, water quality at station 1326700HCN02 should be considered poor to fair based on the information collected during 2018. Water quality is negatively impacted by channelization, impoundments and water quantity issues that may be attributable to the commercial cranberry industry in this area.

RB3 Station 1327200HCN01 unnamed (Mill Creek Tributary)
This unnamed tributary to Mill Creek originates in a wetland area and flows southeasterly through undeveloped land for approximately one mile before entering Mill Creek 0.25 miles above the Water Mill Pond. This tributary is associated with the portion of Mill Creek that is classified as a Class II trout stream.

Fig. 19 24k Topographic Map


Station Photo facing upstream October 9, 2018

Station 1327200HCN01 was visited on (4) sampling events in January, April, July and October 2018 to monitor baseline water quality. The station was not sampled in January because the entire water column was frozen. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 39 provides basic statistics for laboratory and core field parameters.

Table 39 Station ID 1327200HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	4.45	8.46	6.25	6.0	67
pH	None	3	5.34	6.22	5.81	6.0-9.0	67
Specific conductance	uS/cm	3	180.3	212.7	197.9		
Temperature, water	deg C	3	4.89	19.93	12.74	22.8	0
Turbidity	NTU	4	1.87	5.1	3.31	0.84	100
Alkalinity, total	mg/l	3	11.6	25.4	17.0		
Chloride	mg/l	3	32.7	47.1	38.63		
Sulfate	mg/l	3	Not Detected	2.95	Not Calculated		
Total suspended solids	mg/l	3	4	5.8	4.7		
Ammonia-nitrogen	mg/l	3	0.057	0.138	0.104		
Inorganic nitrogen (nitrate and nitrite)	mg/l	3	0.106	2.57	0.99	0.13	67
Kjeldahl nitrogen	mg/l	3	0.876	1.88	1.219	0.33	100
Phosphorus	mg/l	3	0.04	0.066	0.051	0.02875/0.075	100/0
Soluble Reactive Phosphorus (SRP)	mg/l	3	0.011	0.044	0.023		
Escherichia coli	MPN/100ml	3	21.1	2419.6	869.0		
Total Coliform	MPN/100ml	3	866.4	>2,419.6	Not Calculated	400	100

Parameters of notable concern include:

- Dissolved oxygen values ranging from 4.45-8.46 mg/L
- Turbidity values ranging from 1.87 – 5.1 mg/L
- Kjeldahl Nitrogen (TKN) values ranging from 0.876- 1.88 mg/L
- Nitrate+Nitrite ranging from 0.106-2.57 mg/L
- Total phosphorus ranging from 0.04-0.066 mg/L.
- Total Coliforms ranging from 866.4- >2,419.6 MPN/100mL.

Two samples exceeded the dissolved oxygen and pH threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all three samples exceeded the Turbidity, Kjeldahl nitrogen and Total phosphorus reference criteria. No Total P values exceeded the State of Wisconsin standard of 0.075 mg/L. Two samples exceeded the EPA criteria for Nitrate + Nitrite. The Total coliform threshold of 400 cfu/ml was exceeded in all three samples.

Macroinvertebrate sampling was also completed at station 1327200HCN01. Table 40 provides a summary of the macroinvertebrate data.

Table 40 Macroinvertebrate Data Station 1327200HCN01							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/22/2018	6.909	6.342	0.24	7.088	1.427	9	9

The IBI condition gradient rating for this unnamed creek is “poor”. The HBI water quality rating is “fairly poor” suggesting a significant degree of organic pollution. The FBI value rating was “poor” indicating a very substantial degree of organic pollution. The diversity index and richness values indicated a limited range of aquatic life.

An electrofishing survey was completed at station 1327200HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 4/23/18 to 10/9/18 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. Table 41 provides a summary of the fish data.

Table 41 Fish Data Station 1327200HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/15/2018	Cold-water	22.436	Not Calculated	Very Poor	<25 individual fish captured

The fish survey resulted in less than 25 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. Nine individuals were captured including six Brook stickleback and three Central mudminnow.

In summary, water quality at station 1327200HCN01 should be considered fair based on the information collected during 2018. This is a headwater stream that originates in a forested wetland area. There does not appear to be run-off from non-point sources directly affecting the stream. The poor biological metrics are likely due to the natural conditions found in this wetland community type that is characterized by very high organic material resulting in mucky substrate in the stream channel and adjacent Tag alder swamp wetlands.

RB3 Station 5025163HCN01 unnamed (Smoke)
Station 5025163HCN01 is associated with a man-made drainage ditch that flows northerly for approximately 1.25 miles before entering a wetland area adjacent to the South Fork Lemonweir River. A review of historical aerial photography for this area indicates that the drainage was constructed prior to April 1939. The drainage was likely constructed in an attempt to improve areas for traditional row crop agriculture.

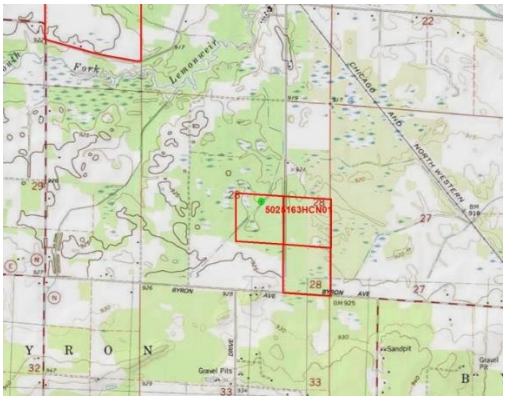

Fig. 20 24k Topographic Map

Station 5025163HCN01 was visited on (4) sampling events in January, April, July and October 2018. The station was dry and not sampled when visited during January and July. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 42 provides basic statistics for laboratory and core field parameters.

Table 42 Station ID 5025163HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	2	3.37	9.04	6.21	5.0	50
pH	None	2	4.86	5.26	5.06	6.0-9.0	100
Specific conductance	uS/cm	2	36.7	46	41.4		
Temperature, water	deg C	2	6.96	13.9	10.43	31.7	0
Turbidity	NTU	1		2.54	Not Calculated	0.84	100
Alkalinity, total	mg/l	2	5.51	9.87	7.69		
Chloride	mg/l	2		Not Detected			
Sulfate	mg/l	2	Not Detected	2.54	Not Calculated		
Total suspended solids	mg/l	2	3.3	4.67	3.99		
Ammonia-nitrogen	mg/l	2	0.064	0.193	0.128		
Inorganic nitrogen (nitrate and nitrite)	mg/l	2	0.052	0.207	0.13	0.13	50
Kjeldahl nitrogen	mg/l	2	1.23	1.32	1.28	0.33	100
Phosphorus	mg/l	2	0.092	0.122	0.107	0.02875/0.075	100/100
Soluble Reactive Phosphorus (SRP)	mg/l	2	0.043	0.056	0.05		
Escherichia coli	MPN/100ml	2	6.3	2419.6	1213.0		
Total Coliform	MPN/100ml	2	>2,419.6		Not Calculated	400	100

Parameters of notable concern include:

- Nitrate + Nitrite values of 0.052 and 0.207 mg/L
- Kjeldahl Nitrogen (TKN) values of 1.23 and 1.32 mg/L
- Total Coliform values >2,419.6 MPN/100mL
- Total phosphorus values of 0.092 and 0.122 mg/L

Both samples exceeded the pH threshold and one exceeded the dissolved oxygen threshold. Low pH values are expected in forested drainage areas in this area where reducing conditions are often found. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, the both samples exceeded the Kjeldahl nitrogen and Total phosphorus reference criteria. The Total P values also exceeded the State of Wisconsin standard of 0.075 mg/L. One sample exceeded the Nitrate + nitrite criteria. The Total coliform threshold of 400 cfu/ml was also exceeded in both samples.

Macroinvertebrate sampling was also completed at station 5025163HCN01. Table 43 provides a summary of the macroinvertebrate data.

Table 43 Macroinvertebrate Data Station 5025163HCN01							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/22/2018	6.231	6.231	1.61	5.467	1.811	9	8

The IBI condition gradient rating for this unnamed waterway is "poor". The HBI water quality rating is "fair" suggesting a fairly significant degree of organic pollution. The FBI value rating was "fair" indicating a fairly substantial degree of organic pollution. The diversity index and richness values indicated a limited range of aquatic life.

An electrofishing survey was not completed at station 5025163HCN01 because the site lacked available water during the visit. A temperature data logger was deployed in the stream from 4/23/18 to 10/9/18 to collect hourly temperature readings. The data has not been used for stream assessment because the temperature sensor was periodically exposed to air when the channel was dry or water elevation dropped below the temperature sensor. This reach of the waterway is incapable of supporting a population of fish throughout the year but likely contains minnow species at times when there is sufficient available water.

In summary, water quality at station 5025163HCN01 should be considered fair based on the information collected during 2018. This is a drainage that originates in a forested wetland area. There appears to be minimal impact from surrounding land-use.

RB3 Station 5024814HCN01 unnamed (Greendeer)

Station 5024814HCN01 is associated with an intermittent drainage that flows generally east for approximately 1.85 miles before entering the South Fork Lemonweir River. The monitoring station is located on tribal land approximately 1.05 miles upstream from the confluence with the Lemonweir. The waterway was historically ditched downstream of tribal land but this ditch network has not been maintained and has numerous obstructions and/or breaches that affect hydrology. Tribal members have become increasingly concerned with water quality and quantity issues related to this waterway because of an upstream sand mining operation. The upstream mine had a dewatering and wetland fill violation in 2016 that resulted in a release of sediment laden water. Operators implemented corrective measures and continue to operate within an approved WDNR permit that allows the release of "clean" dewatering water into this waterway. Dewatering activities have been occurring in late fall or winter at times when the water table elevation is normally low. It has also resulted in thick ice sheets covering a large portion of the wetland area for months at a time. The Nation is concerned about the long-term impacts of upstream dewatering releases on the wetland community and how it may change the plant and wildlife community associated with this area.

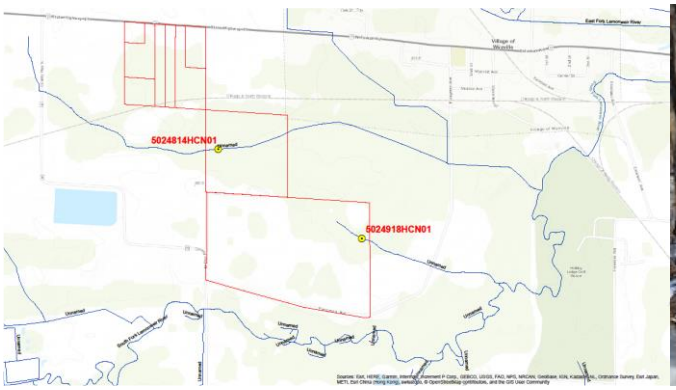

Fig.21 24k Topographic Map

Station Photo November 2018
Inundation from Mine Dewatering

Station 5024814HCN01 was visited on (4) sampling events in January, April, July and October 2018. The site was inundated and frozen with dewatering water on January 9th and dry when visited on July 23rd. The site was also inundated with dewatering water when visited on October 9th and was also not sampled during this event because the sampling reach was indistinguishable from the surrounding flooded timber that resembled a hardwood swamp. During the April visit, core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and *E.coli*. Table 44 provides basic statistics for laboratory and core field parameters.

Table 44 Station ID 5024814HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	1		8.31		5.0	0
pH	None	1		5.76		6.0-9.0	100
Specific conductance	uS/cm	1		49.9			
Temperature, water	deg C	1		19.34		31.7	0
Turbidity	NTU	1		5.77		0.84	100
Alkalinity, total	mg/l	1		8.56			
Chloride	mg/l	1		5.58			
Sulfate	mg/l	1		4.29			
Total suspended solids	mg/l	1		12.2			
Ammonia-nitrogen	mg/l	1		0.213			
Inorganic nitrogen (nitrate and nitrite)	mg/l	1		0.025		0.13	0
Kjeldahl nitrogen	mg/l	1		1.36		0.33	100
Phosphorus	mg/l	1		0.044		0.02875/0.075	100/0
Soluble Reactive Phosphorus (SRP)	mg/l	1		0.018			
Escherichia coli	MPN/100ml	1		6.3			
Total Coliform	MPN/100ml	1		66.7		400	0

Parameters of notable concern include:

- Turbidity value of 5.77 NTU
- Kjeldahl Nitrogen (TKN) value of 1.36 mg/L
- Total phosphorus value of 0.044 mg/L

The sample exceeded the pH threshold but low pH values are normal in forested drainage areas in this area where reducing conditions are often present. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, the sample exceeded the turbidity, Kjeldahl nitrogen and Total phosphorus reference criteria. The Total P value did not exceed the state standard.

Macroinvertebrate sampling was also completed at station 5024814HCN01. Table 45 provides a summary of the macroinvertebrate data.

Table 45 Macroinvertebrate Data Station 5024814HCN01							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/24/2018	4.20	4.20	5.87	5.50	1.706	8	8

The IBI condition gradient rating for this unnamed waterway is “good” and management actions should focus on maintaining this condition. The HBI water quality rating is “very good”

suggesting a possible slight degree of organic pollution. The FBI value rating was "fair" indicating a fairly substantial degree of organic pollution. The diversity index and richness values indicated a limited range of aquatic life. One factor potentially affecting macroinvertebrate community structure in this waterway is the upstream sand mine that discharges to this waterway during pit dewatering operations.

An electrofishing survey was not completed at station 5024814HCN01 because the site lacked available water during the visit on August 15th. A temperature data logger was deployed in the stream from 4/23/18 to 10/9/18 to collect hourly temperature readings. The data has not been used for stream assessment because the temperature sensor was periodically exposed to air when the channel was dry or water elevation dropped below the temperature sensor. This reach of the waterway is incapable of supporting a population of fish throughout the year.

In summary, water quality at station 5024814HCN01 should still be considered good based on the limited information collected during 2018. The Nation is concerned with the upstream sand mining operation that releases pit water into the waterway during dewatering activities. Measures are in place at the mine site to remove suspended solids, but inundation of this waterway and surrounding lands is occurring more frequently and during periods when this waterway was historically dry or at low flow.

RB3 Station 5024918HCN01 unnamed (Shaw)
Station 5024918HCN01 is associated with a man-made drainage that flows generally east for approximately 0.55 miles before entering the South Fork Lemonweir River. The monitoring station is located on tribal land approximately 0.45 miles upstream from the confluence with the Lemonweir. The waterway originates from a forested wetland area on tribal land and is entirely ditched through forested and agricultural areas.

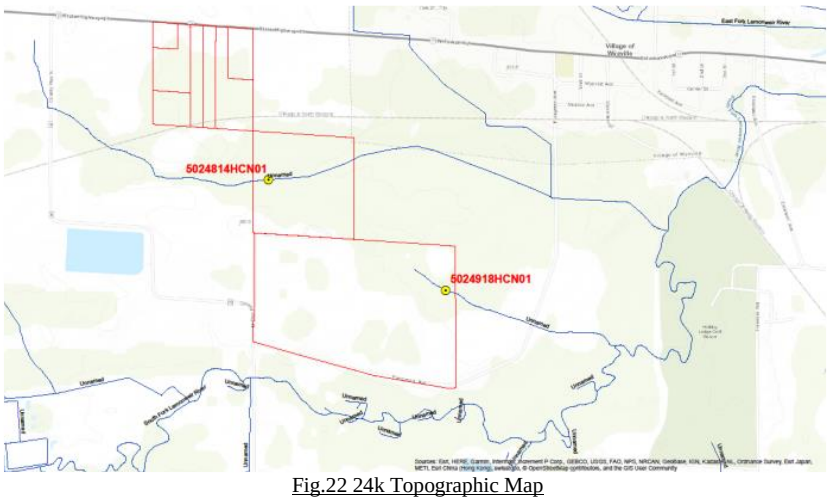

Fig.22 24k Topographic Map

Station 5024918HCN01 was visited on (4) sampling events in January, April, July and October 2018. The site was dry when visited on these occasions. The site was also dry when visited for macroinvertebrate and fish sampling on May 24th and August 15th respectively. In addition, a temperature data logger was deployed in the stream on 4/23/18 but was subsequently removed

during the July visit because the site lacked water and clearly is incapable of supporting a fish population.

In summary, assessment of water quality at station 5024814HCN01 was not possible during 2018 and is unlikely in the near future unless conditions were to drastically change at this site. This station will be revaluated prior to monitoring RB3 stations again in 2023.

Hemlock Creek Watershed

RB4 Stations 1366300HCN01 and 1367000HCN01are located in the Hemlock Creek HUC-10 watershed. The Hemlock Creek Watershed is 96.39 square miles and is found in the central Wisconsin counties of Wood and Juneau. Hemlock Creek Watershed ultimately drains into the Wisconsin River. The watershed is located in the transition between the northern forest ecological landscape zone and the central sand plains zone that is associated with glacial Lake Wisconsin.

Several cranberry marshes exist within the Hemlock Creek Watershed. There are concerns that contaminants from fertilizers and pesticides are being discharged from various nonpoint sources and may be degrading water quality and harming sensitive aquatic species.

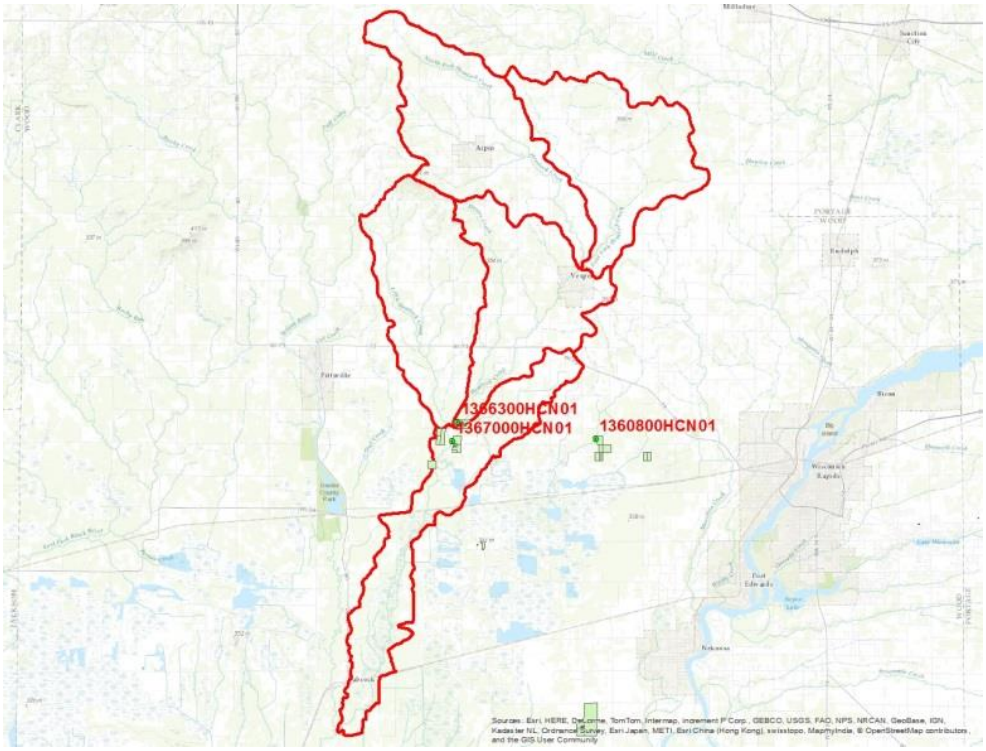

Fig. 23 Topographic Map (Interior lines delineate HUC-12 sub-watersheds)

RB4 Station 1366300HCN01 Hemlock Creek

Hemlock Creek flows for 38 miles before joining with the Yellow River south of the unincorporated town of Babcock. The creek is the receiving water for the Arpin and Vesper municipal Wastewater Treatment Plants. This reach of Hemlock Creek is designated with the Warm-water Forage Fishery Designated Use by the WDNR, but is currently attaining the default Fish and Aquatic Life Use. The WDNR assessed this water during the 2012 303D listing cycle,

and total phosphorus data exceeded the listing criteria for the fish and aquatic life use. However, the available biological data do not indicate impairment.

Station 1366300HCN01 is located on allotment trust approximately 0.35 miles upstream from the Hemlock Road bridge crossing. The site is accessed via a forestry road on the tribal parcel.

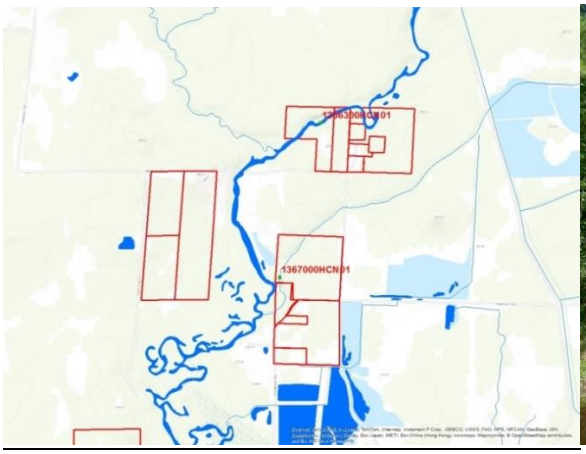

Fig. 24 Topographic Map

Facing Upstream from Hemlock Road Bridge

Station 1366300HCN01 was visited on (4) sampling events in January, April, July and October 2019 to complete baseline monitoring at this rotating station. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli. Table 46 provides basic statistics for laboratory and core field parameters.

Table 46 **Station ID** **1366300HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	2	11.39	11.93	11.66	5.0	0
pH	None	4	6.87	8.00	7.24	6.0-9.0	0
Specific conductance	uS/cm	4	83.9	130.1	110.5		
Temperature, water	deg C	4	0.03	23.14	9.54	31.7	0
Turbidity	NTU	4	2.38	11.09	6.73	0.84	100
Alkalinity, total	mg/l	4	17.7	34.9	27.6		
Chloride	mg/l	4	7.17	15.7	9.96		
Sulfate	mg/l	4	3.14	9.47	5.72		
Total suspended solids	mg/l	4	3.2	10.1	5.4		
Ammonia-nitrogen	mg/l	4	0.077	0.102	0.0875		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.503	1.64	0.804	0.13	100
Kjeldahl nitrogen	mg/l	4	0.929	1.37	1.09	0.33	100
Phosphorus	mg/l	4	0.135	0.265	0.184	0.02875/0.075	100/100
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.046	0.197	0.121		
Escherichia coli	MPN/100ml	4	12.1	727	331.9		
Total Coliform	MPN/100ml	4	579.4	>2419.6	1959.6	400	100

Parameters of notable concern include:

- Turbidity ranging from 2.38 – 11.09 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.929 – 1.37 mg/L

- Nitrate+Nitrite ranging from 0.503 – 1.64 mg/L.
- Total Phosphorus ranging from 0.135 - 0.265 mg/L.
- Total Coliforms values 579.4 - >2,419.6 MPN/100mL.

No temperature, pH or dissolved oxygen values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, the (4) samples were above the threshold values for turbidity, Kjeldahl nitrogen, Nitrate+Nitrite and Total Phosphorus. All samples also exceeded Total P State of Wisconsin standard of 0.075 mg/L and the Total coliform threshold of 400 cfu/ml.

Macroinvertebrate sampling was also completed at station 1366300HCN01. The table below provides a summary of the macroinvertebrate data.

Table 47 Macroinvertebrate Data Station 1366300HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/5/2019	5.37	6.13	2.76	4.63	1.72	16	16

The IBI condition gradient rating at station 1366300HCN01 is "good" and efforts should focus on maintaining this condition. The HBI water quality rating for this station is "good" with some organic pollution. The FBI value rating was "good" also indicating that some organic pollution was probable. The diversity index and richness values indicated a range of aquatic life.

An electrofishing survey was completed at station 1366300HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream on 6/18/19 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. Staff was unable to locate the logger on 12/4/19 and it is presumed to have been tampered with and lost. The 106 Program reviewed available temperature information and concluded the use of the warm-water IBI for fish. Table 48 provides a summary of the fish data.

Table 48 Fish Data Station 1366300HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
6/27/2019	warm-water	Not Determined	Not Calculated	Very Poor	<50 individuals captured

The fish survey resulted in less than 50 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. (33) Individuals were captured comprised of six native species, most individuals captured were minnow species.

In summary, water quality at station 1366300HCN01 should be considered fair based on the information collected during 2019. This stream is heavily influenced by non-point source run-off related to row crop agriculture and cranberry operations in the watershed. These activities contribute to elevated levels of nutrients and suspended sediments along with elevated water temperatures.

RB4 Station 1367000HCN01 unnamed (Manly Creek)

This unnamed waterway is part of a severely altered drainage system associated with various cranberry growing operations in the area. The sampling station is located approximately 0.37 miles downstream from the box culvert crossing on Hemlock Rd and approximately 0.21 miles upstream from the confluence with Hemlock Creek. The sampling station is accessed via a walking path on allotment trust land.

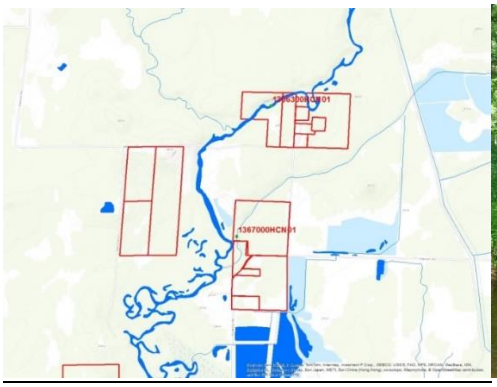

Fig. 25 Topographic Map

Facing upstream at Sampling Station

Station 1367000HCN01 was visited on (4) sampling events in January, April, July and October 2019 to complete baseline monitoring at this rotating station. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli. The site was not sampled or monitored in April due to inundation of this creek from nearby Hemlock Creek. Table 49 provides basic statistics for laboratory and core field parameters.

Table 49 **Station ID** **1367000HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	2	9.76	10.63	10.20	5.0	0
pH	None	4	6.44	7.11	6.68	6.0-9.0	0
Specific conductance	uS/cm	4	48.6	164.1	86.7		
Temperature, water	deg C	4	0.04	23.5	9.69	31.7	0
Turbidity	NTU	4	2.88	13	7.15	0.84	100
Alkalinity, total	mg/l	4	10.3	22.5	15.8		
Chloride	mg/l	4	4.24	8.46	5.70		
Sulfate	mg/l	4	2.88	6.54	4.10		
Total suspended solids	mg/l	4	4.8	8.5	6.1		
Ammonia-nitrogen	mg/l	4	0.131	0.242	0.1748		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.113	0.307	0.183	0.13	75
Kjeldahl nitrogen	mg/l	4	0.809	1.24	0.97	0.33	100
Phosphorus	mg/l	4	0.070	0.133	0.096	0.02875/0.075	100/75
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.035	0.075	0.061		
Escherichia coli	MPN/100ml	4	9.8	275.5	100.6		
Total Coliform	MPN/100ml	4	42.2	>2419.6	1825.3	400	75

Parameters of notable concern include:

- Turbidity ranging from 2.88 – 13 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.809 – 1.24 mg/L
- Nitrate+Nitrite ranging from 0.113 – 0.307 mg/L.
- Total Phosphorus ranging from 0.070 - 0.133 mg/L.
- Total Coliforms values ranging from 42.2 - >2,419.6 MPN/100mL.

No temperature, pH or dissolved oxygen values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples were above the threshold values for turbidity, Kjeldahl nitrogen and Total Phosphorus with three exceeding the Nitrate+Nitrite threshold. Three phosphorus and Total coliform values also exceeded the State of Wisconsin standards of 0.075 mg/L and 400 MPN/100mL respectively.

Macroinvertebrate sampling was also completed at station 1367000HCN01. The table below provides a summary of the macroinvertebrate data.

Table 50 Macroinvertebrate Data Station 1367000HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/5/2019	6.77	6.77	6.04	6.08	1.93	8	8

The IBI condition gradient rating at station 1367000HCN01 is "fair" and efforts should focus on restoration. The HBI water quality rating for this station is "fairly poor" with significant organic pollution. The FBI value rating was "fairly poor" also indicating that organic pollution was substantial. The diversity index and richness values indicated a range of aquatic life.

An electrofishing survey was completed at station 1367000HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 6/18/19 to 12/4/19 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. Table 51 provides a summary of the fish data.

Table 51 Fish Data Station 1367000HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
9/25/19	cold-water	23.08	Not calculated	Very poor	<25 individuals captured

The fish survey resulted in less than 25 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. (19) Individuals were captured in total with (11) Creek chub, (3) Yellow perch, (2) White sucker and the remaining fish being minnow species.

In summary, water quality at station 1367000HCN01 should be considered poor to fair based on the information collected during 2019. This stream is affected by upstream cranberry operations that likely contribute to elevated levels of nutrients and stream temperature. Water quantity is likely affected at various times throughout the year due to water needs related to irrigation and harvesting of the cranberry crop.

Cranberry Creek Watershed

RB4 Stations 1360800HCN01 is located in the Cranberry Creek HUC-10 watershed. The Cranberry Creek Watershed is 127.51 square miles and is found in the central Wisconsin counties of Wood and Juneau. The watershed ultimately drains into the Wisconsin River. The watershed is located in the ecological landscape of the central sand plains which is associated with glacial Lake Wisconsin.

As the name implies, Cranberry Creek Watershed is mainly cranberry marshes. There are 17 to 20 cranberry-growing operations with over 100 cranberry bogs. There is a concern that nutrients from fertilizers and pesticides discharged from these marshes could be degrading water quality and harming sensitive species of aquatic life.

Fig. 26 Topographic Map (Interior lines delineate HUC-12 sub-watersheds)

RB4 Station 1360800HCN01 Elm Creek

Elm Creek flows for seven miles before entering the cranberry bogs of the township of Cranmoor in Wood County. The WDNR defined attainable use for Elm Creek is as a Warm Water Sport Fishery. The designated use is the default Fish and Aquatic Life Use. Sampling Station 1360800HCN01 is located on allotment trust approximately 0.62 miles upstream of the Young Rd. bridge crossing.

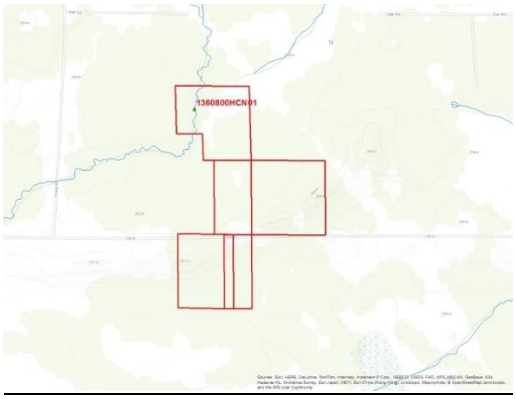

Fig. 27 Topographic Map

Station 1360800HCN01 was visited on (4) sampling events in January, April, July and October 2019 to complete baseline monitoring at this rotating station. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli. Table 52 provides basic statistics for laboratory and core field parameters.

Table 52 **Station ID** **1360800HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	2	10.58	10.88	10.73	5.0	0
pH	None	4	6.53	7.23	6.87	6.0-9.0	0
Specific conductance	uS/cm	4	77.8	142.5	102.3		
Temperature, water	deg C	4	-0.06	22.5	8.76	31.7	0
Turbidity	NTU	4	4.88	12	7.54	0.84	100
Alkalinity, total	mg/l	4	12.2	38.3	27.4		
Chloride	mg/l	4	6.82	19.6	11.29		
Sulfate	mg/l	4	3.05	12.1	6.11		
Total suspended solids	mg/l	4	4.1	9.4	5.7		
Ammonia-nitrogen	mg/l	4	0.067	0.119	0.0865		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.192	0.628	0.326	0.13	100
Kjeldahl nitrogen	mg/l	4	0.841	1.39	1.04	0.33	100
Phosphorus	mg/l	4	0.086	0.218	0.157	0.02875/0.075	100/100
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.042	0.133	0.086		
Escherichia coli	MPN/100ml	4	2	307.6	111.8		
Total Coliform	MPN/100ml	4	387.3	>2419.6	1739.9	400	75

Parameters of notable concern include:

- Turbidity ranging from 4.88 – 12 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.841 – 1.39 mg/L
- Nitrate+Nitrite ranging from 0.192 – 0.628 mg/L.
- Total Phosphorus ranging from 0.086 - 0.218 mg/L.
- Total Coliforms values ranging from 387.3 - >2,419.6 MPN/100mL.

No temperature, pH or dissolved oxygen values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, the four samples were above the threshold values for turbidity, Kjeldahl nitrogen, Nitrate of Nitrite and Total

Phosphorus. All Total P values also exceeded the State of Wisconsin standard of 0.075 mg/L. The Total coliform threshold of 400 cfu/ml was exceeded in three samples collected in 2019.

Macroinvertebrate sampling was also completed at station 1360800HCN01. The table below provides a summary of the macroinvertebrate data.

Table 53 Macroinvertebrate Data Station 1360800HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/5/2019	5.43	5.38	4.37	4.81	2.35	34	32

The IBI condition gradient rating at station 1360800HCN01 is "good" and efforts should focus on maintaining this condition. The HBI water quality rating for this station is "good" with some organic pollution. The FBI value rating was "excellent" also indicating that organic pollution was unlikely. The diversity index and richness values indicated a range of aquatic life.

An electrofishing survey was completed at station 1360800HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 6/18/19 to 12/4/19 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the warm-water IBI for fish. Table 54 provides a summary of the fish data.

Table 54 Fish Data Station 1360800HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
10/17/19	warm-water	24.86	Not calculated	Very Poor	<50 individuals captured

The fish survey resulted in less than 50 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. (17) Individuals were captured with one White sucker and (16) Central mudminnow being the two species.

In summary, water quality at station 1360800HCN01 should be considered fair based on the information collected during 2019. This stream is heavily influenced by non-point source run-off related to row crop agriculture and cranberry operations in the watershed. These activities contribute to elevated levels of nutrients and suspended sediments along with elevated water temperatures.

Little Roche a Cri Creek Watershed

RB4 station 1351400HCN01 is located in the Little Roche a Cri Creek HUC-10 watershed. The Little Roche a Cri Creek Watershed is 196.2 square miles and is found in the central Wisconsin counties of Adams, Waushara and Marquette. The watershed ultimately drains into the Wisconsin River. The watershed is located in the ecological landscape zone of the central sand plains which is associated with glacial Lake Wisconsin.

The basin is characterized by agricultural activities throughout with intensive row cropping taking place in the central sands region. The last glaciers to flatten Wisconsin only stretched

through part of the basin, consequently affecting the Little Roche-A-Cri Watershed topography. The glaciers created a network of warm and cold water streams fed by surface and groundwater sources that all connect to the Wisconsin River. The Central Wisconsin River Basin has one of the largest and most diverse arrays of surface water systems in the state.

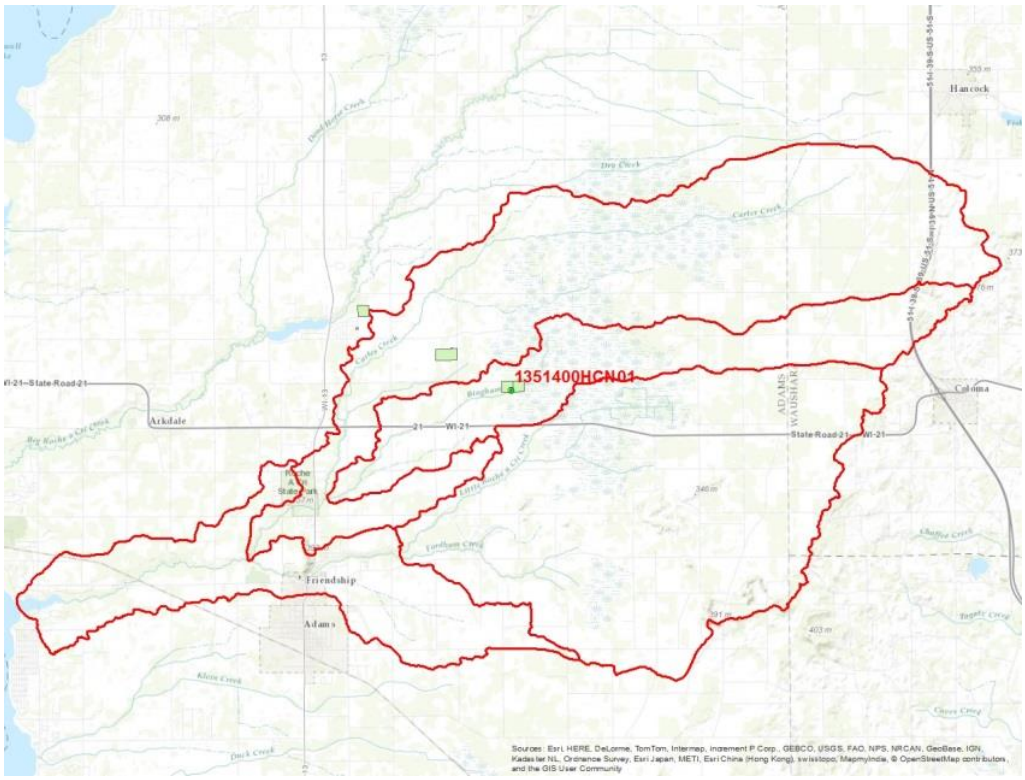

Fig. 28 Topographic Map (Interior lines delineate HUC-12 Sub-watersheds)

RB4 station 1351400HCN01 Bingham Creek

Bingham Creek is an 8.42 mile waterway classified as a forage fishery by the WDNR. The stream is a clear, hard water stream that flows in a southwest direction and is a tributary of Carter Creek. Sand and silt are the dominant bottom types. Beaver are present and have dammed portions of the stream altering water elevation and the flow regime. Station 1351400HCN01 is located approximately 1.32 miles upstream of the 8th Drive road crossing. The site is located on allotment trust and is accessed via a forestry road and then walking across the stream floodplain.

Fig. 29 Topographic Map

Facing Upstream at Sampling Station

Station 1351400HCN01 was visited on (4) sampling events in January, April, July and October 2019 to complete baseline monitoring at this rotating station. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli. The site was not sampled or monitored in April due to the town road being blocked by multiple downed trees. Table 55 provides basic statistics for laboratory and core field parameters.

Table 55 Station ID 1351400HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	2	9.14	9.29	9.22	5.0	0
pH	None	4	5.73	7.21	6.55	6.0-9.0	25
Specific conductance	uS/cm	4	62.7	170.2	110.5		
Temperature, water	deg C	4	0.48	21.4	8.95	31.7	0
Turbidity	NTU	4	2.36	8.91	6.39	0.84	100
Alkalinity, total	mg/l	4	30.3	91.8	60.5		
Chloride	mg/l	4	1.28	2.3	1.85		
Sulfate	mg/l	4	0.75	2.18	1.11		
Total suspended solids	mg/l	4	1	4.33	2.21		
Ammonia-nitrogen	mg/l	4	0.043	0.138	0.0853		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.018	0.069	0.038	0.13	0
Kjeldahl nitrogen	mg/l	4	0.557	1.44	0.91	0.33	100
Phosphorus	mg/l	4	0.024	0.06	0.037	0.02875/0.075	75/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.01	0.035	0.019		
Escherichia coli	MPN/100ml	4	3	108.1	49.0		
Total Coliform	MPN/100ml	4	7.4	>2419.6	1128.0	400	50

Parameters of notable concern include:

- Turbidity ranging from 2.36 – 8.91 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.557 – 1.44 mg/L
- Total Phosphorus ranging from 0.024 - 0.06 mg/L.
- Total Coliforms values ranging from 7.4 - >2,419.6 MPN/100mL.

The pH threshold was exceeded for one measurement. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples were above the threshold values for Kjeldahl nitrogen and three were above the phosphorus threshold. None of the samples exceeded the State of Wisconsin phosphorus standard of 0.075 mg/L. The Total coliform threshold of 400 cfu/ml was exceeded in two samples.

Macroinvertebrate sampling was also completed at station 1351400HCN01. The table below provides a summary of the macroinvertebrate data.

Table 56 Macroinvertebrate Data Station 1351400HCN01							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/4/2019	5.44	5.03	4.41	5.42	2.29	19	18

The IBI condition gradient rating at station 1351400HCN01 is "fair" and efforts should focus on restoration. The HBI water quality rating for this station is "fair" with fairly significant organic pollution. The FBI value rating was "fair" also indicating that organic pollution was fairly substantial. The diversity index and richness values indicated a range of aquatic life.
An electrofishing survey was completed at station 1351400HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 6/18/19 to 12/4/19 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the warm-water IBI for fish. Table 57 provides a summary of the fish data.

Table 57 Fish Data Station 1351400HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
9/25/19	warm-water	24.51	Not calculated	Very poor	<50 individuals captured

The fish survey resulted in less than 50 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. (17) Individuals were captured comprising five species. The dominant species was Central mudminnow with (11) individuals being captured. The other species included Brook stickleback, Bluegill, Grass pickerel and Johnny darter.

In summary, water quality at station 1351400HCN01 should be considered fair based on the information collected during 2019. This stream is affected by run-off from non-point sources in the upper watershed.

Lower Lemonweir River Watershed

RB4 station 1304900HCN01 and 5026569HCN01 are located in the Lower Lemonweir River Watershed HUC-10 watershed. The Lower Lemonweir River Watershed is 209.62 square miles and is found primarily in the west central Wisconsin county of Juneau. The watershed is primarily located in the ecological landscape zone of the Central Sand Plains but portions of the south and west extend into the Western Coulees and Ridges.

All the creeks and ditches in the watershed drain to the Lemonweir River, which then flows into the Wisconsin River. Many of the creeks in the watershed consist of sand and silt substrates, with low gradients and small to moderately sized attached spring ponds.

Forest is the dominant land cover in the watershed, although agriculture is also a major land use. Wetlands account for just over 13% of the watershed, a percent that is higher than most of the watersheds in the Lower Wisconsin Basin. This high number of wetlands could explain why the Lower Lemonweir River Watershed is the second largest producer of cranberries in the Basin.

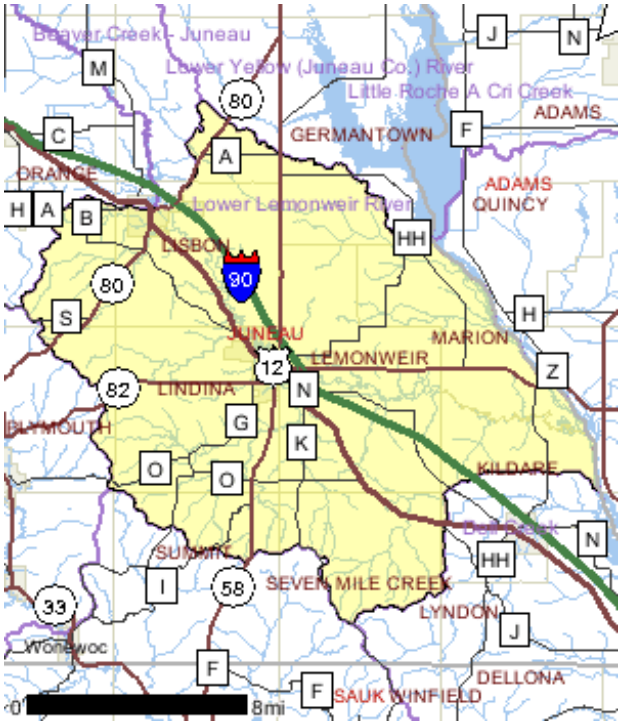

Fig. 30 Street and Hydrology map

RB4 station 1304900HCN01 unnamed (M. Decorah)
This waterway originates in a wetland area and flows in a southwesterly direction for approximately 1.3 miles before the confluence with another unnamed waterway. The segment located on tribal land appears to be relatively unaltered. Downstream of tribal land the waterway becomes severely altered in an attempt to modify the hydrology of the low lying adjacent lands. Station 1304900 is located directly upstream of the road culvert on Howe Lane.

Fig. 31 Topographic Map

Facing Downstream from Howell Rd. Culvert

Station 1304900HCN01 was visited on (4) sampling events in January, April, July and October 2019 to complete baseline monitoring at this rotating station. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli. Table 58 provides basic statistics for laboratory and core field parameters.

Table 58 Station ID 1304900HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	2	7.24	8.86	8.05	5.0	0
pH	None	4	4.89	5.92	5.30	6.0-9.0	100
Specific conductance	uS/cm	4	23.7	44	36.4		
Temperature, water	deg C	4	-0.03	20.8	9.14	31.7	0
Turbidity	NTU	4	0.15	7.8	2.68	0.84	50
Alkalinity, total	mg/l	4	0.5	2.73	1.06		
Chloride	mg/l	4	3.09	5.56	4.42		
Sulfate	mg/l	4	0.75	3.27	1.57		
Total suspended solids	mg/l	4	0.5	5	1.69		
Ammonia-nitrogen	mg/l	4	0.028	0.114	0.0718		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.018	0.509	0.180	0.13	50
Kjeldahl nitrogen	mg/l	4	0.578	1.45	0.85	0.33	100
Phosphorus	mg/l	4	0.003	0.029	0.013	0.02875/0.075	25/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.003	0.01	0.006		
Escherichia coli	MPN/100ml	4	0.5	39.3	16.2		
Total Coliform	MPN/100ml	4	19	>2419.6	1268.1	400	50

Parameters of notable concern include:

- Turbidity ranging from 0.15 – 7.8 NTUs.
- pH ranging from 4.89 – 5.92
- Kjeldahl Nitrogen (TKN) ranging from 0.578 – 1.45 mg/L
- Nitrate+Nitrite ranging from 0.018 – 0.509 mg/L.
- Total Coliforms values ranging from 19 - >2,419.6 MPN/100mL.

No temperature or dissolved oxygen values exceeded the established threshold criteria. All pH values were below the threshold of 6.0 but this is a headwater stream that originates in a coniferous wetland complex that naturally has low pH values. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, two samples were above the threshold values for turbidity and nitrate + nitrite with all samples above for Kjeldahl nitrogen. One Total Phosphorus value was at the EPA threshold but did not exceed the State of Wisconsin standard of 0.075 mg/L. The Total coliform threshold of 400 cfu/ml was exceeded in two samples.

Macroinvertebrate sampling was also completed at station 1304900HCN01. The table below provides a summary of the macroinvertebrate data.

Table 59 Macroinvertebrate Data Station 1304900HCN01							
Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/12/2019	9.70	8.93	2.50	6.92	1.08	10	9

The IBI condition gradient rating at station 1304900HCN01 is “fair” and efforts should focus on restoration. The HBI water quality rating for this station is “fairly poor” with significant organic pollution. The FBI value rating was “fairly poor” also indicating that organic pollution was substantial. The diversity index and richness values indicated a range of aquatic life.

An electrofishing survey was completed at station 1304900HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 6/18/19 to 12/14/19 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the warm-water IBI for fish. Table 60 provides a summary of the fish data.

Table 60 Fish Data Station 1304900HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
9/23/19	warm-water	26.69	Not calculated	Very poor	<50 individuals captured

The fish survey resulted in less than 25 individuals being captured, therefore the IBI score was not calculated and the default rating of Very poor was assigned. The (32) individuals captured were all Central mudminnows.

Although the biological ratings for water quality at station 1304900HCN01are poor to fair, water quality should be considered good based on the information collected during 2019. This is a headwater stream that originates in a forested wetland area. There does not appear to be surface run-off from non-point sources directly affecting the stream. However, these sources may be contributing elevated nutrients to ground water resources in this area that ultimately affect surface waters.

RB4 Station 5026569HCN01 unnamed (A. Decorah)
This unnamed waterway originates in low lying land and flows northwest for approximately 1.1 miles before joining another unnamed waterway. These waterways are severely altered by ditching in an attempt to modify the hydrology of the low lying adjacent lands. Alterations of the waterways and adjacent wetlands include extensive ditching and drain tiling. Station 5026569HCN01 is located 0.19 miles downstream of the culvert crossing located on 43rd Ave. The station is accessed via allotment trust land from STH 58.

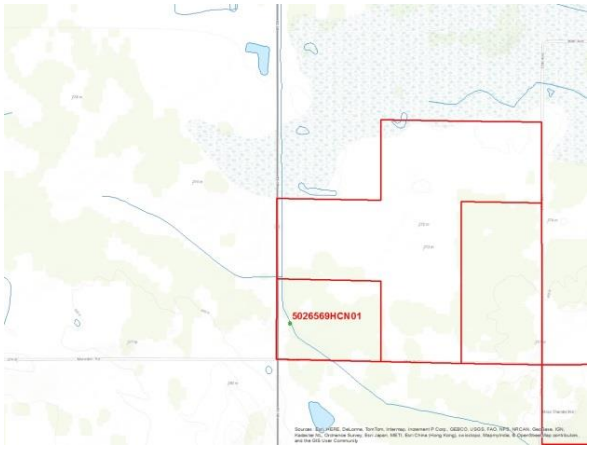

Fig. 32 Topographic Map

Station 5026569HCN01 was visited on (4) sampling events in January, April, July and October 2019 to complete baseline monitoring at this rotating station. The site was not sampled in

January, July or October 2019 because the site lacked available water due to frozen conditions and flow. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli during the monitoring visit in April. Table 61 provides basic statistics for laboratory and core field parameters.

Table 61 Station ID 5026569HCN01							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	1	3.78	3.78	3.78	5.0	100
pH	None	1	6.07	6.07	6.07	6.0-9.0	0
Specific conductance	uS/cm	1	93.5	93.5	93.5		
Temperature, water	deg C	1	2.9	2.9	2.90	31.7	0
Turbidity	NTU	1	1.45	1.45	1.45	0.84	100
Alkalinity, total	mg/l	1	29.5	29.5	29.5		
Chloride	mg/l	1	11.2	11.2	11.20		
Sulfate	mg/l	1	1.58	1.58	1.58		
Total suspended solids	mg/l	1	2.1	2.1	2.1		
Ammonia-nitrogen	mg/l	1	0.091	0.091	0.0910		
Inorganic nitrogen (nitrate and nitrite)	mg/l	1	0.018	0.018	0.018	0.13	0
Kjeldahl nitrogen	mg/l	1	1.1	1.1	1.1	0.33	100
Phosphorus	mg/l	1	0.085	0.085	0.085	0.02875/0.075	100/100
Soluble Reactive Phosphorus (SRP)	mg/l	1	0.025	0.025	0.025		
Escherichia coli	MPN/100ml	1	0.5	0.5	0.5		
Total Coliform	MPN/100ml	1	15.8	15.8	15.8	400	0

Parameters of notable concern include:

- Turbidity value of 1.45 NTU
- Kjeldahl Nitrogen (TKN) value 1.1 mg/L
- Total Phosphorus value 0.085 mg/L
- Dissolved oxygen value of 3.78 mg/L

No temperature or pH values exceeded the established threshold criteria. The station had very low dissolved oxygen levels when visited in April. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, the April sample was above the threshold values for turbidity, Kjeldahl nitrogen and Total Phosphorus. The Total Phosphorus value also exceeded the State of Wisconsin standard of 0.075 mg/L.

Macroinvertebrate and fish sampling was not completed at station 5026569HCN01 due to site conditions present. Water quality at this station should be considered very poor. The natural hydrology of this area has been severely altered by historic drain tiling and ditching. The station is a man-made drainage ditch of unknown age that serves to relay water from upstream property owners. The ditch also affects the hydrology of forested wetlands on the tribal parcel.

<u>Honey Creek Watershed</u>

RB4 station 1259400HCN01 is associated with the Honey Creek HUC-10 watershed. The Honey Creek Watershed lies in southern Sauk County. The streams in the upper portion of the watershed have a fairly good gradient. The south slope of the Baraboo (South) Range, a

Precambrian inlier set of hills, is partially within the watershed. These hills are heavily wooded and contain unique sub-ecosystems with rare plant species. Agriculture, specifically dairy farming, is the predominant land use. Broad-leaf deciduous forest is the second highest land cover in the watershed after crops.

The major known water quality problem in the watershed is from nonpoint source pollution. The increasing siltation of streams is significant and Honey Creek discharges a large amount of sediment to the Wisconsin River. In addition, some streams in the watershed have had problems as a result of manure discharged nearby. Overall water quality in the watershed is poor and most of the tributaries to Honey Creek are considered warm water forage fisheries.

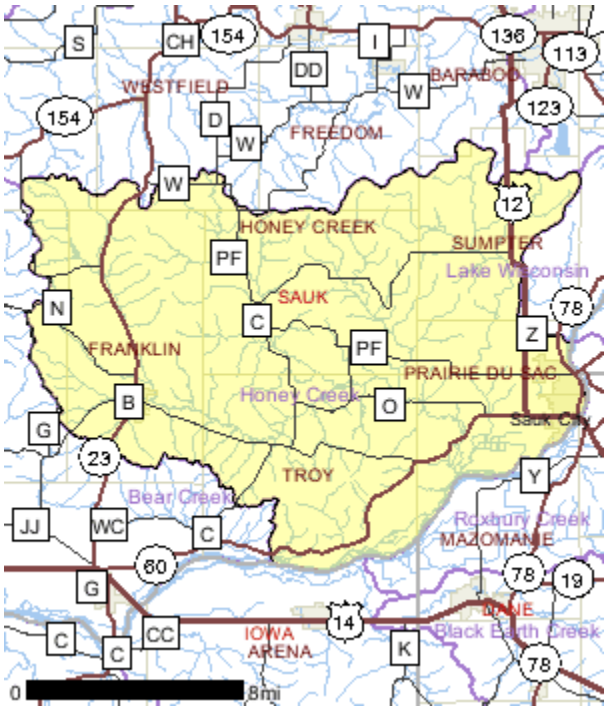

Fig. 33 Honey Creek HUC-10 Watershed

RB4 Station 1259400HCN01 unnamed (Pine Glen)
This unnamed waterway originates on the south facing slope of the Baraboo Hills in a forested area that is part of Devil's Lake State Park. The unnamed stream flows for 3.98 miles before entering Otter Creek. This streams ultimately drain to the Wisconsin River. Station 1259400HCN01 is located on the Nation's Sacred Earth parcel which is part of the former Badger Army Ammunition Plant that produced propellants during WWII, Korean War and Vietnam. The plant was eventually transferred to the U.S. Dept. of Agriculture, National Park Service on behalf of the WI Dept. of Natural Resources and the Bureau of Indian Affairs on behalf of the Ho-Chunk Nation. Streams and intermittent drainages within this area were first altered by euro-american settlers in an attempt to improve areas for farming and homesteads. The era of the ammunition plant ultimately resulted in all streams and drainages within the 6,700 acre plant footprint being ditched and/or rerouted to accommodate plant infrastructure. Station 1259400HCN01 is located 0.15 miles downstream of the perimeter road culvert within the Sacred Earth parcel. The station is accessed via private tribal road from USH 12.

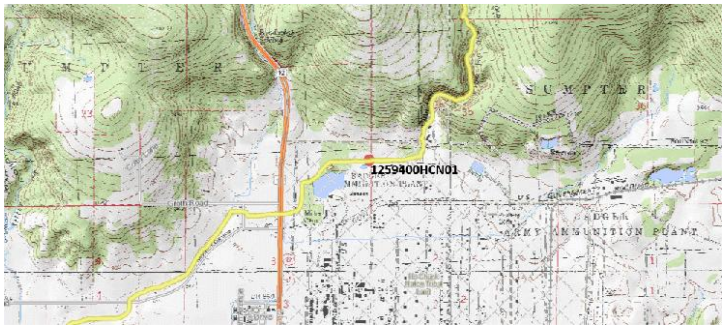

Fig. 34 24k Topographic Map Station 1259400HCN01

Station 1254900HCN01 was visited on (4) sampling events in January, April, July and October 2019 to complete baseline monitoring at this rotating station. Core measurements were completed and water samples were collected and analyzed for nutrients and additional parameters including alkalinity, chloride, sulfate, total suspended solids, Total Coliforms and E.coli. Table 62 provides basic statistics for laboratory and core field parameters.

Table 62 **Station ID** **1259400HCN01**							
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	2	12.83	12.85	12.84	6.0	0
pH	None	4	6.56	7.66	7.09	6.0-9.0	0
Specific conductance	uS/cm	4	34.2	54	43.3		
Temperature, water	deg C	4	2.06	19.8	9.59	22.8	0
Turbidity	NTU	4	1	2.92	1.99	3.38	
Alkalinity, total	mg/l	4	7.9	26.4	18.8		
Chloride	mg/l	4	0.611	1.05	0.85		
Sulfate	mg/l	4	5.5	7.49	6.32		
Total suspended solids	mg/l	4	0.5	1.47	0.94		
Ammonia-nitrogen	mg/l	4	0.0135	0.052	0.0389		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.16	0.249	0.186	1.73	0
Kjeldahl nitrogen	mg/l	4	0.126	0.235	0.159	0.15	75
Phosphorus	mg/l	4	0.011	0.045	0.028	0.070/0.075	0/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.014	0.035	0.023		
Escherichia coli	MPN/100ml	4	1	127.4	45.1		
Total Coliform	MPN/100ml	4	10.2	>2419.6	1243.4	400	50

Parameters of notable concern include:

- Kjeldahl Nitrogen (TKN) values ranging from 0.126 – 0.235 mg/L
- Total Coliform values ranging from 10.2 - >2,419.6 MPN/100mL

No dissolved oxygen, temperature or pH values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 52, no samples produced results above the thresholds for turbidity, nitrate + nitrite or phosphorus. The State of WI threshold for Total phosphorus was also not exceeded. The Kjeldahl nitrogen threshold was exceeded in 75% of samples and the Total coliform threshold of 400 cfu/mL was exceeded in 50% of samples. However, it should be noted that station 1259400HCN01 is on a first order

stream that originates in the undeveloped Baraboo Hills. Total coliform exceedances are likely due to wildlife.

Macroinvertebrate sampling was also completed at station 1259400HCN01. Table 63 provides a summary of the macroinvertebrate data.

Table 63 Macroinvertebrate Data Station 1259400HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
9/12/2019	4.21	4.21	3.98	4.47	2.86	27	24

The IBI condition gradient rating at station 1259400HCN01 is "fair" and efforts should focus on restoration. The HBI water quality rating for this station is "very good" with possible slight organic pollution. The FBI value rating was "good" also indicating that organic pollution was probable. The diversity index and richness values indicated a diverse range of aquatic life.

An electrofishing survey was completed at station 1259400HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 6/12/19 to 12/4/19 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded the use of the cold-water IBI for fish. Table 64 provides a summary of the fish data.

Table 64 Fish Data Station 1259400HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
9/23/19	cold-water	20.63	10	Poor	Three species captured

The fish survey resulted in (29) individuals being captured comprising three species. 59% of individuals were cold-cool water species with remaining 49% being tolerant to warm-water. The sampling reach was a ditched portion of the waterway that is located upstream of a man-made pond and wetland scrape.

Biological ratings for water quality at station 1259400HCN01 range from fair to good for macroinvertebrates and poor for fish. Water quality should be considered fair based on the information collected during 2019. This is a headwater stream that originates in the forested Baraboo Hills and then is severely altered as it transitions into the former Badger Army Ammunition Plant. The tribal and upstream portion of the waterway are not affected by surface run-off from non-point sources. The stream is affected by non-point sources downstream of tribal land as it runs through a network of ditches through row crop agriculture before it enters Otter Creek.

8. Water Quality Issues of Tribal Concern

Baseline water quality monitoring results raise concerns about the current water quality associated with tribal water resources. The sampling locations are vastly different aquatic

systems due to the natural variation in surface water resources across the landscape and also the stressors that can affect water quality. However, concerns with water quality stemming from nutrient enrichment, suspended sediments, turbidity and high bacteria counts have been observed on tribal waters regardless of location and land-use.

The review of nutrient data indicates that 46% (45 of 97) samples analyzed for total phosphorus were above the EPA reference criteria for the respective sub-ecoregion and 28% were also above the State of Wisconsin Total phosphorus standard of 0.075 mg/L. In addition, 29% of nitrate+nitrite samples, 96% Kjeldahl nitrogen and 88% of turbidity samples were above the reference criteria for the respective sub-ecoregion. Lastly, Total coliform analysis resulted in 76% exceeding the single sample maximum threshold value of 400 cfu/100mL.