Ho-Chunk Nation

Clean Water Act Section 106 Program

Assistance Agreement I-06E00738

Two Year Water Quality Assessment Report

Monitoring Period

January 1, 2020-December 31, 2021

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Submitted:

February 4, 2022

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List of Acronyms and Abbreviations

ADC	Acoustic Doppler Current
AWQMS	Ambient Water Quality Monitoring System
BCI	Biotic Condition Index
BIA	Bureau of Indian Affairs
CFU	Colony Forming Units
CPUE	Catch Per Unit Effort
CTQ	Community Tolerance Quotient
CWA	Clean Water Act
DC	Direct Current
DO	dissolved oxygen
DEH	Division of Environmental Health
DELT	deformities, eroded fins, lesions, or tumors
EPA	Environmental Protection Agency
EPT	Ephemeroptera
ESPM	Environmental Sciences Program Manager
ETS	Engineering Technical Services LLC.
FBI	Family Biotic Index
GIS	Geographic Information System
HBI	Hilsenhoff Biotic Index
HCN	Ho-Chunk Nation
HDPE	High Density Polyethylene
HUC	Hydrologic Unit Code
IBI	Index of Biotic Integrity
m	meter
mg/L	milligrams per Liter
MPN	Most Probable Number
NIST	National Institute of Standards and Technology
NTU	Nephelometric Turbidity Unit
pH	Potential of Hydrogen or Power of Hydrogen
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SRP	Soluble Reactive Phosphorus
TKN	Total Kjeldahl Nitrogen
TQ	Tolerance Quotient
uS/cm	microsiemens/centimeter
WDNR	WI Dept. of Natural Resources
WQX	Water Quality Exchange
Yr	Year

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 14,847acres with 4,742 acres held in fee-simple by the Nation and the remaining 10,105 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 7,843 with approximately half the members living in fifteen counties located in the central part of 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 water quality within their Territory. Program activities funded 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. The atlas has been updated to reflect the wetland resources delineated and mapped during 2020-2021.

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	1,246

The Ho-Chunk Nation Division of Environmental Health (DEH) has been managing the EPA CWA Section 106 Program since the Nation first became eligible for funding in FY06. The DEH is currently administering assistance agreement I-06E00738 which includes program activities for the period January 1, 2022-December 31, 2023.

2. Purpose of Monitoring Program

The Nation has become increasingly concerned with surface water quality in recent years due to the increase in animal units per farm, row crop agriculture, sand mining, large-scale 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 for many stations including those that are monitored on a 5-year rotational basis. Rotational stations have only been monitored in two of the last ten years from 2010-2020. Based on the lack of chemical, habitat and biological information pertaining to tribal water resources the following monitoring program 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 macroinvertebrate populations.
- Complete habitat assessments as funding allows 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.
- Determine wetland types and functional values.

3. Monitoring Framework

The Ho-Chunk Nation monitoring program includes multiple activities to assess surface water quality including: collection of water samples for chemical analysis; biological monitoring of fish and macroinvertebrate communities; habitat assessments; and inventory and assessment of wetland resources. In addition, synoptic studies are incorporated into monitoring 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 (9) fixed stations on a quarterly basis during 2020-2021. In addition, (2) Rotating Year 5 stations were monitored in 2020 and (6) Rotating Year 1 stations were monitored in 2021.

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, Wisconsin Rapid Wetland Assessment Methodology (WRWAM)* 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, 2020-December 31, 2021.

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. Bridge14	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
2145400HCN01	North Fork Eau Claire River	Rotating Yr 5	44.8250	90.9260
5013343HCN01	unnamed (Stacy Creek)	Rotating Yr 5	44.7800	90.7030
1714100HCN01	Clear Creek	Rotating Yr 1	44.3490	90.7681
1709000HCN01	Indian Grave Creek	Rotating Yr 1	44.3120	90.7780
1708900HCN01	Levis Creek	Rotating Yr 1	44.3105	90.8046
1716600HCN01	Mollies Creek	Rotating Yr 1	44.3848	90.7077
1742600HCN01	unnamed (Green)	Rotating Yr 1	44.4421	90.6904
1709300HCN01	unnamed (William Sam)	Rotating Yr 1	44.2864	90.6898
Wetland Sites	**Parcel Name**	**Acres**	**Latitude**	**Longitude**
	Blue Wing Village/West Trust	31.70	44.0355	90.4254
	Peter/Iva LaMere. Allot. Trust	39.30	44.0348	90.4102
	Charley Smoke Allot. Trust	40.06	44.0043	90.3903
	Paul Spear Smith Allot. Trust	40.08	44.0039	90.3748
	John Man Allot. Trust	40.12	44.0004	90.3751

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, data is grouped into tabular format by 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 the assessment document are based on the stream temperature classification: 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 are values 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), and nitrate + nitrite or 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 are for *E.coli* are based on NR102.04 (6) that states the geometric mean (126 counts per 100mL) shall not be exceeded in any rolling 90-day period during the recreation

season. The statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. 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 410 colonies per 100mL threshold.

Biological Monitoring

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 many sources including: chemical pollutants from 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 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-05E00738 Revision 2, dated April 14, 2020.

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.	1/6/20, 4/6/20, 7/8/20, 10/19/20, 1/11/21, 4/7/21, 7/8/21, 10/4/21 7/21/21 5/26/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1182400HCN03	Kickapoo R.at Bridge 8	1/13/20, 4/7/20, 7/7/20, 10/20/20, 1/12/21, 4/13/21, 7/14/21, 10/6/21 8/3/2020 5/13/20	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1182400HCN04	Kickapoo R.at Bridge14	1/13/20, 4/7/20, 7/7/20, 10/20/20, 1/12/21, 4/13/21, 7/14/21, 10/6/21	Quarterly	Water Quality Monitoring
1195400HCN01	Indian Creek	1/13/20, 4/7/20, 7/7/20, 10/20/20, 1/12/21,4/13/21, 7/14/21, 10/6/21 7/27/20 5/13/20	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1196900HCN01	Billings Creek	1/13/20, 4/7/20, 7/7/20, 10/20/20, 1/12/21, 4/13/21, 7/14/21, 10/6/21 7/28/2020 5/13/20	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1198200HCN01	unnamed creek (Hay Valley)	1/13/20, 4/7/20, 7/8/20, 10/20/20, 1/12/21, 4/13/21, 7/14/21, 10/6/21 7/27/20 5/13/20	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1714200HCN01	Morrison Creek	1/13/20, 4/6/20, 7/8/20, 10/21/20, 1/13/21, 4/12/21, 7/8/21, 10/5/21 7/22/21 5/25/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1714300HCN01	Dickey Creek	1/13/20, 4/6/20, 7/8/20, 10/21/20, 1/13/21, 4/12/21, 7/7/21, 10/5/21 7/22/21 5/25/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1715800HCN01	Valentine Creek	1/13/20, 4/6/20, 7/8/20, 10/21/20, 1/13/21, 4/12/21, 7/7/21, 10/4/21 7/27/21 5/25/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
2145400HCN01	North Fork Eau Claire River Rotating Y5	1/6/20, 4/6/20, 7/6/20, 10/19/20 8/11/20 5/14/20	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
5013343HCN01	unnamed (Stacy Creek) Rotating Y5	1/6/20, 4/6/20, 7/8/20, 10/19/20 8/11/2020 5/12/2020	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1709000HCN01	Indian Grave Creek Rotating Y1	1/13/21, 4/12/21, 5/26/21, 7/14/21, 10/5/21	Quarterly Single Visit	Water Quality Monitoring Invert Sampling
1708900HCN01	Levis Creek Rotating Y1	1/13/21, 4/12/21, 7/8/21, 10/5/21 5/25/21	Quarterly Single Visit	Water Quality Monitoring Invert Sampling
1716600HCN01	Mollies Creek Rotating Y1	1/11/21, 4/7/21, 7/7/21, 10/5/21 7/28/21 5/25/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1742600HCN01	unnamed creek (Green) Rotating Y1	1/11/21, 4/7/21, 7/7/21, 10/4/21 7/27/21 5/25/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1714100HCN01	Clear Creek Rotating Y1	1/12/21, 4/12/21, 7/8/21, 10/5/21 7/28/21 5/26/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling
1709300HCN01	William Sam Rotating Y1	1/13/21, 4/12/21, 7/7/21, 10/5/21 7/28/21 5/26/21	Quarterly Single Visit Single Visit	Water Quality Monitoring E-fishing Survey Invert Sampling

Wetland Sites	Parcel Name	Monitoring Dates	Monitoring Activity
	Blue Wing Village Trust	5/18/20	Delineate, Classify, Map
	LaMere. Allot. Trust	5/18/20	Delineate, Classify, Map
	Smoke Allot. Trust	5/18/20-5/19/20	Delineate, Classify, Map
	Spear Smith Allot. Trust	5/18/20-5/19/20	Delineate, Classify, Map
	John Man Allot. Trust	5/19/20	Delineate, Classify, Map

7. Monitoring Results

The following section summarizes the results of the baseline water quality monitoring that was conducted during 2020-2021 for the stations identified in Table 2. The (9) fixed stations were sampled quarterly during the months of January, April, July and October 2020-2021. Rotating Yr. 5 stations were also sampled quarterly in 2020 along with Rotating Yr. 1 stations being monitored quarterly in 2021.

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. It should be noted that stations 1182400HCN01 and 1182400HCN02, shown on the map, were not monitored during 2020-2021and are not scheduled for monitoring in upcoming years.

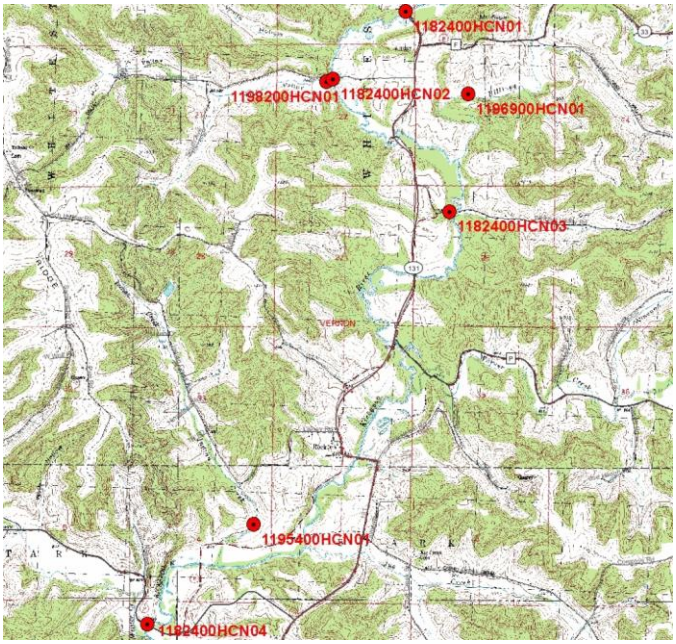

Figure 1 24k Topographic Map

1182400HCN03MIDDLE KICKAPOO RIVER (BRIDGE 8)

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

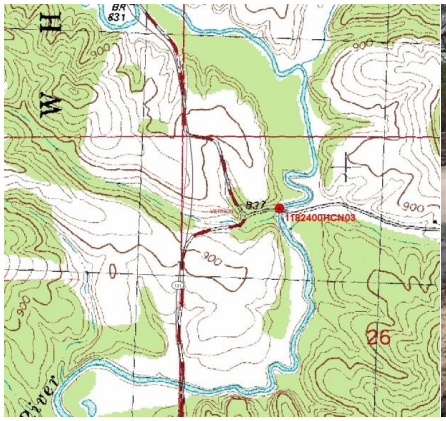

Fig. 2 24k Topographic Map

Station Photo down-stream Bridge 8-October 10, 2018
Typical post-storm event with high water and sediment load.

Station 1182400HCN03 was visited on (8) sampling events to monitor baseline water quality during 2020. 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	8.02	13.35	10.66	5.0	0
pH	None	8	7.81	8.72	8.35	6.0-9.0	0
Specific conductance	uS/cm	8	446.1	488.1	473.3		
Temperature, water	deg C	8	0.19	23.40	10.24	31.7	0
Turbidity	NTU	8	1.90	6.62	3.21	3.38	25
Alkalinity, total	mg/l	8	224	250	239.38		
Chloride	mg/l	8	8.52	9.89	9.10		
Sulfate	mg/l	8	10.00	12.70	11.34		
Total suspended solids	mg/l	8	4.67	38.00	13.75		
Ammonia-nitrogen	mg/l	8	ND	0.082	0.048		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.921	2.08	1.544	1.73	25
Kjeldahl nitrogen	mg/l	8	0.121	0.440	0.273	0.15	87.5
Phosphorus	mg/l	8	0.041	0.130	0.067	0.070/0.075	37.5/37.5
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.029	0.092	0.046		
Escherichia coli	MPN/100ml	8	68.2	613.1	318.3	410	37.5
Total Coliform	MPN/100ml	8	410.6	>2,419.6	1720.9		

Parameters of notable concern include:

- Turbidity ranging from 1.90 - 6.62 NTUs
- Kjeldahl Nitrogen (TKN) ranging from 0.121 - 0.44 mg/L
- Nitrate of Nitrite ranging from 0.921 - 2.08 mg/L
- Total Phosphorus ranging from 0.041 - 0.13 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, 87.5% (7 of 8) sampling events produced results above the threshold for Kjeldahl nitrogen and 25% of the sampling events exceeded the thresholds for nitrate + nitrite and turbidity. The Total phosphorus threshold based on the EPA reference criteria and State of WI standard was exceeded in 37.5% of samples. The threshold applied to E. coli is based on the State of WI standard that states the statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. It should be noted that comparison of sample results to this threshold value is very limited because of the small number of samples the Nation collects during the recreation season.

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
5/13/20	4.46	4.38	5.02	4.15	1.96	17	15

The macroinvertebrate IBI condition gradient rating at station 1182400HCN03 is “good” and efforts should focus on maintaining that condition. 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 relatively low level of diversity at this station.

An electrofishing survey was completed at station 1182400HCN03 using a DC electrofishing tote barge system. The survey crew was impeded by water depth and flow which made it difficult to wade and the sampling reach was shortened by approximately 125 meters because of these factors. A temperature data logger was deployed in the stream on 5/13/20 to collect hourly temperature readings in order to determine the correct assessment tool to apply to the sampling reach. The logger quit collecting temperature data on 7/31/20 for an unknown reason but the data saved prior to failure concluded the use of the warm-water IBI for fish. It should be noted that previous assessments have also used the warm-water IBI for this station even though prior fish surveys have captured cold-water species including Brown trout. In addition, it should be noted that historically the Kickapoo River was a cold-water system. 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
8/3/20	Warm-water	23.95	Not calculated	Very Poor	Difficult wading conditions, reach shortened.

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. (24) Individuals comprising

eight species were captured with White suckers being the dominant species encountered. Three Brown trout were captured but the majority of fish were tolerant to disturbed habitat.

In summary, water quality at station 1182400HCN03 should be considered fair based on the information collected during 2020=2021. Water quality is negatively impacted by non-point sources in the watershed including, but not limited to, row crop agricultural, barnyards and developed areas. These impacts are exacerbated during extreme storm events that produce significant run-off events that result in elevated sediment loads, nutrients, temperature changes and poor water clarity.

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 Trust lands and is used to document water quality as it leaves tribal land.

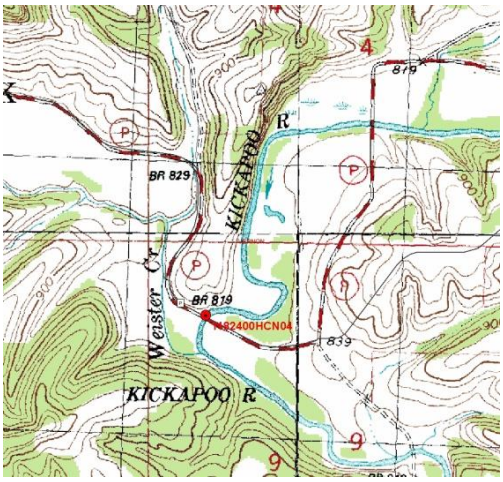

Fig 3. 24k Topographic Map

Station Photo Facing upstream October 10, 2018

Station 1182400HCN04 was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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 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	7	7.63	13.39	10.64	5.0	0
pH	None	8	8.09	8.70	8.37	6.0-9.0	0
Specific conductance	uS/cm	8	441.8	487.5	472.2		
Temperature, water	deg C	8	-0.10	23.60	10.32	31.7	0
Turbidity	NTU	8	1.94	224.00	31.27	3.38	25
Alkalinity, total	mg/l	8	225	246	237.13		
Chloride	mg/l	8	7.70	9.21	8.46		
Sulfate	mg/l	8	10.00	12.80	11.46		
Total suspended solids	mg/l	8	5.67	35.00	13.77		

Ammonia-nitrogen	mg/l	8	ND	0.058	0.041		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.837	1.96	1.45	1.73	25
Kjeldahl nitrogen	mg/l	8	0.170	0.441	0.287	0.15	100
Phosphorus	mg/l	8	0.041	0.140	0.070	0.070/0.075	37.5/37.5
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.025	0.100	0.047		
Escherichia coli	MPN/100ml	7	88.6	1119.9	385.6	410	28.6
Total Coliform	MPN/100ml	7	260.3	>2,419.6	1449.5		

Parameters of notable concern include:

- Turbidity ranging from 1.94 – 224 NTU
- Kjeldahl Nitrogen (TKN) ranging from 0.170 – 0.441 mg/L
- Nitrate of Nitrite ranging from 1.30 – 1.96 mg/L
- Total Phosphorus ranging from 0.041 – 0.140 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 sampling events produced results above the threshold for Kjeldahl nitrogen and 25% of the sampling events exceeded the thresholds for nitrate + nitrite and turbidity. The Total phosphorus threshold based on the EPA reference criteria and State of WI standard was exceeded in 37.5% of samples. The threshold applied to E. coli is based on the State of WI standard that states the statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. It should be noted that comparison of sample results to this threshold value is very limited because of the small number of samples the Nation collects during the recreation season.

Macroinvertebrate sampling and electrofishing surveys were not completed at station 1182400HCN04 due to water depth and flow conditions that made it impossible to wade for such surveys.

In summary, chemical water quality at station 1182400HCN04 should be considered fair based on the information collected during 2020-2021. Water quality is negatively impacted by non-point sources in the watershed including, but not limited to, row crop agricultural, barnyards and developed areas. These impacts are exacerbated during extreme storm events that produce significant run-off events that result in elevated sediment loads, nutrients, temperature changes and poor water clarity.

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 covered bridge. Reaches of Indian Creek under state jurisdiction are designated with the default Fish and Aquatic Life use by the WDNR.

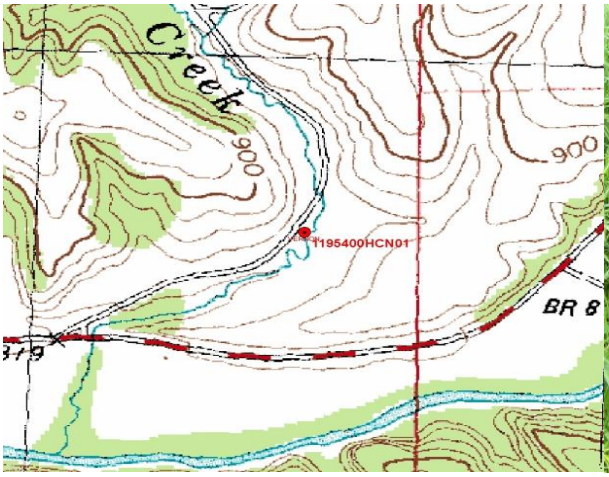

Fig. 4 24k Topographic Map

Station Photo Facing upstream

Station 1195400HCN01 was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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 11 provides basic statistics for laboratory and core field parameters.

Table 11 Station ID	**1195400HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.34	12.57	10.62	6.0	0
pH	None	8	8.12	8.63	8.35	6.0-9.0	0
Specific conductance	uS/cm	8	237.9	495.9	439.8		
Temperature, water	deg C	8	0.25	21.10	9.49	22.8	0
Turbidity	NTU	8	1.24	4.66	2.79	3.38	12.5
Alkalinity, total	mg/l	8	236	263	251.75		
Chloride	mg/l	8	3.10	5.01	4.05		
Sulfate	mg/l	8	9.10	11.00	10.30		
Total suspended solids	mg/l	8	3.91	29.00	10.61		
Ammonia-nitrogen	mg/l	8	0.043	0.109	0.061		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.710	1.09	0.885	1.73	0
Kjeldahl nitrogen	mg/l	8	ND	0.278	0.203	0.15	75
Phosphorus	mg/l	8	0.034	0.101	0.067	0.070/0.075	37.5/37.5
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.030	0.073	0.050		
Escherichia coli	MPN/100ml	7	13.1	1986.3	601.9	410	42.9
Total Coliform	MPN/100ml	7	225.4	>2,419.6	1543.8		

Parameters of notable concern include:

- Turbidity ranging from 1.24 – 4.66 NTU
- Kjeldahl Nitrogen (TKN) ranging from not detected to 0.278 mg/L
- Total phosphorus ranging from 0.034 – 0.101 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, 75% of events produced results above the threshold for Kjeldahl nitrogen and the July 2020 sampling event

exceeded the threshold for turbidity. The Total phosphorus threshold based on the EPA reference criteria and State of WI standard was exceeded in 37.5% of samples which were collected during July 2020 and July and October 2021. The threshold applied to E. coli is based on the State of WI standard that states the statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. It should be noted that comparison of sample results to this threshold value is very limited because of the small number of samples the Nation collects during the recreation season.

Macroinvertebrate sampling was also completed at station 1195400HCN01. Table 12 provides a summary of the macroinvertebrate data.

Table 12 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
5/13/20	3.22	3.77	7.52	3.62	3.06	19	16

The IBI condition gradient rating at station 1195400HCN01 is "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 fairly 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 5/13/20 to 10/21/20 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 13 provides a summary of the fish data.

Table 13 Fish Data Station 1195400HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/27/20	Cold-water	19.91	Not calculated	Very Poor	Less than 25 individuals captured.

The fish survey resulted in only (18) individuals being captured and therefore it was not possible to calculate the IBI. Although the IBI was not calculated, the station was assigned a rating of Very Poor do to the overall lack of fish. Seven species were captured including one Brown trout, Creek chubs, White suckers, pan fish and minnow species. The Brown trout that was captured was the only trout the program has captured in this stream since surveys began in 2009.

In summary, water quality at station 1195400HCN01 is fair based on the information collected during 2020-2021. 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. It is however difficult to determine whether the dams have a positive or negative impact on water quality over various periods of time. Beaver dams may impede fish movement and affect stream temperature and movement of sediment within this system in the short-term but likely have a positive impact on the overall ecological health of the system in the long-term.

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.

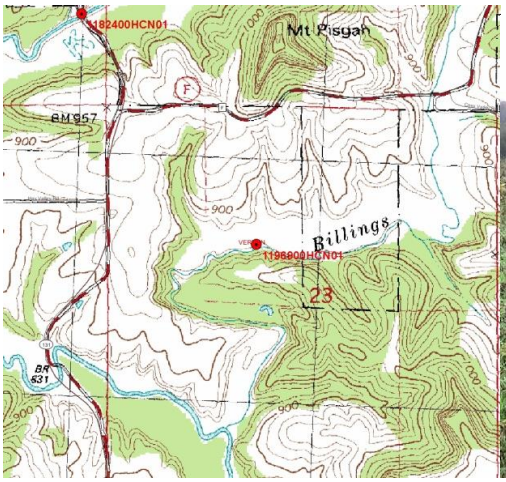

Fig 5. 24k Topographic Map

Station Photo Facing Upstream

Station 1196900HCN01 was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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 14 provides basic statistics for laboratory and core field parameters.

Table 14 Station ID	**1196900HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.50	13.07	11.06	6.0	0
pH	None	8	7.34	8.72	8.07	6.0-9.0	0
Specific conductance	uS/cm	8	446.0	493.3	479.9		
Temperature, water	deg C	8	1.31	18.70	9.34	22.8	0
Turbidity	NTU	8	0.13	5.39	2.00	3.38	12.5
Alkalinity, total	mg/l	8	229	270	250		
Chloride	mg/l	8	5.70	7.19	6.35		

Sulfate	mg/l	8	9.30	11.20	10.41		
Total suspended solids	mg/l	8	2.75	15.00	6.64		
Ammonia-nitrogen	mg/l	8	ND	0.139	0.058		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	1.24	1.91	1.60	1.73	25
Kjeldahl nitrogen	mg/l	8	0.132	0.290	0.208	0.15	62.5
Phosphorus	mg/l	8	0.026	0.072	0.042	0.070/0.075	12.5/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.017	0.049	0.027		
Escherichia coli	MPN/100ml	8	104.6	1299.7	441.5	410	37.5
Total Coliform	MPN/100ml	8	190.4	>2,419.6	1543.8		

Parameters of notable concern include:

- Turbidity ranging from 0.13 – 5.39 NTUs
- Kjeldahl Nitrogen (TKN) ranging from 0.132 – 0.290 mg/L
- Nitrate of Nitrite ranging from 1.24 – 1.91 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, the turbidity and Total P thresholds were both exceeded in the July 2020 sampling event. However, the Total Phosphorus value was below the State of WI standard. Kjeldahl nitrogen was exceeded in five of eight events and nitrate plus nitrite was exceeded in the January 2020 sample. The threshold applied to E. in coli is based on the State of WI standard that states the statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. It should be noted that comparison of sample results to this threshold value is very limited because of the small number of samples the Nation collects during the recreation season.

Macroinvertebrate sampling was also completed at station 1196900HCN01. Table 15 provides a summary of the macroinvertebrate data.

Table 15 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
5/13/20	4.05	4.14	6.84	4.17	3.51	28	22

The IBI condition gradient rating at station 1196900HCN01 is “good” and management efforts should focus on maintaining that condition. The HBI water quality rating for this station is “very good” with possible slight organic pollution. The FBI value rating was also “very good” indicating possible slight organic pollution. The diversity index and richness values indicated a 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 on 5/13/20 but failed during operation and staff was unable to recover data from the logger. However, prior temperature profiling of this stream concluded the use of the cold-water IBI.

Table 16 Fish Data Station 1196900HCN01					
Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/28/20	Cold-water	Not determined	40	Fair	23 Brown trout captured.

The survey resulted in (71) individuals being captured and the temperature regime indicated use of the cold-water IBI. The corresponding IBI rating was fair with 36% of species being cool or cold-water. Brown trout was the only salmonid present with multiple size classes encountered. Other species included Mottled sculpin, White sucker and various minnow species.

In summary, water quality at station 1196900HCN01 is fair to good based on information collected during 2020-2021. 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 cool to cold-water fishery with Brown trout. It was also notable that the Total phosphorus value did not exceed the state standard in any sample collected.

1198200HCN01unnamed (Hay Valley Rd. Creek)
Hay Valley Rd. Creek is an approximately three-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.

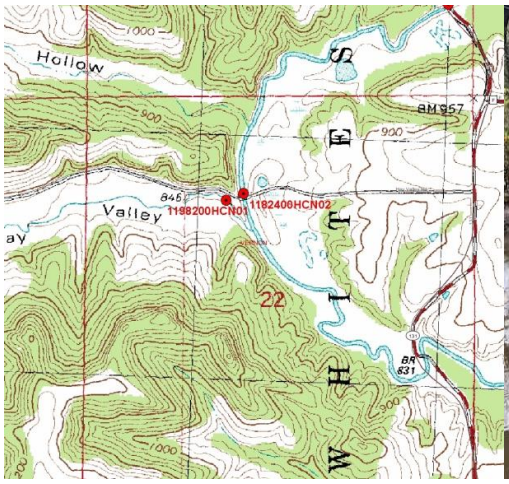

Fig. 6 24k Topographic Map


Station Photo facing Upstream

Station 1198200HCN01 was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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 17 provides basic statistics for laboratory and core field parameters.

Table 17 Station ID	1198200HCN01						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.74	12.79	10.48	6.0	0
pH	None	8	7.97	8.69	8.30	6.0-9.0	0
Specific conductance	uS/cm	8	430.7	470.0	456.4		
Temperature, water	deg C	8	1.27	17.50	9.11	22.8	0
Turbidity	NTU	8	0.31	7.14	2.54	3.38	25
Alkalinity, total	mg/l	8	228	255	243.00		
Chloride	mg/l	8	3.10	5.27	3.84		
Sulfate	mg/l	8	9.10	10.90	10.12		
Total suspended solids	mg/l	8	4.18	22.00	11.64		
Ammonia-nitrogen	mg/l	8	ND	0.066	0.044		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.931	1.170	1.018	1.73	0
Kjeldahl nitrogen	mg/l	8	ND	0.310	0.175	0.15	37.5
Phosphorus	mg/l	8	0.019	0.070	0.037	0.070/0.075	12.5/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.016	0.049	0.024		
Escherichia coli	MPN/100ml	8	53.5	1299.7	611.7	410	50
Total Coliform	MPN/100ml	8	ND	>2,419.6	1657.4		

Parameters of notable concern include:

- Kjeldahl Nitrogen (TKN) values ranging from no detection – 0.31 mg/L
- Turbidity 0.31 – 7.14 NTUs
- Total Phosphorus 0.019 - 0.070 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, the turbidity threshold was exceeded during the April and July 2020 sampling event and the Kjeldahl nitrogen threshold was exceeded in three of eight events. The EPA Total phosphorus threshold was also exceeded in the July 2020 sample. The threshold applied to E. in coli is based on the State of WI standard that states the statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. It should be noted that comparison of sample results to this threshold value is very limited because of the small number of samples the Nation collects during the recreation season.

Macroinvertebrate sampling was also completed at station 1198200HCN01. Table 18 provides a summary of the macroinvertebrate data.

Table 18 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
5/13/20	4.07	4.08	6.16	4.71	2.96	17	13

The IBI condition gradient rating at station 1198200HCN01 is “good” 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 “good” suggesting that some organic pollution was probable. The diversity index and richness values indicated a fairly poor level of diversity in the macroinvertebrate.

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 5/13/20 to 10/20/20 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 although the 22.8 deg C threshold daily maximum mean was exceeded on 7/19/20. This stream is classified as a trout water and therefore the cold-water IBI will be applied for the purpose of this assessment report.

Table 19 Fish Data Station 1198200HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/27/20	Cold-water	22.91	0	Very Poor	Two Brown trout captured.

The fish survey resulted in (30) individuals being captured with two Brown trout comprising the cool or cold-water species. Other species captured included Creek chubs, White suckers and various minnow species. The last survey at this station in 2018 resulted in four Brown trout and two Brook trout being captured. Brook trout were also previously captured at this station during surveys in 2009 and 2014 but were absent in survey years 2007, 2012 and 2016.

In summary, water quality at station 1198200HCN01 is fair based on information collected during 2020-2021. 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 may 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.

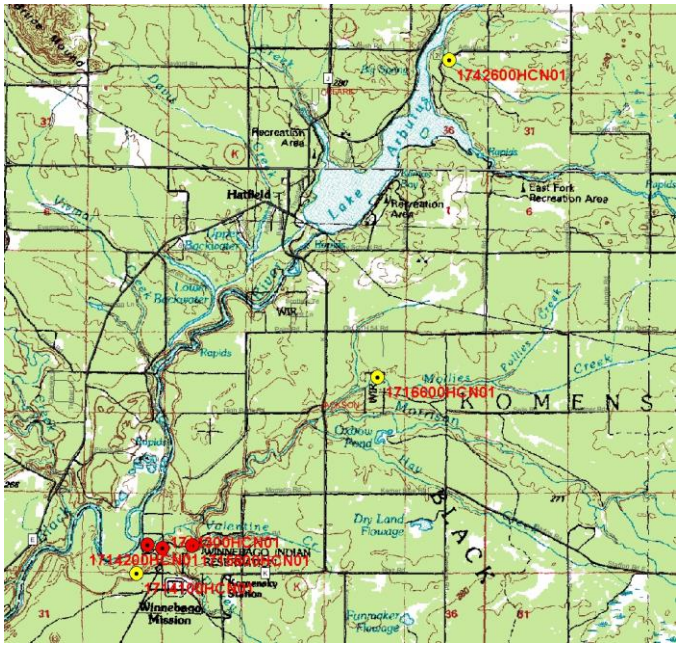

Fig. 7 100k Topographic Map

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 agricultural crop in the Morrison Creek watershed and many streams have been impounded to divert water for cranberry operations. In addition, wetland and stream hydrology throughout the watershed has been altered by historical ditching that attempted to improve areas for agricultural production and other uses. 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, Black River State Forest and Ho-Chunk lands before entering the Black River. The lower eight miles of Morrison Creek can support warm-water 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 diurnally and seasonally. 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.

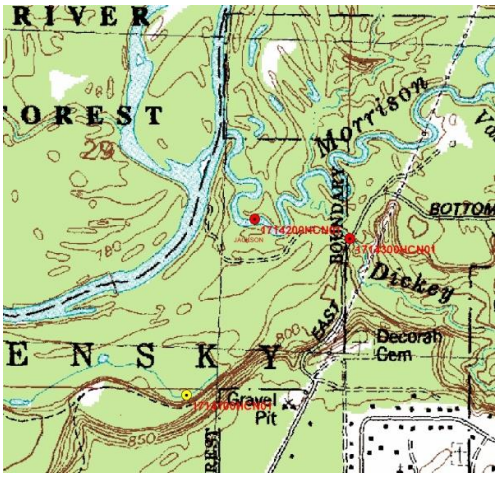

Fig. 8 24k Topographic Map


Station Photo Facing upstream

Station 1714200HCN01 was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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 20 provides basic statistics for laboratory and core field parameters.

Table 20 Station ID	**1714200HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	7.81	13.41	10.66	5.0	0
pH	None	8	5.60	8.71	6.80	6.0-9.0	0
Specific conductance	uS/cm	8	15.6	30.2	23.9		
Temperature, water	deg C	8	-0.05	22.00	10.16	31.7	0
Turbidity	NTU	8	0.11	4.12	1.73	0.84	87.5
Alkalinity, total	mg/l	8	1.24	3.88	2.37		
Chloride	mg/l	8	1.70	3.47	2.59		
Sulfate	mg/l	8	1.82	3.37	2.47		
Total suspended solids	mg/l	8	1.49	14.00	5.43		
Ammonia-nitrogen	mg/l	8	ND	0.078	0.041		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.073	0.165	0.110	0.13	25
Kjeldahl nitrogen	mg/l	8	0.373	0.950	0.567	0.33	100
Phosphorus	mg/l	8	0.019	0.060	0.036	0.02875/0.075	50/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	0.005	0.029	0.014		
Escherichia coli	MPN/100ml	8	2.0	326.00	92.5	410	0
Total Coliform	MPN/100ml	8	68.6	>2,419.6	1556.2		

Parameters of notable concern include:

- Nitrate of Nitrite ranging from 0.073 – 0.165 mg/L
- Kjeldahl Nitrogen (TKN) ranging from 0.373 - 0.950 mg/L
- Total Phosphorus ranging from 0.019 - 0.060 mg/L.
- Turbidity ranging from 0.11-4.12 NTU

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 samples produced results above the threshold for Kjeldahl nitrogen and seven of eight samples exceeded the turbidity threshold. The July 2020 and January 2021 samples were above the nitrate + nitrite threshold. 50% of samples were above the EPA threshold for Total Phosphorus but none exceeded the WDNR Total phosphorus threshold. The threshold applied to E. coli is based on the State of WI standard that states the statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. It should be noted that comparison of sample results to this threshold value is limited because of the small number of samples the Nation collects during the recreation season.

Macroinvertebrate sampling was also completed at station 1714200HCN01. The table below provides a summary of the macroinvertebrate data.

Table 21 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
05/25/21	2.52	2.75	8.03	3.53	3.81	27	25

The IBI condition gradient rating at station 1714200HCN01 is “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 “excellent” also indicating 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 1714200HCN01 on 7/22/21 using a DC electrofishing tote barge system. Electrofishing efforts in the Black River area are encumbered by low conductivity waters making it difficult to capture fish using a portable electrofishing system such as a barge or backpack. This stream is considered being capable of supporting a warm-water sport fishery in the lower eight miles. A temperature data logger was deployed in the stream from 4/12/21 to 10/11/21 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 22 Fish Data Station 1714200HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/22/21	Warm-water	25.3	65	Excellent	Poor electrofishing efficiency

Several warm-water fish and minnow species were encountered during the survey including (101) specimens comprising (12) native fish species. Species encountered included Bluegill, White crappie, Walleye, Largemouth bass and several native minnow species including Rainbow and Johnny darters.

In summary, water quality at station 1714200HCN01 is considered good based on the information collected during 2020-2021. 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

The Dickey Creek watershed is located entirely within the Black River State Forest with few identifiable nonpoint sources. Dickey Creek is currently a warm water forage fishery. Elevated water temperatures due to three upstream impoundments, low gradient and a shifting sand substrate may limit the stream as a potential warm-water sport fishery and also as a cold-water fishery. However, hourly temperature profiling in recent years suggests some potential to support a cool or cold-water fish community.

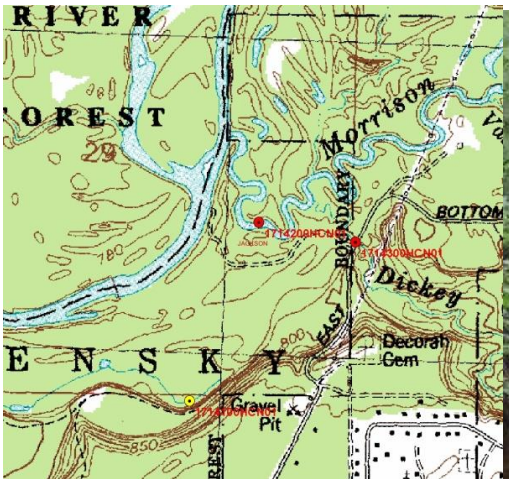

Fig. 9 24k Topographic Map


Station Photo Facing upstream

Station 1714300HCN01 is located approximately 50 feet upstream of the Pettibone Pass Road crossing. This station was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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	7.74	12.99	10.32	6.0	0
pH	None	8	5.95	8.38	6.89	6.0-9.0	0
Specific conductance	uS/cm	8	24.8	57.7	45.4		
Temperature, water	deg C	8	0.01	19.60	9.67	22.8	0
Turbidity	NTU	8	0.09	6.33	1.77	0.84	75
Alkalinity, total	mg/l	8	1.39	6.48	4.13		
Chloride	mg/l	8	4.41	10.40	8.04		
Sulfate	mg/l	8	1.44	2.83	2.10		
Total suspended solids	mg/l	8	ND	16.00	4.80		
Ammonia-nitrogen	mg/l	8	ND	0.087	0.050		

Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.066	0.210	0.129	0.13	37.5
Kjeldahl nitrogen	mg/l	8	0.314	1.20	0.540	0.33	75
Phosphorus	mg/l	8	0.013	0.074	0.030	0.02875/0.075	12.5/0
Soluble Reactive Phosphorus (SRP)	mg/l	8	ND	0.023	0.010		
Escherichia coli	MPN/100ml	8	ND	275.5	91.0	410	0
Total Coliform	MPN/100ml	8	33.8	>2,419.6	1323.1		

Parameters of notable concern include:

- Nitrate of Nitrite ranging from 0.066 – 0.210 mg/L
- Kjeldahl Nitrogen (TKN) ranging from 0.314 – 1.20 mg/L
- Total Phosphorus ranging from 0.013 - 0.074 mg/L
- Turbidity ranging from 0.09-6.33 NTU

No dissolved oxygen, pH or temperature values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, 75% of samples produced results above the threshold for Kjeldahl nitrogen and turbidity. The nitrate of nitrite threshold was also above the threshold in three of eight samples and the EPA reference criteria for Total phosphorus was above the threshold in the July 2020 sample but did not exceed the State of Wisconsin standard.

Macroinvertebrate sampling was also completed at station 1714300HCN01. The table below 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
5/25/21	3.81	3.93	7.95	4.06	4.63	44	42

The IBI condition gradient rating at station 1714300HCN01 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 “very good” also indicating possible slight organic pollution. The diversity index and richness values indicated a wide range of macroinvertebrate aquatic life.

An electrofishing survey was completed at station 1714300HCN01 on 7/22/21 using a DC electrofishing tote barge system. As previously stated, electrofishing efforts in the Black River area are encumbered by low conductivity waters making it difficult to capture fish using a portable electrofishing system such as a barge or backpack. This stream is considered a warm-water forage fishery. However, a data logger was deployed in the stream from 4/12/21 to 10/5/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded that the maximum daily mean temperature was 21.7 degrees Celsius suggesting use of the cold-water IBI for fish. This determination is consistent with temperature profiling conducted in 2017 and 2018 where maximum daily mean temperatures were 21.05 and 22.94 degrees Celsius respectively.

Table 25 Fish Data Station 1714300HCN01					
Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/22/21	Cold-water	21.7	0	Very Poor	Warm-water fish community present.

(93) specimens comprising (7) native fish species were captured and released as part of the fish survey. The fish community appears to be dominated by warm-water species. Species encountered included Bluegill, White sucker, Central mudminnow, Creek chub, Brown bullhead and Brook stickleback.

In summary, water quality at station 1714300HCN01 is considered fair to good based on the information collected during 2020-2021. Dickey Creek may be influenced to some degree by manmade reservoirs upstream that were originally designed for waterfowl production and to provide fishing opportunities for panfish and potentially Largemouth bass. These reservoirs likely contribute to elevated water temperatures in Dickey Creek.

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 road culvert.

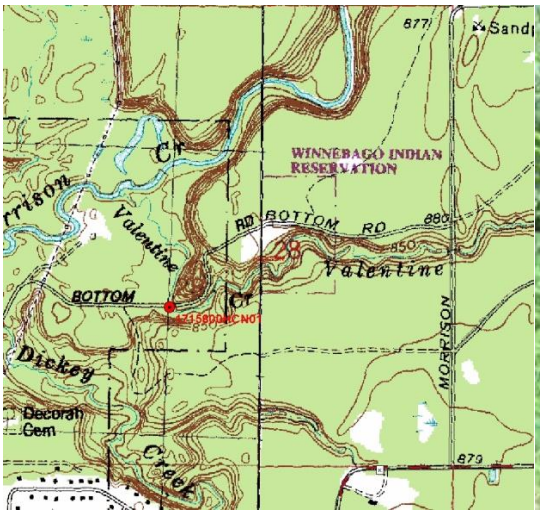

Fig. 10 24k Topographic Map

Station Photo Facing upstream

Station 1715800HCN01 was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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 26 provides basic statistics for laboratory and core field parameters.

Table 26 Station ID	1715800HCN01						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.35	13.32	10.73	6.0	0
pH	None	8	5.65	8.68	7.06	6.0-9.0	25
Specific conductance	uS/cm	8	47.0	56.9	53.5		
Temperature, water	deg C	8	0.54	15.27	8.27	22.8	0
Turbidity	NTU	8	0.06	2.85	0.71	0.84	12.5
Alkalinity, total	mg/l	8	1.9	7.6	5.76		
Chloride	mg/l	8	8.32	11.00	9.38		
Sulfate	mg/l	8	1.92	2.90	2.44		
Total suspended solids	mg/l	8	ND	2.67	1.58		
Ammonia-nitrogen	mg/l	8	ND	0.295	0.074		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	ND	0.176	0.109	0.13	50
Kjeldahl nitrogen	mg/l	8	0.141	0.504	0.325	0.33	62.5
Phosphorus	mg/l	8	0.009	0.026	0.015	0.02875/0.075	0
Soluble Reactive Phosphorus (SRP)	mg/l	8	ND	0.010	0.006		
Escherichia coli	MPN/100ml	8	2.0	461.1	104.9	410	12.5
Total Coliform	MPN/100ml	8	89.1	>2,419.6	1344.1		

Parameters of notable concern include:

- Nitrate of Nitrite ranging from 0.071 – 0.144 mg/L
- Kjeldahl nitrogen values from 0.165 – 0.44 mg/L
- Turbidity ranging from 0.27-2.85 NTU

No dissolved oxygen or temperature values exceeded the established threshold criteria. The pH was below the threshold of six during the April and July 2021sampling visits although low pH is not uncommon in this area. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, four samples produced results above the threshold for Nitrate+Nitrite and five samples exceeded the Kjeldahl threshold. The July 2020 sample was also above the EPA threshold for Turbidity.

Macroinvertebrate sampling was also completed at station 1715800HCN01. The table below provides a summary of the macroinvertebrate data.

Table 27 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
5/25/2021	3.02	3.36	5.69	3.38	4.07	33	32

The IBI condition gradient rating at station 1715800HCN01 is “good” 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 “excellent” also indicating that organic pollution was unlikely. The diversity index and richness values indicated a broad range of macroinvertebrate life.

An electrofishing survey was completed at station 1715800HCN01 on 7/27/21 using a DC electrofishing backpack system. Valentine Creek is a Class I trout water with natural reproduction. A temperature data logger was deployed in the stream from 4/12/21 to 10/4/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded that the maximum daily mean temperature was 21.9 degrees Celsius suggesting use of the cold-water IBI for fish.

Table 28 Fish Data Station 1715800HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/27/21	Cold-water	21.9	90	Excellent	Brook trout dominant species.

Brook Trout are a dominant species indicating the exceptional water quality found in Valentine Creek.

(91) specimens comprising (6) native fish species were captured and released as part of the fish survey. 91% of species were cool or cold-water species with (73) Brook trout being captured, measured for weight and length and then successfully released.

In summary, water quality at station 1715800HCN01 continues to be excellent based on the information collected during 2020-2021. 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.

1714100HCN01 Clear Creek

Clear Creek is a mile-long tributary to the Black River in Jackson County. Station 1714100HCN01 is located in the northeast corner of the Ho-Chunk Nation King of Thunder parcel where Clear Creek originates from a diverse wetland complex and a series of springs.

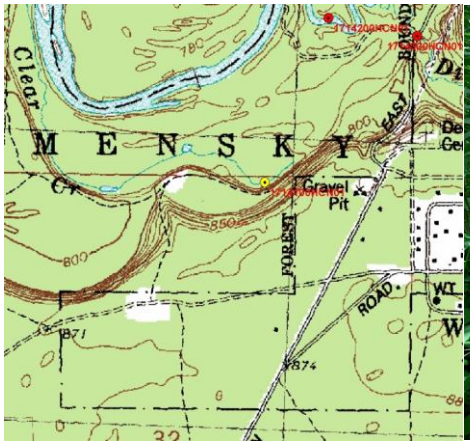

Fig. 11 24k Topographic Map

Station Photo Facing upstream

Station 1714100HCN01 was visited on (4) sampling events in January, April, July and October 2021 to monitor baseline water quality at this quarterly rotating basin station. 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 29 provides basic statistics for laboratory and core field parameters.

Table 29 Station ID	**1714100HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	7.96	10.57	9.31	6.0	0
pH	None	4	6.26	8.60	7.01	6.0-9.0	0
Specific conductance	uS/cm	4	156.1	206.6	172.7		
Temperature, water	deg C	4	5.32	13.20	9.85	22.8	0
Turbidity	NTU	4	0.02	0.58	0.23	0.84	0
Alkalinity, total	mg/l	4	20.4	20.9	20.68		
Chloride	mg/l	4	22.50	33.90	28.10		
Sulfate	mg/l	4	6.42	7.03	6.79		
Total suspended solids	mg/l	4	1.85	51.70	16.32		
Ammonia-nitrogen	mg/l	4	ND	0.093	0.048		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	1.170	2.730	1.820	0.13	100
Kjeldahl nitrogen	mg/l	4	ND	0.621	0.316	0.33	25
Phosphorus	mg/l	4	0.020	0.044	0.031	0.02875/0.075	50/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.009	0.015	0.012		
Escherichia coli	MPN/100ml	4	ND	185.0	50.3	410	0
Total Coliform	MPN/100ml	4	65.3	1732.9	733.9		

Parameters of notable concern include:

- Turbidity ranging from 0.48-2.82 NTUs.
- Nitrate+Nitrite ranging from 0.78-3.25 mg/L.
- Kjeldahl nitrogen ranging from 0.14 – 0.434 mg/L.

No dissolved oxygen, temperature, turbidity or pH values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples exceeded the reference criteria for nitrate + nitrite and the January 2021 sample

exceeded the Kjeldahl nitrogen threshold. The EPA reference criteria for Phosphorus was exceed in the January and April 2021 samples.
Macroinvertebrate sampling was also completed at station 1714100HCN01. The table below provides a summary of the macroinvertebrate data.

Table 30 Macroinvertebrate Data Station 1714100HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/26/21	4.54	5.00	1.99	4.70	3.17	26	26

The IBI condition gradient rating at station 1714100HCN01 is rated as "poor". The HBI water quality rating for this station is "good" with possibly some degree of organic pollution. The FBI value rating was also "good" indicating some organic pollution probably. The diversity index and richness values indicated a fairly diverse community of invertebrates considering the physical characteristics of this stream. Clear Creek is a first order stream that has little development and/or potential sources of point and non-point contributions. The IBI rating of poor and HBI and FBI ratings of good are unlikely the result of organic pollution.

An electrofishing survey was completed at station 1714100HCN01 on 7/28/21 using a DC electrofishing backpack system. A temperature data logger was deployed in the stream on 4/12/21 to 10/4/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature sensor was found to be compromised upon recovery and no temperature data was retrievable from the sensor. Previous temperature profiling of this stream confirms this is a cold-water head water stream that is spring fed.

Table 31 Fish Data Station 1714100HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/28/21	Cold-water	Not Determined	No score	Very Poor	No fish captured during survey.

In summary, water quality at station 1714100HCN01 is very good to excellent based on information collected during 2021. Clear Creek is a headwater stream that originates in an undeveloped area from springs within the surrounding wetland complex. These springs are readily observable flowing from the base of the hillside that is underlain by sandstone to the south of Clear Creek. Although this station is within Ho-Chunk trust land, the vast majority of the stream is located on land owned by the State of Wisconsin. The WDNR has classified this waterbody as an Exceptional Resource Water (ERW) because of excellent water quality and as a Class I trout stream because it supports naturally reproducing trout in the lower stream reach.

1709300HCN01 unnamed (William Sam Creek)
This unnamed creek flows approximately two miles northwest from Trowe Marsh before joining Levis Creek. Trowe Marsh hydrology has been severely altered by historic ditching that took place in the late 1800s and early 1900s. Hourly temperature monitoring conducted by Ho-Chunk Nation indicates that the water body is a warm water system and likely only capable of supporting a warm water forage fishery. Station 1709300HCN01 is located on the Ho-Chunk

Nation William Sam parcel approximately 0.35 miles upstream of the confluence with Levis Creek.

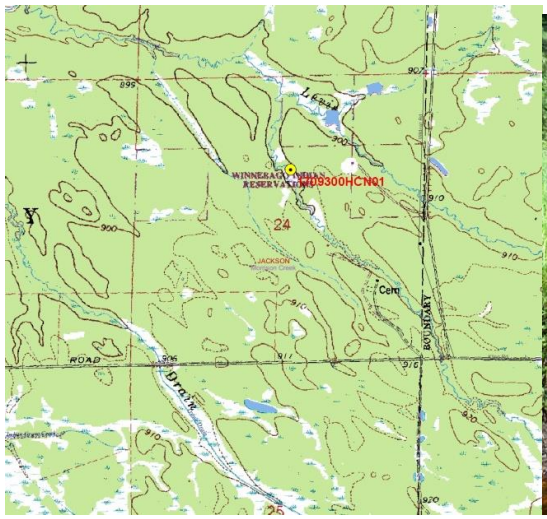

Fig. 12 24k Topographic Map


Station Photo Facing Upstream

Station 1709300HCN01 was visited on (4) sampling events in January, April, July and October 2021 to monitor baseline water quality 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 and Total Coliforms/*E.coli*. Table 32 provides basic statistics for laboratory and core field parameters.

Table 32 Station ID	**1709300HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	7.14	11.56	9.16	6.0	0
pH	None	4	3.97	7.18	5.35	6.0-9.0	75
Specific conductance	uS/cm	4	13.6	19.2	16.4		
Temperature, water	deg C	4	0.91	19.81	11.56	31.7	0
Turbidity	NTU	4	0.13	1.59	0.78	0.84	50
Alkalinity, total	mg/l	4	1	2.79	1.79		
Chloride	mg/l	4	0.55	1.95	1.24		
Sulfate	mg/l	4	0.56	1.54	1.20		
Total suspended solids	mg/l	4	ND	9.86	5.18		
Ammonia-nitrogen	mg/l	4	ND	0.093	0.048		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	ND	0.066	0.055	0.13	0
Kjeldahl nitrogen	mg/l	4	0.545	1.05	0.713	0.33	100
Phosphorus	mg/l	4	0.021	0.069	0.043	0.02875/0.075	75/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.005	0.027	0.019		
Escherichia coli	MPN/100ml	3	24.3	218.7	91.8	410	0
Total Coliform	MPN/100ml	3	2419.6	>2,419.6	2419.7		

Parameters of notable concern include:

- Turbidity ranging from 0.13-1.59 NTUs.
- Kjeldahl Nitrogen (TKN) from 0.545-1.05 mg/L
- Total Phosphorus ranging from 0.021-0.069 mg/L.

No dissolved oxygen or temperature values exceeded the established threshold criteria. Three pH measurements were below the threshold range but low pH waters are common in the area. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples exceeded the reference criteria for Kjeldahl nitrogen and the July and October 2021 samples exceeded the turbidity threshold. Three samples were above the EPA reference criteria for Total phosphorus but all results were below the state standard.

Macroinvertebrate sampling was also completed at station 1709300HCN01. The table below provides a summary of the macroinvertebrate data.

Table 33 Macroinvertebrate Data Station 1709300HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/26/21	4.53	4.53	3.65	4.66	3.36	10	10

The IBI condition gradient rating at station 1709300HCN01 is "fair" suggesting that restoration may be needed to improve water quality and conditions for biological communities. The HBI water quality rating for this station is "good" with some degree of organic pollution possible. The FBI value rating was also "good" indicating some probable organic pollution. The diversity index and richness values indicated a low level of invertebrate diversity.

An electrofishing survey was completed at station 1709300HCN01 on 7/28/21 using a DC electrofishing backpack system. A temperature data logger was deployed in the stream from 4/12/21 to 10/4/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded that the maximum daily mean temperature was 23.0 degrees Celsius suggesting the stream was a cool-water system and therefore use of the cold-water IBI for fish was appropriate.

Table 34 Fish Data Station 1709300HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/28/21	Cool-water	23.0	Not calculated	Very poor	<25 individuals captured

(20) specimens comprising (4) native fish species were captured and released as part of the fish survey. Species captured included Central mudminnow, Creek chub, White sucker and Johnny Darter. 95% of the fish captured are species considered to be tolerant of low dissolved oxygen and/or disturbed habitat. The fish community appears to have been greatly affected by past hydrologic manipulations in Trowe marsh.

In summary, water quality at station 1709300HCN01 is fair based on information collected during 2021. Water quality and biological populations are likely influenced by historic ditching and drainage modifications that continue to influence water temperature, sediment transport and fish movement.

1709000HCN01 Indian Grave Creek

Wetlands comprise the headwaters of Indian Grave Creek. It flows northwesterly for nine miles before entering Levis Creek. This stream was considered a warm-water forage fishery until cold groundwater from the Wazee iron mine dewatering operations was pumped to the stream. This diversion of groundwater to the creek temporarily changed the fishery in the lower 4.5 miles to a Class I brook trout stream. Since closure of the mine in April 1983, groundwater has not been routed to the creek but it still supports a cool-water fishery. Station 1709000HCN01 is located on the Ho-Chunk Nation Joe Wolf parcel approximately 0.1 miles upstream of the confluence with Levis Creek.

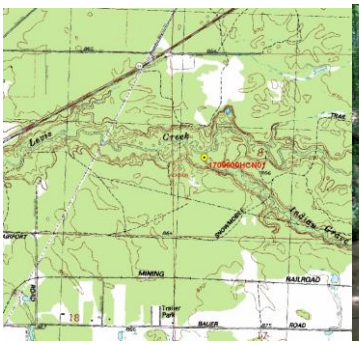

Fig. 13 24k Topographic Map

Station Photo Facing Upstream

Station 1709000HCN01 was visited on (4) sampling events in January, April, July and October 2021 to monitor baseline water quality at this quarterly rotating basin station. 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 35 provides basic statistics for laboratory and core field parameters.

Table 35 Station ID	**1709000HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	8.71	11.71	10.11	6.0	0
pH	None	4	6.33	6.95	6.70	6.0-9.0	0
Specific conductance	uS/cm	4	48.8	123.2	86.3		
Temperature, water	deg C	4	3.99	19.16	11.18	22.8	0
Turbidity	NTU	4	0.07	5.42	2.98	0.84	75
Alkalinity, total	mg/l	4	7.95	23.7	15.92		
Chloride	mg/l	4	0.93	2.39	1.58		
Sulfate	mg/l	4	10.10	27.50	20.03		
Total suspended solids	mg/l	4	1.85	11.00	4.75		
Ammonia-nitrogen	mg/l	4	ND	0.109	0.066		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.075	0.219	0.144	0.13	50
Kjeldahl nitrogen	mg/l	4	0.216	0.705	0.391	0.33	50
Phosphorus	mg/l	4	0.015	0.055	0.027	0.02875/0.075	25/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.004	0.020	0.011		
Escherichia coli	MPN/100ml	4	3.0	152.9	62.5	410	0
Total Coliform	MPN/100ml	4	59.6	>2,419.6	1066.3		

Parameters of notable concern include:

- Turbidity ranging from 0.07-5.42 NTUs.

- Kjeldahl Nitrogen (TKN) from 0.216-0.705 mg/L
- Nitrate+Nitrite ranging from 0.075-0.219 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 51, there were three turbidity and two Kjeldahl nitrogen samples above the reference criteria. Two samples also exceeded the nitrate + nitrite and one sample exceeded the Total phosphorus reference criteria.

Macroinvertebrate sampling was also completed at station 1709000HCN01. The table below provides a summary of the macroinvertebrate data.

Table 36 Macroinvertebrate Data Station 1709000HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/26/21	3.63	3.57	7.83	4.07	4.11	29	26

The IBI condition gradient rating at station 1709000HCN01 is "excellent" suggesting that efforts should be directed at maintaining this condition. The HBI and FBI water quality ratings for this station were "very good" with potentially possible slight apparent organic pollution. The diversity index and richness values indicated a broad range of macroinvertebrate diversity.
An electrofishing survey was completed at station 1709000HCN01 on 7/27/21 using a DC electrofishing backpack system. The backpack system is not the preferred electrofishing equipment for a stream of this size with low conductivity, but access to the sampling reach requires traversing approximately 0.25 miles on foot through a forested area. A temperature data logger was deployed in the stream from 4/12/21 to 10/4/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature sensor was found to be compromised upon recovery and no temperature data was retrievable from the sensor. Previous temperature profiling of this stream concluded use of cold-water IBI for fish.

Table 37 Fish Data Station 1709000HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
10/12/21	Cold-water	Not Determined	70	Good	Difficulty capturing fish with backpack system. Additional Brook trout observed but not captured or included in IBI calculation.

The electrofishing survey resulted in (27) specimens being captured, measured and successfully released without injury or mortality. The survey identified (3) native species with 81% of fish captured being cool or cold-water species. (22) Brook trout were captured during the survey which was a significant increase in the number of Brook trout from the previous electrofishing survey in 2016 that yielded (7) Brook trout and (9) fish total for the survey.

In summary, water quality at station 1709000HCN01 is considered good based on information collected during 2021. Although this station is within Ho-Chunk trust land, the majority of the stream is located on land owned by the State of Wisconsin. Historical ditching of the stream and adjacent marshes are apparent in the headwaters with over 3.5 miles of ditching identifiable on aerial photography from 2015.

1708900HCN01 Levis Creek

Levis Creek originates in an extensive wetland complex in the Black River State Forest. Ditches constructed decades ago to drain the wetlands for forestry and agriculture still persist today. Squaw Mound Flowage is a 14-acre impoundment located on the upper end of Levis Creek. The stream is managed as a class I trout stream from its junction with Indian Grave Creek to the Black River. Upstream of Indian Grave Creek confluence, forage fish generally inhabit the stream. The area draining into Levis Creek is largely forested. Station 1708900HCN01 is located southeast of STH 54 approximately 50 feet upstream of the STH 54 concrete box culvert structure.

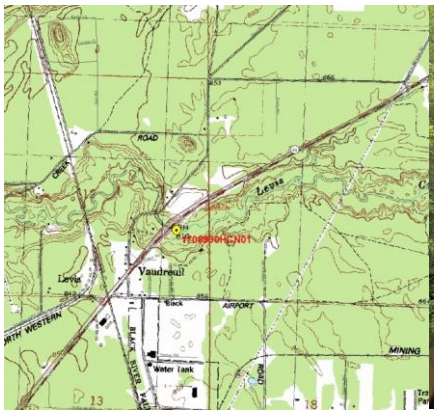

Fig. 14 24k Topographic Map

Photo Facing upstream

Station 1708900HCN01 was visited on (4) sampling events in January, April, July and October 2021 to monitor baseline water quality at this quarterly rotating basin station. 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*. The table below provides basic statistics for laboratory and core field parameters.

Table 38 Station ID	**1708900HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	8.38	12.18	10.15	6.0	0
pH	None	4	6.73	6.89	6.79	6.0-9.0	0
Specific conductance	uS/cm	4	46.7	85.4	65.7		
Temperature, water	deg C	4	2.12	17.26	10.73	22.8	0
Turbidity	NTU	3	1.44	3.52	2.39	0.84	100
Alkalinity, total	mg/l	4	6.76	15	10.95		
Chloride	mg/l	4	1.36	4.21	2.64		
Sulfate	mg/l	4	9.89	16.00	12.67		
Total suspended solids	mg/l	4	1.17	12.10	5.66		

Ammonia-nitrogen	mg/l	4	ND	0.061	0.038		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.089	0.241	0.159	0.13	75
Kjeldahl nitrogen	mg/l	4	0.285	0.750	0.477	0.33	50
Phosphorus	mg/l	4	0.021	0.059	0.032	0.02875/0.075	25/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	ND	0.016	0.012		
Escherichia coli	MPN/100ml	4	4.1	307.6	99.2	410	0
Total Coliform	MPN/100ml	4	22.7	>2,419.6	1077.6		

Parameters of notable concern include:

- Turbidity ranging from 1.44-3.52 NTUs.
- Kjeldahl Nitrogen (TKN) from 0.285-0.750 mg/L
- Nitrate+Nitrite ranging from 0.089-0.241 mg/L.

No temperature, dissolved oxygen or pH values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, all samples exceeded the reference criteria for turbidity and 50% of samples exceeded the Kjeldahl nitrogen. The nitrate + nitrite threshold was exceeded in 50% of samples and the Total phosphorus reference was exceeded in the July 2021 sample.

Macroinvertebrate sampling was also completed at station 1708900HCN01. The table below provides a summary of the macroinvertebrate data.

Table 39 Macroinvertebrate Data Station 1708900HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/25/21	0.98	1.81	5.33	2.40	2.40	26	24

The IBI condition gradient rating at station 1708900HCN01 is “good” indicating that any management efforts should focus on maintaining that condition. The HBI water quality rating for this station is “excellent” with no apparent organic pollution. The FBI value rating was also “excellent” indicating organic pollution was unlikely. The diversity index and richness values indicated a broad range of macroinvertebrate diversity.

An electrofishing survey was completed at station 1708900HCN01 on 8/5/21 using a DC electrofishing tote-barge system. A temperature data logger was deployed in the stream from 4/12/21 to 10/5/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded that the maximum daily mean temperature was 21.3 degrees Celsius suggesting the stream was a cold-water system and therefore use of the cold-water IBI for fish was appropriate.

Table 40 Fish Data Station 1708900HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/5/21	Cold-water	21.3	50	Fair	Difficult to effectively survey stream with the backpack unit due to stream width, low conductivity and stained water.

The fish survey resulted in (31) specimens being captured, measured and released. These fish included (4) native fish species including Brook trout, Johnny Darter, White sucker and Central mudminnow and the non-native Brown trout which were commonly stocked in prior years. were captured and released as part of the fish survey. 48% of fish were cool or cold-water species with (5) Brook trout and (10) Brown trout being captured and successfully released.

In summary, water quality at station 1708900HCN01 is considered good based on information collected during 2021. 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 exceptional water quality and as a Class I trout stream because it has naturally reproducing trout in the segment from the Black River to Indian Grave Creek.

1716600HCN01 Mollies Creek

Mollies Creek is a ten-mile long tributary to Morrison Creek in Jackson County. Mollies Creek is a warm water forage fishery. Station 1716600HCN01 is located on the Ho-Chunk Nation Opinkah parcel approximately 1.2 miles downstream of the Cemetery Road bridge crossing.

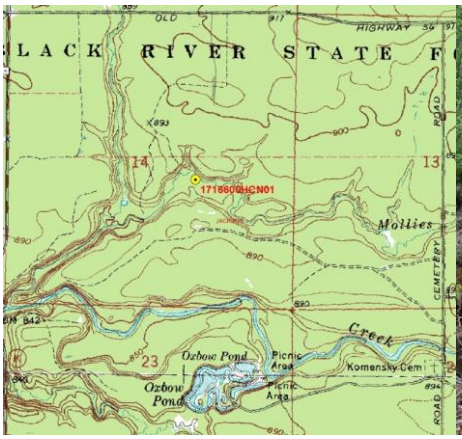

Fig. 15 24k Topographic Map

Station Photo Facing Upstream

Station 1716600HCN01 was visited on (4) sampling events in April, July and October 2021 and January 2017 to monitor baseline water quality at this quarterly rotating basin station. 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 41 provides basic statistics for laboratory and core field parameters.

Table 41 Station ID	**1716600HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	8.19	13.16	10.17	6.0	0
pH	None	4	6.18	6.98	6.52	6.0-9.0	0
Specific conductance	uS/cm	4	22.0	32.9	25.8		
Temperature, water	deg C	4	0.03	19.84	12.90	31.7	0
Turbidity	NTU	4	0.60	1.32	0.92	0.84	50
Alkalinity, total	mg/l	4	3.08	9.96	6.09		
Chloride	mg/l	4	0.64	1.73	1.19		

Sulfate	mg/l	4	2.11	3.27	2.51		
Total suspended solids	mg/l	4	ND	3.38	2.03		
Ammonia-nitrogen	mg/l	4	ND	0.084	0.041		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.055	0.079	0.062	0.13	0
Kjeldahl nitrogen	mg/l	4	0.298	0.528	0.423	0.33	75
Phosphorus	mg/l	4	0.014	0.028	0.020	0.02875/0.075	0/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	ND	0.006	0.004		
Escherichia coli	MPN/100ml	4	ND	75.4	27.5	410	0
Total Coliform	MPN/100ml	4	37.1	>2,419.6	1228.9		

Parameters of notable concern include:

- Turbidity ranging from 0.60-1.32 NTUs.
- Kjeldahl Nitrogen (TKN) from 0.298-0.528 mg/L

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

Macroinvertebrate sampling was also completed at station 1716600HCN01. The table below provides a summary of the macroinvertebrate data.

Table 42 Macroinvertebrate Data Station 1716600HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/25/21	3.58	3.83	7.37	3.09	4.26	33	33

The IBI condition gradient rating at station 1716600HCN01 is “good” suggesting that efforts should focus on maintaining or continuing to improve this condition over time. The HBI water quality rating for this station is “very good” with possible slight organic pollution. The FBI value rating was “excellent” indicating organic pollution was unlikely. The diversity index and richness values indicated a diverse community of macroinvertebrates.

An electrofishing survey was completed at station 1716600HCN01 on 7/28/21 using a DC electrofishing back-pack system. A temperature data logger was deployed in the stream from 4/7/21 to 10/4/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded that the maximum daily mean temperature was 24.2 degrees Celsius suggesting the stream was a warm-water system and therefore use of the warm-water IBI for fish was appropriate.

Table 43 Fish Data Station 1716600HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/28/21	Warm-water	24.2	30	Fair	

(63) specimens comprising (6) native fish species were captured and released as part of the fish survey. Species captured included Creek chub, Central mudminnow, White sucker, Johnny Darter, Blackside darter, Rainbow darter, Longnose dace and Redbelly dace. 40% of the fish captured are species considered to be tolerant of low dissolved oxygen and/or disturbed habitat.

In summary, water quality at station 1716600HCN01 is considered good based on information collected during 2021. 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 portion of Mollies Creek is classified as a warm-water fishery. Approximately one mile downstream of station 1716600HCN01, Mollies Creek enters an area designated as the Upper Black River State Natural Area.

1742600HCN01 unnamed (Green Allotment Creek)

This unnamed creek, located in the O'neill-Cunnigham watershed, flows approximately one-mile northwest before joining with the Black River just above Lake Arbutus. Sampling station 1742600HCN01 is located directly upstream of the Arbutus Drive culvert crossing. Long-term hourly temperature monitoring conducted by the Ho-Chunk Nation suggest that the stream is trending towards a warm water system and likely only capable of supporting a forage fishery.

Fig. 16 24k Topographic Map

Station Photo June Facing Upstream

Station 1742600HCN01 was visited on (4) sampling events in April, July and October 2021to monitor baseline water quality at this quarterly rotating basin station. 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 44 provides basic statistics for laboratory and core field parameters.

Table 44 Station ID	**1742600HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	6.67	12.58	9.96	6.0	0
pH	None	4	5.62	8.55	6.79	6.0-9.0	0
Specific conductance	uS/cm	4	23.6	41.9	32.1		
Temperature, water	deg C	4	0.34	16.73	11.11	31.7	0
Turbidity	NTU	4	0.18	1.43	0.51	0.84	25
Alkalinity, total	mg/l	4	1	8.38	5.25		
Chloride	mg/l	4	1.12	2.22	1.65		

Sulfate	mg/l	4	2.92	4.69	3.60		
Total suspended solids	mg/l	4	ND	4.36	2.04		
Ammonia-nitrogen	mg/l	4	ND	0.267	0.103		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.119	0.529	0.266	0.13	75
Kjeldahl nitrogen	mg/l	4	0.183	0.743	0.527	0.33	75
Phosphorus	mg/l	4	0.008	0.037	0.022	0.02875/0.075	25/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	ND	0.018	0.008		
Escherichia coli	MPN/100ml	4	ND	613.1	160.0	410	25
Total Coliform	MPN/100ml	4	1.0	>2,419.6	784.9		

Parameters of notable concern include:

- Turbidity ranging from 0.18-1.43 NTUs.
- Kjeldahl Nitrogen (TKN) from 0.183 - 0.743 mg/L
- Nitrate+Nitrite ranging from 0.119 - 0.529 mg/L.

No dissolved oxygen, pH or temperature values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, there were one turbidity and three Kjeldahl nitrogen samples above the reference criteria. Three nitrate + nitrite values were also above the reference criteria. The EPA threshold for Total phosphorus was exceeded in the July 2021sample but well below the state standard of 0.075 mg/L.

Macroinvertebrate sampling was also completed at station 1742600HCN01. The table below provides a summary of the macroinvertebrate data.

Table 45 Macroinvertebrate Data Station 1742600HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/25/21	4.95	4.95	4.90	5.30	3.84	18	18

The IBI condition gradient rating at station 1742600HCN01 is “fair” suggesting that management actions should focus on restoration to improve this condition. The HBI water quality rating for this station is “good” suggesting possibly some organic pollution. The FBI value rating was “fair” indicating organic pollution was likely. The diversity index and richness values indicated fairly low diversity in the macroinvertebrate community.

An electrofishing survey was completed at station 1742600HCN01 on 7/27/21 using a DC electrofishing back-pack system. A temperature data logger was deployed in the stream from 4/7/21 to 10/4/21 to collect hourly temperature readings in order to determine the correct IBI to apply to the sampling reach. The temperature profile concluded that the maximum daily mean temperature was 21.3 degrees Celsius suggesting the stream was a cold-water system and therefore use of the cold-water IBI for fish was appropriate.

Table 46 Fish Data Station 1742600HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/27/21	Cold-water	21.3	0	Very Poor	No cool or cold-water fish captured.

The fish survey resulted in (128) individuals being captured with only three species being represented that were not cool or cold-water species. The site was assigned the IBI rating of Very poor that corresponds to the score of zero. The IBI classification based on temperature would suggest the use of the cold-water IBI. However, the stream has attributes of a warm-water forage fishery and is also a head-water stream with generally low productivity.

In summary, water quality at station 1742600HCN01 is considered fair to good based on information collected during 2021. The majority of this head-water stream is located on Ho-Chunk trust land that is in forest and wetland land cover with no development. The stream has no identifiable stressors on the portion located above or within the tribal land.

<u>Middle and South Branches Embarrass River Watershed</u>

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.

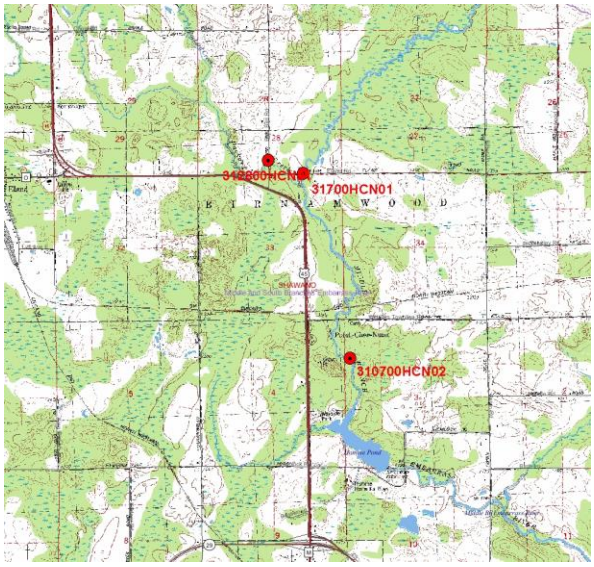

Fig. 11 24k Topographic Map

310700HCN02 Middle Branch Embarrass River (downstream)

Station 310700HCN02 is located approximately 0.43 miles upstream of Homme Pond. The station is located on the Ho-Chunk Nation Christianson 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.

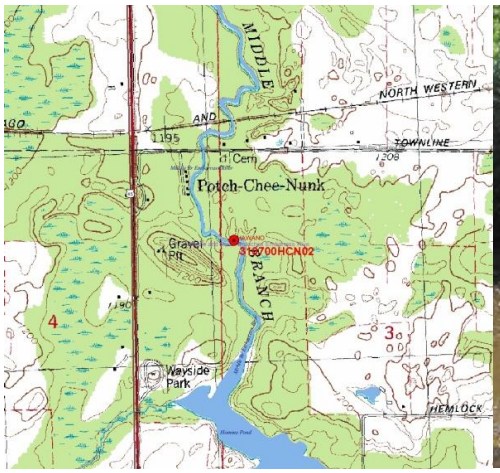

Fig. 12 24k Topographic Map

Station Photo Facing upstream

Station 310700HCN02 was visited on (8) sampling events to monitor baseline water quality during 2020-2021. 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 47 provides basic statistics for laboratory and core field parameters.

Table 47 Station ID	**310700HCN02**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	6	8.01	12.96	10.25	6.0	0
pH	None	8	7.22	8.57	7.99	6.0-9.0	0
Specific conductance	uS/cm	8	208.4	485.4	359.2		
Temperature, water	deg C	8	-0.06	20.70	8.94	22.8	0
Turbidity	NTU	8	0.16	4.74	1.24	0.84	50
Alkalinity, total	mg/l	8	105	222	169.75		
Chloride	mg/l	8	6.75	13.40	10.59		
Sulfate	mg/l	8	3.21	7.74	5.42		
Total suspended solids	mg/l	8	1.10	23.00	5.74		
Ammonia-nitrogen	mg/l	8	ND	0.120	0.043		
Inorganic nitrogen (nitrate and nitrite)	mg/l	8	0.599	3.26	1.627	0.13	100
Kjeldahl nitrogen	mg/l	8	0.216	1.05	0.611	0.33	87.5
Phosphorus	mg/l	8	0.009	0.079	0.040	0.02875/0.075	50/25
Soluble Reactive Phosphorus (SRP)	mg/l	8	ND	0.036	0.017		
Escherichia coli	MPN/100ml	8	8.6	1299.7	393.2	410	37.5
Total Coliform	MPN/100ml	8	84.5	>2,419.6	1149.3		

Parameters of notable concern include:

- Turbidity ranging from 0.16-4.74 NTUs.
- Kjeldahl Nitrogen (TKN) ranging from 0.216 – 1.05 mg/L.
- Nitrate+Nitrite ranging from 0.599 – 3.26 mg/L.
- Total Phosphorus ranging from 0.009 - 0.079 mg/L.

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 nitrate + nitrite and seven of eight were above the Kjeldahl nitrogen threshold. 50% of Total phosphorus values were above the EPA reference criteria with the April and July 2021 samples also exceeding the State of Wisconsin standard of 0.075 mg/L. The threshold applied to E. coli is based on the State of WI standard that states the statistical threshold value (410 counts per 100mL) shall not be exceeded more than 10% of the time during any rolling 90-day period during the recreation season. It should be noted that comparison of sample results to this threshold value is limited because of the small number of samples the Nation collects during the recreation season.

Macroinvertebrate sampling was also completed at station 310700HCN01. The table below provides a summary of the macroinvertebrate data.

Table 48 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
5/26/21	3.74	3.81	9.84	4.31	4.74	49	42

The IBI condition gradient rating at station 310700HCN02 is “excellent” and efforts should focus on considering outstanding and exceptional listing. 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 some organic pollution was probable. The diversity index and richness values indicated a diverse range of macroinvertebrates.

An electrofishing survey was completed at station 310700HCN02 on 7/21/21 using a DC electrofishing tote-barge system. A temperature data logger was not deployed in the stream during the 2021 open water season but prior temperature profiling supports the application of the cold-water IBI for fish for this station.

Table 49 Fish Data Station 310700HCN02

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
7/27/21	Cold-water	Not Determined	50	Fair	Difficulty wading this stream.

The fish survey resulted in (127) specimens being captured, measured and released. These fish included (10) native fish species with native Brook trout comprising 20% of the fish captured and White sucker comprising 32% of the sample. Other species included Johnny Darter, Rainbow trout, Longnose dace, Blackside darter, Creek chub, Smallmouth bass, Hognose sucker and Mottled sculpin. 25% of fish species captured were cool or cold-water species.

In summary, water quality at station 310700HCN02 is considered good based on the information collected during 2020-2021. 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.

South Fork Eau Claire River Watershed

RB5 stations 5013343HCN01 and 5013291HCN01 are located in the South Fork Eau Claire River HUC-10 watershed. The watershed encompasses approximately 229 square miles and is found in the western half of Clark County, WI. The South Fork Eau Claire River Watershed is located in two ecological landscapes, the Forest Transition and the Central Sand Plains. The Forest Transition Ecological Landscape lies along the northern border of Wisconsin's Tension Zone, through the central and western part of the state, and supports both northern forests and agricultural areas. The southern half of this watershed is primarily county forest, while the northern half is used for agriculture. It should be noted that station 5013291HCN01 was not monitored during any of the sampling events in 2020 because the sampling station was dry during each visit.

Low-gradient warm water streams abound in this watershed. Only Black, Dickison, Horse, and Scott Creeks are classified as trout waters. Mead Lake is the largest impoundment in the South Fork of the Eau Claire River watershed. The watershed ultimately drains to the Eau Claire River that flows into multiple lakes and reservoirs before its confluence with the Chippewa River.

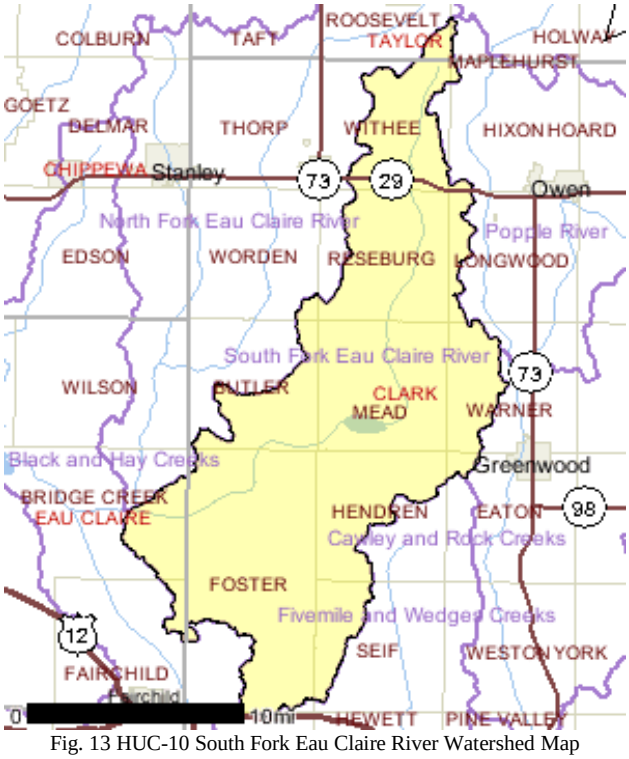

Fig. 13 HUC-10 South Fork Eau Claire River Watershed Map

RB5 Station 5013343HCN01

This unnamed waterway originates in forested wetland drainage and flows northwest for approximately 0.7 miles before joining another unnamed waterway. These waterways ultimately flow into Rocky Run a waterway with a default WDNR Fish and Aquatic Life Designated Use. The unnamed waterway associated with station 5013343HCN01 flows through a forested landscape and is generally unaltered with significant natural buffer areas. Station

5013343HCN01 HCN01 is located 0.25 miles downstream of the culvert crossing located on Sterling Ave. The station is accessed via allotment trust land from Sterling Ave.

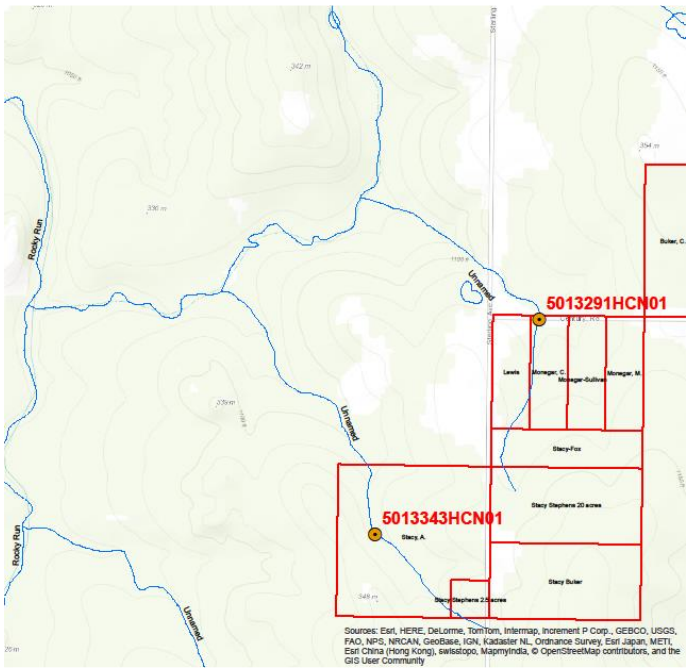

Fig. 14 Topographic Map

Station 5013343HCN01 was visited on (4) sampling events during 2020 to complete baseline monitoring at this rotating station. The site was not sampled or monitored in October because it lacked available water 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. Table 50 provides basic statistics for laboratory and core field parameters.

Table 50 Station ID	**5013343HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	4	6.57	12.18	10.03	3	0
pH	None	4	7.31	8.65	8.21	6.0-9.0	0
Specific conductance	uS/cm	4	24.2	39.3	31.7		
Temperature, water	deg C	4	0.36	25.30	9.62	31.7	0
Turbidity	NTU	4	0.10	12.79	5.39	0.84	75
Alkalinity, total	mg/l	4	3.32	9.1	5.87		
Chloride	mg/l	4	0.94	3.40	2.55		
Sulfate	mg/l	4	2.64	4.10	3.19		
Total suspended solids	mg/l	4	1.33	4.50	2.63		
Ammonia-nitrogen	mg/l	4	ND	0.041	0.034		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	ND	0.168	0.113	0.13	50
Kjeldahl nitrogen	mg/l	4	0.250	0.493	0.364	0.33	75
Phosphorus	mg/l	4	0.020	0.073	0.040	0.02875/0.075	50/0
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.008	0.039	0.018		
Escherichia coli	MPN/100ml	4	4.1	60.5	28.3	410	0
Total Coliform	MPN/100ml	4	46.0	>2419.6	1238.2		

Parameters of notable concern include:

- Kjeldahl Nitrogen (TKN) values of 0.250 - 0.493 mg/L
- Nitrate+Nitrite values of no detection to 0.168 mg/L
- Total Phosphorus values of 0.020 – 0.073 mg/L
- Turbidity values ranging from 0.10 – 12.79 NTU

No temperature, pH or dissolved oxygen values exceeded the established threshold criteria. Based on the EPA reference criteria for Ecoregion VII sublevel ecoregion 51, 75% of samples were above the threshold values for Kjeldahl nitrogen and turbidity. 50% of samples exceeded the EPA reference criteria for Total phosphorus and Nitrate + Nitrite thresholds but samples did not exceed the State of Wisconsin Total phosphorus standard of 0.075 mg/L.

Macroinvertebrate sampling was also completed at station 5013343HCN01. The table below provides a summary of the macroinvertebrate data.

Table 51 Macroinvertebrate Data Station 5013343HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/12/20	4.26	4.28	4.19	3.81	4.09	23	23

The IBI condition gradient rating at station 5013343HCN01 is “fair” and efforts should focus on improving stream condition. The HBI water quality rating for this station is “very good” with possible slight organic pollution. The FBI value rating was also “very good” indicating possible slight organic pollution. The diversity index and richness values indicated a range of aquatic life.

An electrofishing survey was completed at station 5013343HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 5/13/20 to 10/20/20 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. However, this stream is considered a forage fishery because it lacks adequate available water depth and flow during the year.

Table 52 Fish Data Station 5013343HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/11/20	Cold-water	20.59	Not calculated	Very Poor	< 25 individuals captured

The fish survey resulted in (13) individuals being captured with Brook stickleback being the only species captured. The IBI was not calculated because less than 25 fish were captured. The prior survey in 2015 documented (29) Brook stickleback and (4) Creek chub being captured.

In summary, water quality at station 5013343HCN01 is considered good based on the information collected during 2020. This stream is a first order stream in an undeveloped area that may be slightly influenced by row crop agriculture in the watershed. The stream was likely a forage fishery historically so the overall lack of species and lack of sport fish and/or cold-water species appears to be the normal state for this waterbody.

North Fork Eau Claire River Watershed

RB5 station 2145400HCN01 lies within the North Fork Eau Claire River Watershed. This watershed is within four Wisconsin counties: south eastern Chippewa, southwestern Taylor, northwest Clark, and northeast Eau Claire. This watershed is one of twenty-four watersheds within the Lower Chippewa River Basin. The watershed encompasses approximately 206 square miles composed of primarily agricultural and forest landscapes. Wetlands and grasslands make up the other major land use and cover in the watershed. The watershed is located in three ecological landscapes, the Forest Transition, the Northcentral Forest and the Central Sand Plains.

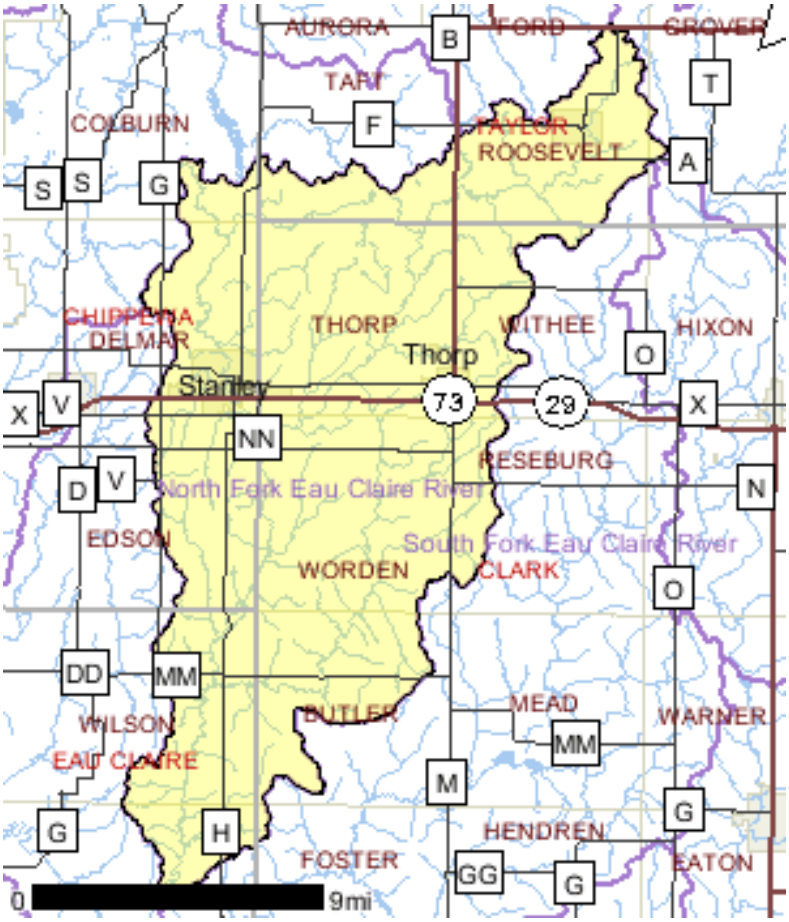

Fig. 15 HUC-10 North Fork Eau Claire River Watershed Map

RB5 Station 2145400HCN01

The North Fork of the Eau Claire River originates in southwestern Taylor County. It flows for approximately 48 miles before joining up with the South Fork in Eau Claire County. The North Fork of the Eau Claire River is a 56-mile warm water sport fishery. The river lacks deep water habitat for sport fish especially during low flow periods and the WDNR has identified potential issues with sedimentation and high phosphorus levels due to nonpoint source runoff.

Station 2145400HCN01 is located approximately 0.25 miles upstream of the confluence with Simes Creek. The site is accessed via the O'connor Trust parcel from County Highway MM.

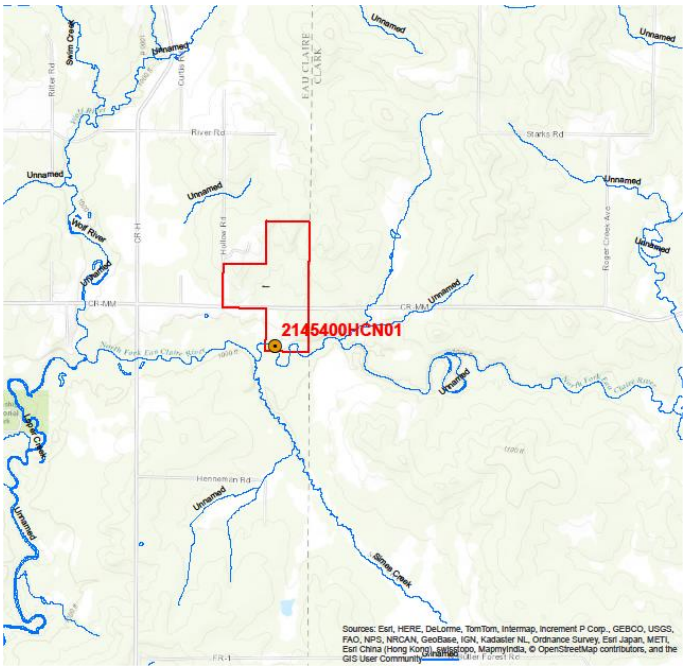

Fig. 16 Topographic Map

Station 2145400HCN01 was visited on (4) sampling events during 2020 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. Tables 53 provides basic statistics for laboratory and core field parameters.

Table 53 Station ID	**2145400HCN01**						
Parameter	**Units**	**# (n) Samples**	**Min.**	**Max.**	**Avg.**	**Threshold Value**	**% (n) Exceedance**
Dissolved oxygen (DO)	mg/l	3	9.38	13.43	11.22	5	0
pH	None	4	7.92	8.89	8.33	6.0-9.0	0
Specific conductance	uS/cm	4	117.3	195.6	151.8		
Temperature, water	deg C	4	-0.06	26.20	9.54	31.7	0
Turbidity	NTU	4	1.42	23.00	7.60	0.84	100
Alkalinity, total	mg/l	4	43	60.1	52.38		
Chloride	mg/l	4	8.94	18.80	12.06		
Sulfate	mg/l	4	3.60	5.91	4.72		
Total suspended solids	mg/l	4	1.70	7.17	4.37		
Ammonia-nitrogen	mg/l	4	ND	0.181	0.126		
Inorganic nitrogen (nitrate and nitrite)	mg/l	4	0.300	0.760	0.547	0.13	100
Kjeldahl nitrogen	mg/l	4	0.670	0.872	0.800	0.33	100
Phosphorus	mg/l	4	0.112	0.170	0.130	0.02875/0.075	100/100
Soluble Reactive Phosphorus (SRP)	mg/l	4	0.075	0.140	0.098		
Escherichia coli	MPN/100ml	4	25.9	98.3	55.2	410	0
Total Coliform	MPN/100ml	4	199.3	>2419.6	933.3		

Parameters of notable concern include:

- Kjeldahl Nitrogen (TKN) values of 0.670 - 0.872 mg/L
- Nitrate+Nitrite values ranging from 0.300 - 0.76 mg/L

- Total Phosphorus value ranging from 0.112 – 0.17 mg/L
- Total Coliforms values ranging from 199.3 - 613.1 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 three samples were above the threshold values for Kjeldahl nitrogen, Nitrate + Nitrite and Total phosphorus. The October 2015 sample also exceeded the turbidity threshold.

Macroinvertebrate sampling was also completed at station 2145400HCN01. The table below provides a summary of the macroinvertebrate data.

Table 54 Macroinvertebrate Data Station 2145400HCN01

Date	Hilsenhoff Biotic Index (HBI)	10-Max HBI	Index of Biotic Integrity (IBI)	Family Biotic Index (FBI)	Shannon Diversity Index	Species Richness	Genera Richness
5/14/20	3.75	3.68	6.10	3.92	3.95	36	32

The IBI condition gradient rating at station 2145400HCN01 is "good" 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 also "very good" indicating possible slight organic pollution. The diversity index and richness values indicated a very good range of aquatic life.

An electrofishing survey was completed at station 2145400HCN01 using a DC electrofishing ETS backpack system. A temperature data logger was deployed in the stream from 5/12/20 to 10/20/20 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 55 Fish Data Station 2145400HCN01

Date	IBI Classification	Max. Daily Mean Temp C°	Index of Biotic Integrity (IBI) Score	IBI Rating	Comments
8/11/20	Warm-water	24.37	Not calculated	Not determined	Equipment limitations

The fish survey resulted in (30) individuals being captured with seven species represented. Species included several minnow species including Johnny darter, Fantail darter and Rainbow darter along with Creek chub, Common shiner and dace species. The IBI was not calculated because less than (50) fish were captured using a backpack shocker. Site access, location and staff availability limited the use of the tote barge unit and therefore the backpack system was used. A single backpack is inadequate for conducting surveys on such a large stream and relatively low conductivity waters results in an ineffective sampling field and significant battery drain in a short period of time.

In summary, water quality at station 5013343HCN01 is considered fair based on the information collected during 2020. Chemical water quality appears to be significantly influenced by row crop agriculture within the watershed. The stream does appear to support a fairly diverse warm-water fish and macroinvertebrate community.

8. Water Quality Issues and Upcoming Assessment Efforts

Baseline water quality monitoring results continue to be of concern regarding the current water quality found on tribal lands. 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 primarily from non-point source contributions continue to be apparent. Elevated nutrient levels, suspended sediments, turbidity, elevated water temperature and high bacteria counts have been observed on several streams that are found in agriculture dominant watersheds.

The Nation has made significant efforts over the past 20 years to address non-point source contributions on tribal land. USDA NRCS Environmental Quality Incentives Program cost-sharing and Bureau of Indian Affairs grants have been used to install Best Management Practices to reduce soil erosion and in turn improve water quality while providing wildlife habitat. These practices have included the installation of miles of grassed waterway, stream buffer strips, streambank stabilization and water control structures. In addition, the Nation has completed multiple wetland and stream restoration projects and converted several hundred acres of row-crop agricultural fields to native grass and forb plantings that provide wildlife habitat and are far more effective at stabilizing the soil and promoting infiltration. The future of water quality on tribal land is dependent on the ability of stakeholders to communicate and work together with a common goal of improving water quality and soil health while providing an economic model for conservation agriculture to be profitable and sustainable.

In 2022, monitoring efforts will continue to focus on the (9) fixed stations located in Jackson, Shawano and Vernon Counties of Wisconsin. In addition, the program will revisit the (2) Rotating Year Two Stations located in La Crosse Co. WI and Houston Co. MN that were last visited in 2017. These stations will be visited quarterly in January, April, July and October. Monitoring activities will include the collection of water samples for chemical analysis and the biological monitoring of fish and macroinvertebrate communities.