LTBB Water Quality Program

Water Quality Assessment Report

A summary and compilation of data taken under EPA 106 Clean Water Act Portion of the Performance Partnership Grant BG-96552411

For Data Collection Activities Completed: 1/1/23-12/31/23

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Atlas Table

Table 1 is an inventory of Tribal water resources. The number of monitored sites on lakes, creeks, streams, rivers, and wetlands are the sites completed and summarized during the reporting period. Total miles of rivers and streams on Tribal Lands, acres of lakes/reservoirs/ponds on Tribal lands, acres of wetlands (including coastal), and miles of Great Lakes shoreline are based on reservation boundaries at beginning of assessment period for the middle column. The furthest right column describes these land and water resources in the 1836 ceded territory, in which we have a responsibility to co-manage the natural resources.

Table 1. Atlas Table

Factor/Resource	Reservation	Ceded Territory
Surface area of Tribal lands (acres)	1361.28	29,888,576
Total number of enrolled LTBB Tribal citizens	4576	-
Total miles of rivers and streams on Tribal lands	1.96	18,010
Number of monitoring sites on rivers, streams, or creeks	8	-
Number of monitoring sites on lakes/reservoirs/ponds	0	-
Acres of lakes/reservoirs/ponds on Tribal lands	2.42	488,064
Acres of wetlands (including coastal)	296.4	3,171,904
Number of monitored wetland sites	2	-
Miles of Great Lakes shoreline	1.43	2,176.9

Purpose/Description of LTBB Water Quality Protection Program (WQPP)

LTBB has always emphasized our strong connection to the Nibiish (“water” in Anishnaabemowin) and they are known as “water people”. Nibiish is part of our culture, traditions and has sustained the Tribe throughout time. Without clean waters, this perpetuation would not continue.

In 2010, the LTBB Surface Water Quality Protection Program completed a baseline assessment for specific water bodies within and adjacent to the 1855 Reservation Boundary. The data assessed was taken during 6-month field seasons over ten years on a biennial rotation. During this time, the program experienced new Tribal water quality issues/concerns, governmental changes, increased trust land, and a better understanding of changes in parameters and the frequency with which water bodies should be monitored.

The Wetlands Protection Program was merged with the Surface Water Quality Protection Program in August of 2013. LTBB recognizes wetlands as surface water and chose to re-name the program to Water Quality Protection Program (WQPP). In addition, merging programs provided some relief to strained budgets due to increased space costs, indirect rates and increased communication between LTBB water staff. The two water staff members have increased activities and duties and needed continued training to complete Floristic Quality Assessments (FQAs). Interim Regulations were completed in January 2011, by a Natural Resource staff and commission-based workgroup but these regulations have not been presented to nor approved by Tribal Council. Updated draft regulations were completed in 2020

and again in 2023. As of early 2024, the regulations are being reviewed by LTBB's Executive Services Attorney to ensure proper formatting and legal requirements are met before sending to Tribal Council for approval. We anticipate that the final regulations will be approved by Tribal Council sometime in 2024. We are also in the process of filling an Environmental Appeals Board to review appeals on LTBB wetland permitting decisions. LTBB WQPP may also research grant opportunities to review other functional assessments that may be useful in classifying high quality wetlands based on Tribal uses. Any data collection activities were updated and approved in the revised December 2020 LTBB Quality Assurance Project Plan or approved via email afterward (i.e. moving VNC1 to VNC1B).

In 2022, as a result of the LTBB reservation boundary case, LTBB's 106 jurisdictional waters were greatly reduced to include only those on or connected to trust properties. In addition to current sites approved or denied by EPA for the new jurisdiction, one existing site was moved (LTB1A) to be closer to a trust parcel and a new site (ZIC) was created on a trust parcel.

Although, most of our surface waters are of high quality, based on the LTBB Non-point Source Assessment Plan, the status of our clean waters is threatened by increased population and development with some waters and wetlands having impairments in non-point source pollution categories. Based on this program's progress, development of plans and assessments, and future legislation efforts, the following commitments were made for this grant period:

1. Continue to monitor and assess LTBB Reservation Boundary waters, wetlands, and any waters that impact Tribal waters and/or uses.
2. Continue to pursue regulatory authority for water resource protection.
3. Continue to identify sources of nonpoint source pollution and implement best management practices.
4. Collaborate with other LTBB staff and Tribal and non-Tribal water resource professionals on water resource projects or research.

All non-data commitments were reported extensively in our semi-annual reports, final narrative report and self-evaluation for this grant period. Therefore, commitment 1 and the two following data activities will be the only activities assessed:

- Collect biological, chemical, and physical data and assess data results every two years by using various water quality standards, criteria, calculating metrics, correlations, and trend analysis.
- Collect biological and physical data on wetlands.

Dates, times, parameters, GPS coordinates, WQX/CDX ID, location description of water bodies/wetlands monitored can be found in LTBB's Monitoring Strategy.

Monitoring Methods

Nutrient and Chemical Parameters

Depending on the type of water body: stream or lake, water samples are collected and analyzed for total nitrogen, total phosphorus, chloride and/or chlorophyll α (lakes)/total suspended solids (streams). In streams, individual samples are taken every two feet across a cross-section with a one-gallon jug that is rinsed three times with the water to be collected. Once the water is collected, the sample is homogenized via shaking and poured into the sample bottles provided by the LTBB and the contracted lab. For lake sites, water samples are collected using either a Kemmerer or VanDorn water sampler. If lake stratification generally occurs, water samples are taken at the surface, middle, and bottom depths of the vertical water profile. If lake stratification is not known to occur, water samples are taken at mid-depth of the vertical profile.

Physical/Bio-physical Parameters

OTT Hydromet Hydrolab sondes are used to collect dissolved oxygen, temperature, conductivity, and depth and pH data in all water bodies. In streams, sonde data is recorded every two-feet across a cross-section and averaged once uploaded onto the LTBB Network. If lake stratification is not known to occur, sonde readings are taken at mid-depth of the vertical profile. On lakes that stratify, we record physical data every meter to recognize/identify the thermocline. In addition, secchi disk and chlorophyll-α data are collected on lakes. The secchi disk is lowered three times to assure an average clarity measurement using LTBB QAPP protocol. Chlorophyll-α samples are collected using an amber bottle at twice the averaged clarity measurement and are filtered on return to the LTBB Lab or within 24 hours.

In addition to using the sondes, a Sontek Flowtracker is used to take discharge readings to on streams, creeks and rivers. The USGS mid-section method is used to collect velocity readings across a cross-section.

Biological Parameters

Macroinvertebrates are collected every spring on most water bodies. All lakes will be surveyed for macroinvertebrates every four to six years instead of every two, except for Susan Lake. Little Traverse Bay is sampled for water quality every three years, instead of every two. The number of organisms has been low in the past at those sites therefore, the benefit of the data does not exceed the time it takes to sort. Lakes have five grab sites where collection occurs in different sediment substrates in the littoral zone. Depending on hardness of the lake bottom, either an Ekman Bottom Sampler or a D-frame kick-net is used. In rivers, streams, and creeks, there are three established kick sites within a 100-meter reach. These kick sites are in riffle areas unless riffles are absent. If riffles are absent, grab sites were chosen in different substrates. Collection is accomplished by using a kick-net or dip net depending on the velocity of each stream system. Samples, including substrate, are put into 500-mL bottles and preserved with 95% ethanol. Sorting of these samples are mainly completed using a random sampling method in the off-season. Samples on all water bodies are combined for a 300+ target organism count for streams and 500+ for lakes. Identification is completed by a contracted entomologist. All contracted entomologists submit 10% of their identified macroinvertebrates to another entomologist for quality assurance purposes. Metrics and diversity scores are completed by LTBB water staff. Macroinvertebrate surveys from collection to calculations are a long and extensive process.

In July, qualitative ***habitat assessments*** are conducted at water bodies where the assessment is deemed to be representative. Habitat is assessed by observing the 100-meter reach within an area on a stream system using the water quality site as the mid-reach point. The lake habitat assessment form, modified from Grand Portage Reservation's habitat assessment and EPA habitat protocol for lakes, is completed by two staff observing conditions around the shoreline of the lake. These habitat assessments are assessed if a potential impairment may be correlated to a change in habitat condition.

Quantitative ***pebble counts*** are completed by two staff on stream systems that are wadeable and as time allows. The pebble count is a LTBB modified version of Little River Band and Wentworth Protocol for substrate analysis.

Floristic Quality Assessments (FQAs), including identification of threatened, endangered and invasive species are completed on LTBB wetlands with a current target of completing each wetland every 5 years with field visits being done in the early summer and fall seasons. Currently, WQPP staff and the LTBB Conservationist are contracting with Michigan Natural Features Inventory for the fall assessments until staff feel their plant knowledge is sufficient to complete FQAs without other entities to quality assure field identification. We are planning 2023 to be the last year of contracting MNFI to help with these surveys. At the end of the survey, we will complete the field portion of the Michigan Rapid Assessment Method (MiRAM) data sheet. The sections of the MiRAM that require looking at maps and using GIS, are completed in the fall and winter months.

Assessment Methods

Analysis of Water Sample Parameters

Water samples analyzed for total nitrogen, total phosphorus and chlorophyll-α are currently analyzed by Great Lakes Environmental Center, Inc (GLEC) in Traverse City, MI. Water samples collected for total chloride and suspended solids results are analyzed in the LTBB laboratory. LTBB's equipment is unable to accurately analyze chloride levels if total chloride concentration is greater than 25 mg/L; therefore, if total chloride levels are observed or known to be over 25 mg/L at a particular water body, the samples are sent to GLEC. GLEC's equipment can accurately analyze samples over 25 mg/L. All samples are recorded in the LTBB log book and GLEC's chain-of-custody procedures are followed when shipping samples.

Any results that were lab generated are quality assured by following procedures within the QAPP. Field duplicates and blanks are collected on a seasonal or two-month basis. If a water body is monitored for a six-month field season, blanks and duplicates are ran every two months. The LTBB contract lab, GLEC, also runs blanks and duplicates/triplicates on our samples following their own schedule. Acceptable precision for replicate samples is ±15% for both analyses. The following equation is used in precision calculation:

$$\text{Relative Percent Difference (RPD)} = \frac{(S-A) \times 100}{A}$$

Where: S = Sample Value
A = Average of Replicate

If the results do not pass ±15% threshold (aka if the RPD is greater than 15% in either direction), they are flagged, the outlier is investigated and the data is not used in analysis. Physical parameters are checked for errors by the LTBB WQB and/or WQT.

Assessment of Parameters

2023 parameter results for this Water Quality Assessment Report will be assessed by using LTBB draft water quality standards. Tables will be displayed in the lakes, creeks, streams, and rivers summaries showing the results and will report whether or not actual values are or are not exceeding standards/thresholds used to assess LTBB waters.

The WQPP applies LTBB draft Tribal Uses to water bodies within and adjacent to the 1855 Reservation boundaries. The LTBB WQPP has created LTBB-specific tribal water quality uses and corresponding definitions. These LTBB uses have not been approved by the LTBB Natural Resource Commission or by Tribal Council and are applied to water bodies and wetlands for assessment purposes only. A list of the LTBB draft Tribal Uses are available in the next section. LTBB draft Tribal Uses should be used as reference in this assessment. Tribal Uses will be listed by their acronyms in the Tribal Uses and Attainment Section. Data Summary Tables are provided within the Tribal Uses and Attainment Section for each water body data collection site indicating whether or not there were exceedances using the assessment criterion provided in the tables. Any additional information, such as temperature logger data or lake profiles, is provided in chart, graph or narrative form. Biological data will be assessed by using tables or graphs to display results. Sections within the Biological Data sections may include, quantitative pebble counts, macroinvertebrate metrics, and/or discharge rates.

Quantitative pebble counts began in 2011; therefore, if two sets of pebble counts have been completed in different years at any wadeable stream sites the data will be compared by percentage change. If there is an increase or decrease of 10% or greater of a specific substrate type, then habitat conditions for indigenous aquatic life may be improving or declining depending on the specific substrate type (Table 2). However, if a specific substrate type increased or decreased by less than 10%, habitat has not changed drastically. However, with only two data sets to compare and a random sampling method being used results should be considered as only a component of all parameters measured and cannot show a direct correlation in change in habitat conditions.

Table 1. Optimum changes in pebble counts.

Substrate Type	Optimum Changes in Habitat Conditions
Boulders	↑
Cobble	↑
Pebble	↑
Gravel	↑
Clay	↓
Macroinvertebrate (macro)	↑
Woody Debris	↑
Sand	↓
Silt	↓
Detritus/Vegetation	↑ no more than 15%
Muck	↓

Floristic Quality Assessments (FQAs) and the MiRAM were completed for two LTBB properties (Taimi Hoag Natural Area and Cross Village parcels) in 2023, and an FQA/MiRAM score is provided for these properties. For assessment purposes only, a wetland with a Floristic Quality Index (FQI) of 35 or greater, with a mean Coefficient of Conservatism of 6.5 or greater, or as calculated using methods in the MiRAM, will be used to define whether or not 2023 assessments defined these wetlands as "high quality".

A Narrative Summary section is provided with any additional information regarding use attainment, management issues, potential causes of perturbation, or indications of higher water quality. Trend analysis is performed using all data collected by LTBB with some sampling beginning in either 2000 or 2001. Trend analysis will only be displayed if trends are found. A trend will be considered if approximately seventy percent (R^2=0.7 or higher) of the variation in the response variable can be explained by the explanatory variable using a simple linear regression.

Macroinvertebrates collected in 2023 were sorted to family in-house and are currently at the taxonomist. These results will be included in the next report. Once they have been identified we will use a spreadsheet created by staff at the Little River Band of Ottawa Indians to calculate the Northern Lakes and Forest Index, Margalef's richness, Shannon-Weiner Diversity Index, number of Ephemeroptera, Plecoptera, and Trichoptera individuals, and the Hilsenhoff Biotic Index (Table 3). According to staff at the Little River Band of Ottawa Indians, the Northern Lakes and Forest (NLF) Index is the most accurate for our geographical area.

Table 2. Macroinvertebrate indices.

Acronym	Index	Description	Ranking Criteria
NLF	Northern Lakes and Forest	A Benthic Community Index to assess the biological integrity of wadeable streams in the ecoregion. Index values ranged from 10 to 50, and scores from impaired sites were significantly different than non-impaired sites (P<0.001). Index values were divided into three narrative interpretations of biological integrity (poor, fair, and good).	Good 36+ Fair 23-35 Poor <23
HBI	Hilsenhoff Biotic Index	The overall tolerance of the community in a sampled area, weighted by the relative abundance of each taxonomic group (family, genus, etc.). Organisms are assigned a tolerance number from 0 to 10 pertaining to that group's known sensitivity to organic pollutants; 0 being most sensitive, 10 being most tolerant.	Excellent 0-3.75 Very Good 3.76-4.25 Good 4.26-5 Fair 5.01-5.75 Fairly Poor 5.76-6.50 Poor 6.51-7.25 Very Poor 7.26-10.0
EPT	Ephemeroptera, Plecoptera, and Trichoptera	Three orders of macroinvertebrates that are most sensitive to pollution.	The higher number of EPT individuals in a water body, the cleaner it is.

LTBB Tribal Uses

These Tribal uses have been created by the Water Quality Protection Workgroup. These uses were signed into law in September 2016. As mentioned in the Assessment of Parameters section, these are intended to be used for water quality protection legislation but are only being used for assessment purposes in this report.

In addition to these Tribal Uses, an antidegradation policy is applied to Tribal waters. Antidegradation requirements provide for the protection of existing water uses and limitations on degradation of high-quality waters. Water bodies monitored by the WQPP are assigned specific use designations.

Human Health Uses

A. Primary Contact Recreation (PCR). Waters used for any activities normally involving direct contact with water to the point of complete submergence, particularly immersion of the head, with considerable risk of ingesting water or having it come into contact with the eyes and nose, such as swimming. All surface waters are designated for this use. Supplemental criteria specific to this use are listed in Subchapter V.

B. Secondary Contact Recreation (SCR). Waters supporting any activities normally involving direct contact of some part of the body with water, but not normally involving

immersion of the head or ingestion water, such as fishing, wading, dry boating, and hunting. All surface waters are designated for this use. Supplemental criteria specific to this use are listed in Subchapter V.

C. Public Water Supply (PWS). Waters that with conventional treatment can be used as a source of drinking water. Supplemental criteria specific to this use are listed in Subchapter V.

Cultural Uses

A. Traditional, Cultural or Ceremonial Uses (TCC). Waters that support vegetation and activities linked to traditional, cultural, medicinal, and/or ceremonial practices of LTBB Citizens. Supplemental criteria for this use include but are not limited to those for Primary Contact Recreation.

B. Wild Rice Areas (WRA). Surface waters that currently have or historically had the potential to sustain the growth of wild rice (Manoomin, or *Zizania palustris*) for either wildlife or human consumption. Supplemental criteria specific to this use are listed in Subchapter V.

Aquatic Life Support Uses

A. Indigenous Aquatic Life (IAL). Waters supporting a population of wildlife and indigenous aquatic life originating, living, growing, reproducing, or otherwise occurring in a particular water body, including indigenous wildlife populations that utilize the water body for subsistence, sustained growth and and/or propagation. Supplemental criteria specific to this use are listed in Subchapter V.

B. Wildlife Support (WLS). Waters that support birds, mammals, and other non-aquatic organisms that consume tribal waters or any of the various forms of aquatic life found in tribal waters.

C. Coldwater Fishery (CDW). Waters that support cold water fish species that prefer clear, cold waters and are not tolerant of extreme temperature or dissolved oxygen changes. Supplemental criteria specific to this use are listed in Subchapter V.

D. Cool Water Fishery (CLW). Waters that support cool water fish species that prefer cooler waters and are not tolerant of extreme temperature or dissolved oxygen changes. Supplemental criteria specific to this use are listed in Subchapter V.

E. Warm Water Fishery (WWF). Waters that support or are managed for populations of warm water fish species and which lack significant populations of salmonid fishes. Supplemental criteria specific to this use are listed in Subchapter V.

F. Subsistence Fishery (SUB). Waters fished by indigenous people to provide food for their families, community, or for traditional/cultural purposes. This use is also a

human health and cultural use. Supplemental criteria are listed in Subchapter V.

Other Use Designations

A. Navigation Uses (NAV). Waters suitable for moving on, through, or used for following a route, usually by boat or canoe. All LTBB waters shall be of sufficient quality for use in navigation.

B. Commercial Uses (COM). Waters used for the creation, selling, or trading of a good or service. All LTBB waters shall be of sufficient quality for commercial uses.

C. Industrial Uses (IND). Waters used for the commercial production, manufacture, or construction of a goods or services. All LTBB waters shall be of sufficient quality to be used for commercial purposes.

D. Aquaculture Uses (AQA). Waters used for the commercial cultivation or production of any aquatic organisms such as but not limited to fish, mollusks, crustaceans, algae, or aquatic plants. All LTBB waters shall be of sufficient quality for aquaculture purposes.

E. Agriculture Uses (AGR). Waters used for irrigation purposes, livestock watering, and/or any other farming practices involving the use of water. All LTBB waters shall be of sufficient quality for agriculture uses.

F. Outstanding Tribal Resource Waters (OTR). These designated waters represent a unique sacred and cultural resource of the LTBB, due for example to their use, their association with the traditional value system of the LTBB, or their beauty. They are therefore given this most protective non-degradation (Tier III) status to ensure their preservation. Waters designated as Outstanding Tribal Resource Waters are listed in Section 406. Other waters whose high quality makes them an exceptional recreational, cultural, or ecological resource of the LTBB may also be designated Outstanding Tribal Resource Waters pursuant to the procedures in Section 105.

Streams, Creeks and Rivers Assessments

Tannery Creek

Giigoonhkaamik

Description and Background

Tannery Creek is a cold-water creek and is the third largest tributary in the Little Traverse Bay Watershed. This creek is the most anthropocentrically-impacted creek within the LTBB Reservation. Tannery Creek is approximately 5 miles long and is a perennial, spring-fed creek. The creek meanders through agricultural land, a golf course, and areas of dense development. All land surrounding the creek is owned privately. Historically, a tannery was located on the creek, hence its name. When the tannery was in operation it has been said that Tannery Creek was highly polluted due to the continuous discharge of toxic tannery waste into the creek. This historical overview is purely documented from verbal accounts.

In 2021 and 2022, four road-stream crossings were replaced on Tannery Creek: at Mitchell Road, TYC2A on private property, Boyer Road, and Country Club Road. LTBB has two monitoring sites on Tannery Creek. The upstream site, TYC2A, is located on private property and permission is sought before each field season. This site is close to the origin of the creek and experiences minimal human disturbance. This site was discontinued in 2022, due to jurisdiction changes. The downstream site, TYC1A, was moved upstream in spring 2021, to about 100-feet above the weir and renamed TYC1B. High water levels in Little Traverse Bay regularly created a back flow into the creek and ponding, stretching outside of the channel. The site moved upstream to measure the creek itself, instead of influences from the bay. Macroinvertebrates were collected in 2023. Due to the jurisdictional changes, Tannery Creek will only be routinely sampled under 106, at TYC1B, in the future. To view a map of these site locations, please see Map 1. The table below (Table 4) represent the top 5 land uses for the watershed drainage for our sampling site on Tannery Creek:

Table 4. TYC1B watershed land usage

Land use	Soil group	Area(acres)	Rank	%
Cropland generalized agriculture	B	448.35	1	20.84%
Woody Wetlands (swamp)	D	254.86	2	11.85%
Deciduous Forest	B	204.16	3	9.49%
Pasture/Hay	B	198.82	4	9.24%
Low-Density Residential (general 1/3 - 2 ac lots)	B	138.55	5	6.44%

Tribal Uses and Attainment

The following Tribal uses are applied to Tannery Creek: **PCR** (May through October)**, SCR, IAL, WLS, CDW, SUB, NAV, COM, and IND**. The primary use at TYC2A is **IAL and WLS.** The primary use at TYC1A is **CDW**. All Tribal Uses are fully supported. **SUB** needs further evaluation because of a lack of toxin data in fish.

Data Summary Tables

Table 5. Data Summary Table for Downstream Site (TYC1B) for 2023

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coldwater Fishery °C	February	N/A	N/A
		May	10.36	--
		July	15.08	--
		October	9.40	--
Specific Conductivity	450 µS/cm	February	N/A	N/A
		May	523	X
		July	576	X
		October	631	X
pH	6.5-9 pH units	February	N/A	N/A
		May	7.97	--
		July	8.14	--
		October	8.08	--
Dissolved Oxygen	≥7 mg/L	February	N/A	N/A
		May	11.48	--
		July	9.57	--
		October	10.91	--
Total Phosphorus	28.75 µg/L	February	N/A	N/A
		May	10.30	--
		July	12.90	--
		October	9.40	--
Total Nitrogen	0.6 mg/L	February	N/A	N/A
		May	0.37	--
		July	0.49	--
		October	0.64	X
Chloride	50 mg/L	February	N/A	N/A
		May	36.90	--
		July	43.50	--
		October	38.60	--
Total Suspended Solids	15 mg/L	February	N/A	N/A
		May	3.55	--
		July	5.30	--
		October	7.55	--

Biological Data

Substrate

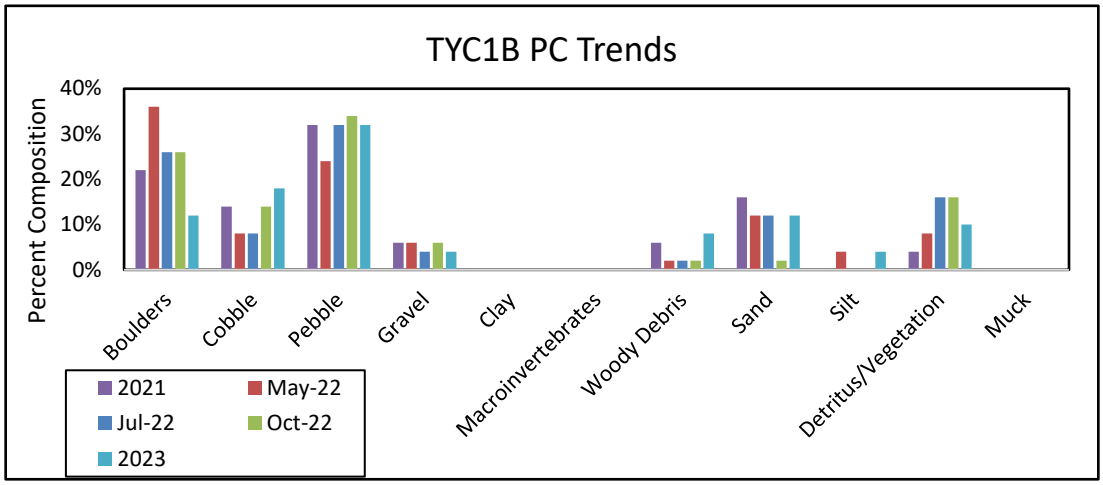


Figure 1. TYC1B pebble count trends

Habitat Assessment

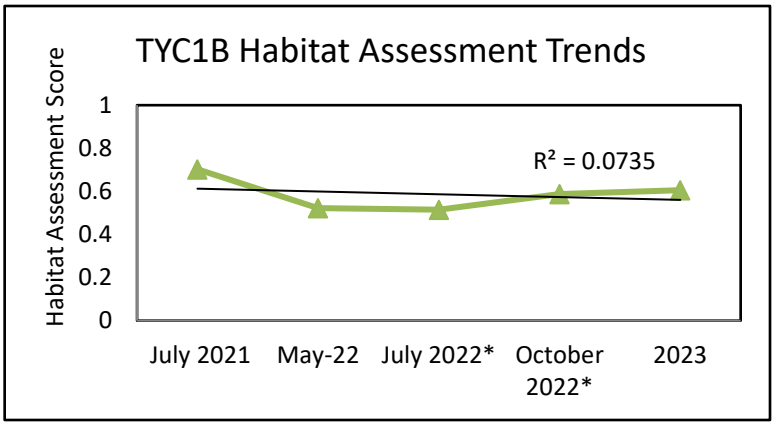


Figure 2. Tannery Creek habitat assessment trends

Discharge Summary

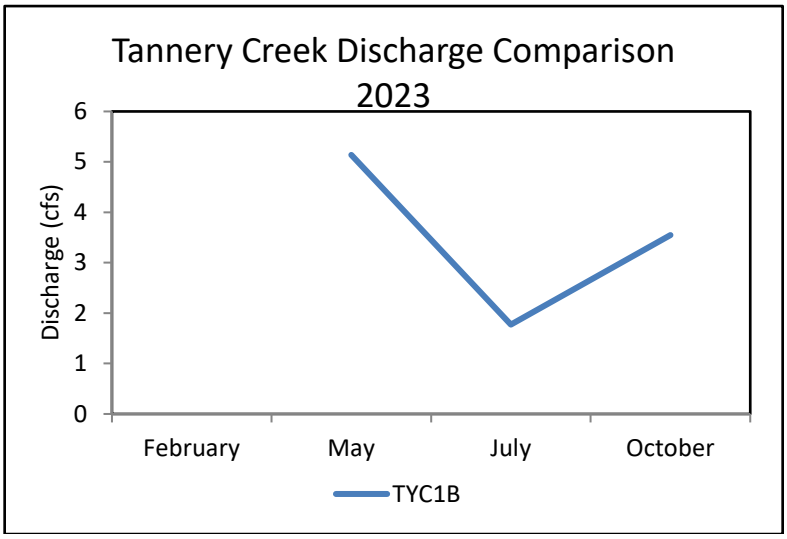


Figure 3. Tannery Creek discharge rates

Macroinvertebrates

Macroinvertebrates results for 2021 are shown below (Table 6). 2023 macros are currently at the taxonomist and results will be included in the next report.

Table 6. 2021 Macroinvertebrate Metrics

2021 Macro Metrics	TYC1B-All	TYC2A-All
Total Individuals	240	309
# Ephemeroptera taxa	3	1
# Diptera taxa	9	18
Richness (margalefs)	3.47	5.06
Shannon Weiner	2.22	2.14
% Trichoptera	2.50	1.29
% Crustacea and Mollusca	17.9	36.9
# Filterers taxa	2	4
# Scrapers taxa	2	0
# EPT taxa	7	4
HBI	4.92	5.99
NLF Score	28	22

Narrative Summary

Due to four culvert replacements/removals on Tannery Creek in 2021 and 2022, we sampled TYC1B in both 2021 and 2022, and returned its odd-year sampling in 2023. One culvert upstream of TYC2A was replaced in August 2021 (Figure 7) and the culverts immediately above TYC2A (Figure 6) were removed in August 2022. Two additional culverts were replaced upstream of TYC1B in September 2021 and September 2022 (Figure 5; Figure 4).

TYC1B was not able to be sampled due to the entire site being completely frozen over in February. There was intermittent rain the day before sampling in July and steady rain the day before sampling in October. With respect to data that was collected, Tannery Creek had several exceedances (Table 5). This is not surprising because it travels through a heavily urbanized area. TYC1B had exceedances in specific conductivity during every sampling event and in total nitrogen in October. Pebble counts show mainly pebble and cobble at TYC1B (Figure 1). Discharge levels and habitat assessment scores were as expected (Figure 2; Figure 3). Total chloride levels are much higher at Tannery Creek than creeks with similar morphology. This is due to land uses surrounding this creek, such as agriculture and development. The total chloride level is the second-highest reported in any creek during the 2023 season. 2023 macros are currently at the taxonomist and results will be included in the next report (Table 6). There were decreasing trends in pH and boulders at TYC1B.

Figure 4. Before and after (2023) pictures of Country Club-Tannery Creek crossing. This crossing is between TYC1B and TYC2A.

Figure 5. Before and after (2023) pictures of Boyer Road-Tannery Creek crossing. This crossing is between TYC1B and TYC2A.

Figure 6. Before and after (2023) pictures of crossing on private property. This is directly upstream of TYC2A.

Figure 7. Before and after (2023) pictures of Mitchell Road-Tannery Creek crossing. This is the next road upstream of TYC2A.

Susan Creek

Description & Background

Susan Creek is an intermittent stream that originates at Susan Lake and is a tributary of the Little Traverse Bay Watershed. Susan Creek is approximately 5 miles long. Much of the area that Susan Creek meanders through is privately owned. The surrounding land includes forested wetlands and agricultural, residential, industrial, and conservancy land. Fifty-five acres of this land is Tribal conservation land known as the Taimi Hoag Natural Area.

The geographic area surrounding Susan Lake and Susan Creek has cultural significance to the Tribe. The area surrounding and adjacent to Susan Creek was traveled by the Odawa bands when migrating north. There is still an active Native American church and burial ground near the headwaters. Susan Lake and Creek were and are still used for fishing, hunting, and gathering. Spear fishing was an active way to fish for trout, steelhead and suckers during the spring and fall runs (when salmon and trout would attempt to spawn) in Susan Creek. The LTBB Taimi Hoag Natural Area is open to Tribal citizens for fishing, hunting, and gathering with proper licenses.

The Tribe manages the area of the creek that is within LTBB Taimi Hoag Natural Area and collaborates with the Little Traverse Conservancy (LTC) in maintaining the trails and any other upkeep within these areas. LTC has preserve land adjacent to the LTBB conservation land.

There are two monitoring sites on Susan Creek. The downstream site (SNC1A) was monitored May-October from 2011-2015. Previously, SNC1 was the downstream site, which was last reported on in LTBB's Baseline Assessment Report 2000-2010. SNC1A is the preferred monitoring site, as it is on Tribal trust land, allowing us to see if the creek is meeting draft tribal water quality standards. SNC1A is located within the Taimi Hoag Natural Area and is upstream of the mouth and U.S. 31 North. The upstream site, SNC2A, was moved from the previous SNC2 in 2007, since SNC2 captured data from Susan Lake rather than from upstream of the Tribal property on Susan Creek like it was intended. SNC2A is located downstream of wetland areas and some agricultural land. It is within the LTC Susan Creek Preserve property. Macroinvertebrates were collected at both SNC1A and SNC2A in 2023.

Despite the jurisdictional changes, both sites on Susan Creek will continue to be routinely monitored through 106. To view a map with exact monitoring locations, please see Map 1 in the Appendix. Below is a pie chart of the dominant land uses in the HUC12 watershed in which Susan Creek resides (Figure 8).

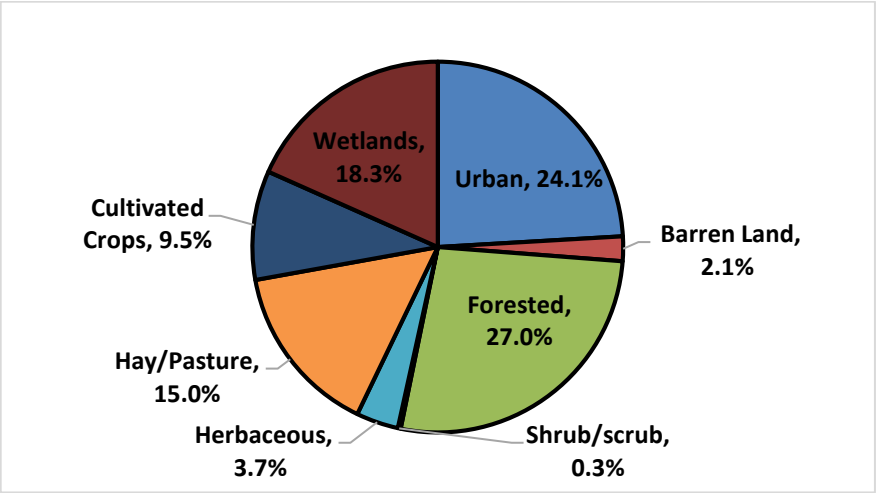


Figure 8. Susan Creek Watershed Land Use Percent Composition

Tribal Uses & Attainment

The following Tribal uses are applied to Susan Creek **PCR** (May through October)**, SCR, IAL, WLS, CLW, SUB, NAV, COM, and IND**. The primary uses at both sites are **IAL** and **WLS.** All Tribal uses except **SUB** are supported based on LTBB data results. **SUB** needs further evaluation because ofa lack of toxin data in fish. Previously, Susan Creek was assessed as a warmwater fishery with routes for anadromous salmonids. Based on baseline temperatures, it will be assessed as a coolwater fishery (CLW) in this report. Fish populations are still unknown. LTBB plans to conduct fish assessments before the next report, so this designation may change.

Data Summary Tables

Table 7. Data Summary Table for Downstream Site (SNC1A)

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coolwater Fishery °C	February	0.67	--
		May	14.44	--
		July	17.94	--
		October	8.60	--
Specific Conductivity	450 µS/cm	February	357	--
		May	321	--
		July	388	--
		October	356	--
pH	6.5-9 pH units	February	7.11	--
		May	7.92	--
		July	8.09	--
		October	8.60	--
Dissolved Oxygen	≥ 6 mg/L	February	12.94	--
		May	9.67	--
		July	9.42	--
		October	10.90	--
Total Phosphorus	28.75 µg/L	February	10.80	--
		May	13.00	--
		July	12.90	--
		October	8.50	--
Total Nitrogen	0.6 mg/L	February	0.21	--
		May	0.60	--
		July	0.54	--
		October	0.52	--
Chloride	50 mg/L	February	15.96	--
		May	13.87	--
		July	18.19	--
		October	23.48	--
Total Suspended Solids	15 mg/L	February	2.55	--
		May	2.80	--
		July	3.55	--
		October	reject	N/A

Table 8. Data Summary Table for Upstream Site (SNC2A)

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coolwater Fishery °C	February	1.00	--
		May	17.40	--
		July	19.05	--
		October	9.03	--
Specific Conductivity	450 µS/cm	February	359	--
		May	322	--
		July	396	--
		October	353	--
pH	6.5-9 pH units	February	6.69	--
		May	8.07	--
		July	8.18	--
		October	8.52	--
Dissolved Oxygen	≥ 6 mg/L	February	12.22	--
		May	9.10	--
		July	8.57	--
		October	10.47	--
Total Phosphorus	28.75 µg/L	February	8.00	--
		May	12.40	--
		July	reject	N/A
		October	21.20	--
Total Nitrogen	0.6 mg/L	February	0.61	X
		May	0.53	--
		July	0.58	--
		October	0.53	--
Chloride	50 mg/L	February	22.23	--
		May	21.42	--
		July	23.81	--
		October	31.10	--
Total Suspended Solids	15 mg/L	February	4.05	--
		May	2.30	--
		July	18.05	X
		October	reject	N/A

Biological Data

Substrate

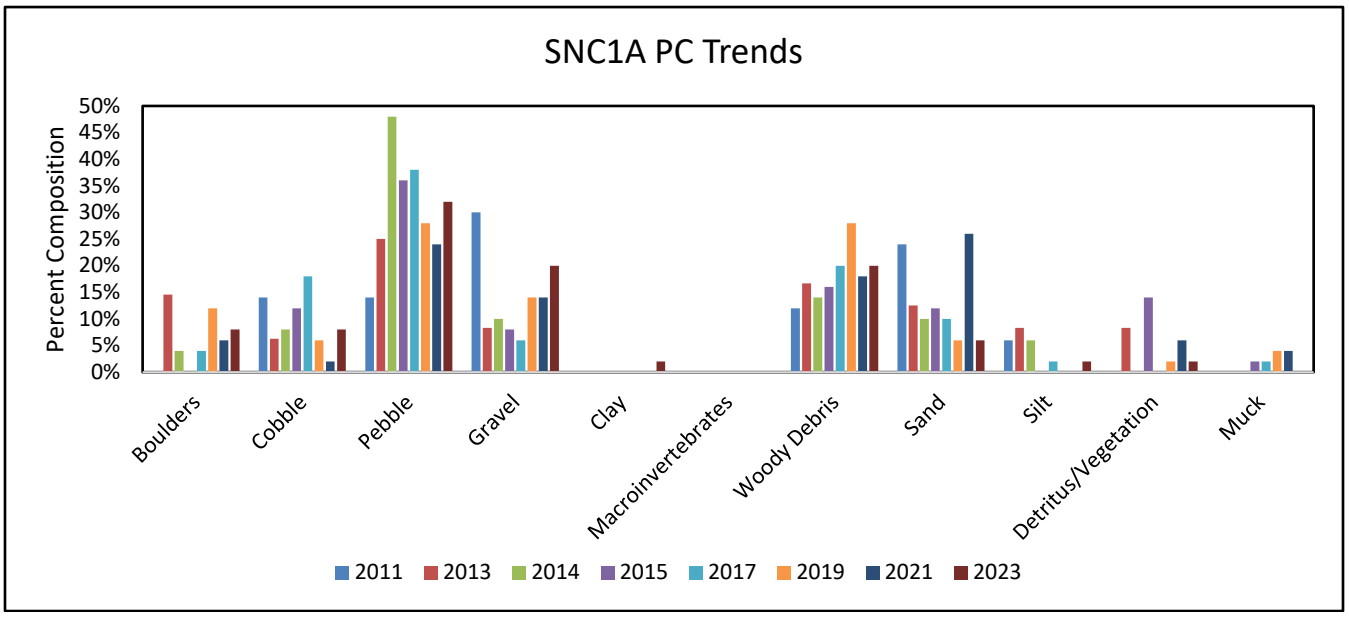


Figure 9. SNC1A pebble count trends

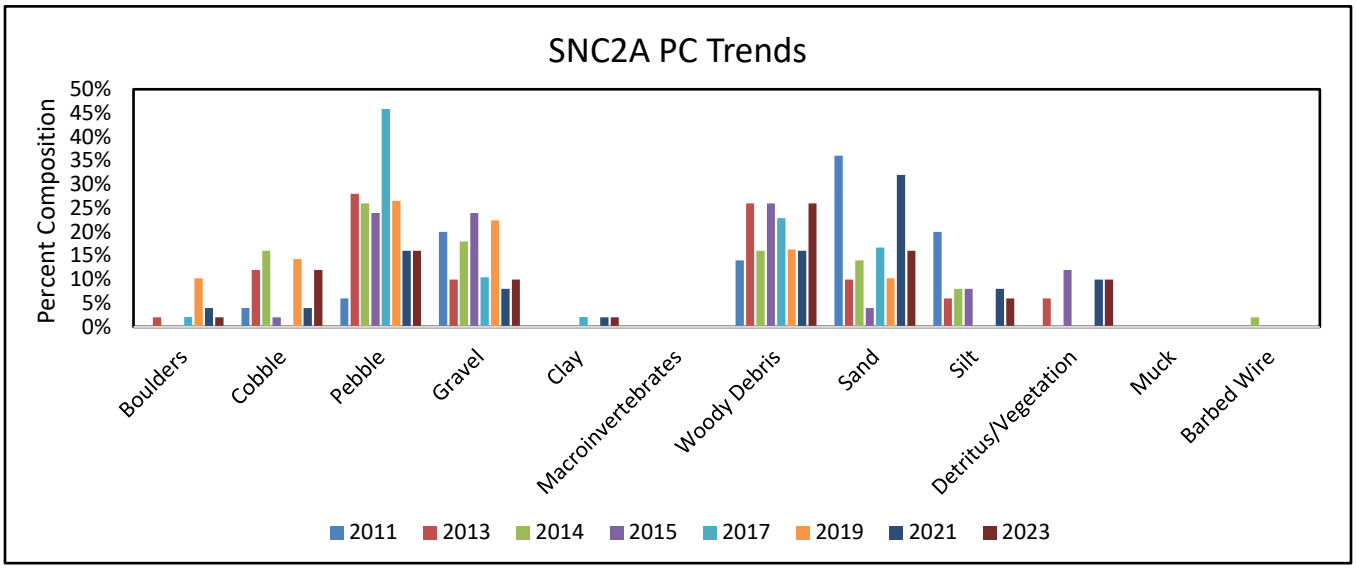


Figure 10. SNC2A pebble count trends

Habitat Assessment

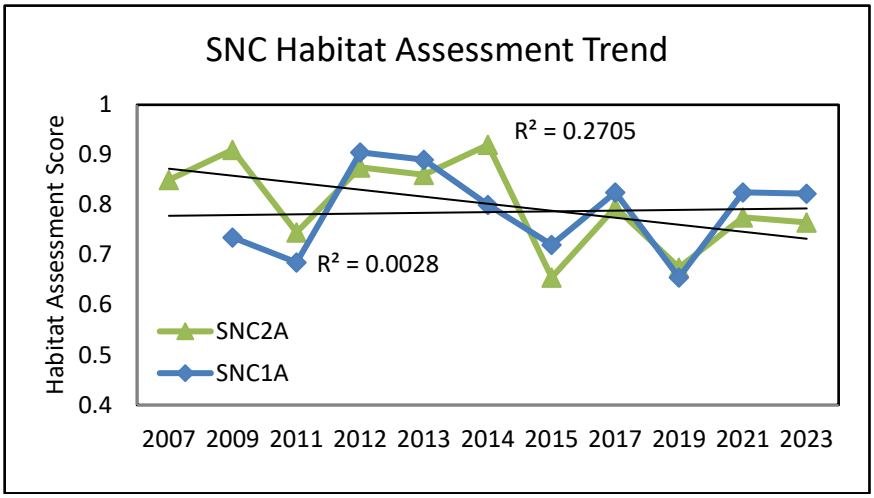


Figure 11. Susan Creek habitat assessment trend

Discharge Rates

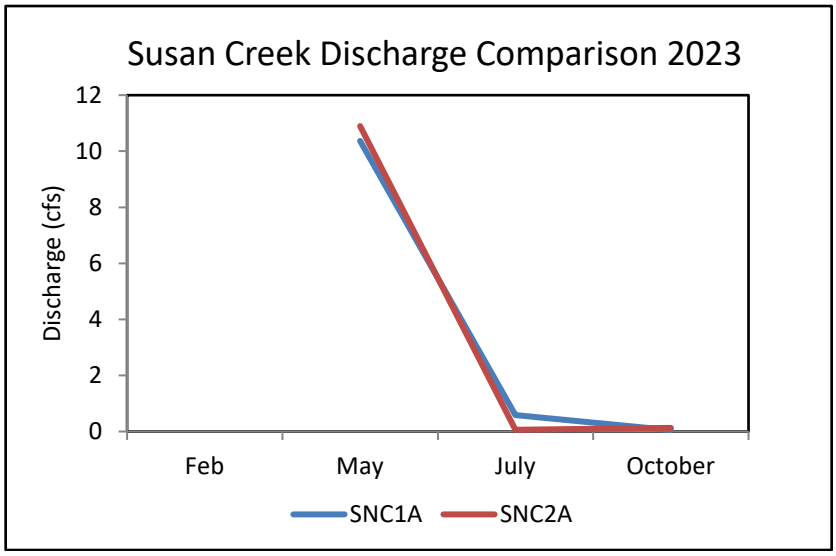


Figure 12. Susan Creek discharge rates

Macroinvertebrates

Macroinvertebrate data from 2021 are shown below (Table 9). 2023 macros are currently at the taxonomist and results will be included in the next report.

Table 9. Susan Creek Macroinvertebrate data

2021 Macro Metrics	SNC1A-All	SNC2A-All
Total Individuals	347	252
# Ephemeroptera taxa	2	3
# Diptera taxa	5	10
Richness (margalefs)	2.56	4.52
Shannon Weiner	-0.36	1.53
% Trichoptera	0	1.19
% Crustacea and Mollusca	0.29	2.38
# Filterers taxa	0	1
# Scrapers taxa	1	1
# EPT taxa	6	8
HBI	5.82	5.81
Score	20	28

Narrative Summary

Steady precipitation occurred at the sites the day prior to sampling in February. SNC1A was mostly froze in February, so discharge measurements were not taken. At SNC2A in July, a silt plume was evident after entering the stream. We waited for it to settle, but it was still evident in the results. The day prior to sampling in October, there was steady rain at both sites.

Data collected at both sites also indicate low disturbances to water quality with the exception of a few exceedances, Total Nitrogen in February and total suspended solids in July at SNC2A (Table 7; Table 8). SNC1A did not have any exceedances. Pebble counts at SNC1A found primarily pebble, gravel, and woody debris and the pebble count at SNC2A found mainly woody debris, sand and pebble (Figure 9; Figure 10). 2023 macros are currently at the taxonomist and results will be included in the next report (Table 9). Habitat assessment scores at both sites have stayed fairly consistent over time (Figure 11). Discharge was expected for the dry year it's been in 2023 (Figure 12).

There were also a few unique site characteristics that were observed at SNC1A. During the spring, summer and fall months, there was some white foam that was observed to be floating on the water's surface. ESP staff believes this foam is due to bacteria in the water coupled with the turbulence of the flow in certain spots (Figure 13). It has been present in every sampling year in recent history.

SNC1A and SNC2A had decreasing trends of sand in the substrate. SNC2A also had an increasing trend with the amount of woody debris.

Figure 13. Foam at SNC1A

Van Creek

Description and Background

Van Creek is a tributary of the East Branch of the Maple River and is approximately 8-miles long. The Main Branch of the Maple River is classified as a Blue-Ribbon Trout Stream by the State of Michigan. LTBB has a 75.7-acre wild game preserve, Waawaashkesh, where seeps and groundwater contribute to the origin of the Creek. Van Creek has been included in the WQPP monitoring design since 2011. To establish a baseline, monitoring occurred May-October every year for five years. However, due to time constraints, vacancy in staff, and the issuance of an approved QAPP, monitoring did not begin until June of 2011. Two stretches of the creek are within two land bases owned by the Tribe. Therefore, EPA approved standards and uses could be applied on these reaches.

VNC2, the upstream site, is located on an 80-acre parcel owned by the Tribe with portions of the property and wetland used for aquaculture. The LTBB Fish Hatchery is located adjacent to this site and the water from the fish ponds, as well as the main facility are discharged into the wetlands connecting to the creek. In 2023, LTBB hatchery staff discharged 2,299-cubic meters of water into Van Creek from the walleye rearing ponds.

In 2019, both sites, VNC1 and VNC2 needed to be moved due to altered flow of the main channel (VNC1) and physical barriers preventing sampling (VNC2). With respect to VNC1, in 2018, there was some construction on the road, as well as the road stream crossing on US 31. When this was finished, the flow of water was directed via newly constructed culvert under the road to the east side of US 31 where historically, the North/South flow of water and subsequent sample site was located on the west side of the road. VNC2 needed to be moved downstream ~25-yards due to extreme flooding of the main channel caused by a beaver dam. Because the sites were not moved a significant distance and won't be experiencing any different inputs, we decided to keep the site names the same. In 2023, VNC2 was moved upstream ~25-yards due to extreme flooding of the main channel below the older beaver dam. The site was moved to just above the older dam and was not sampled for macroinvertebrates and a pebble count was not completed due to water depth and uncertainty of the substrate firmness in the beaver pond. In 2023, VNC1 was sampled through July, however, the Van

Creek-DNR bike trail road-stream crossing was being restored. This project rerouted the creek to the west side of US-31. Due to the creek channel moving away from our site and the need to sample a more representative site than a highway ditch, VNC1 was moved downstream ~2.6 miles onto University of Michigan Biological Station property (with their permission) and renamed VNC1B. VNC1B was added as a new site since it moved a significant distance and was sampled monthly starting in August 2023. Monthly sampling will continue for 5 years to establish a baseline. Macroinvertebrates were collected at VNC1 in 2023, but due to moving the site later in the year, they were not sorted and identified. Macroinvertebrates were not collected at VNC1B in 2023, since the site moved after our usual macroinvertebrate sampling period, but will be sampled in 2024.

Despite the jurisdictional changes, Van Creek will continue to be routinely sampled under 106.
In 2018, there was also a road stream crossing (timber bridge) constructed downstream of VNC2 on Reed road. This greatly assisted the area in draining more efficiently during high water input events (snow melt, flash floods, etc.) and also helped quell beaver activity in the area. To view a map of these sites' locations, please reference Map 1 in the Appendix. The tables below (Table 10, Table 11) represent the top 5 land uses for the watershed drainage for our sampling sites on Van Creek:

Table 10. VNC1 watershed land usage.

Land use	Soil group	Area(acres)	Rank	%
Deciduous Forest	B	1342.60	1	19.03%
Deciduous Forest	A	1266.09	2	17.94%
Grassland; Herbaceous	A	783.27	3	11.10%
Cropland generalized agriculture	B	739.69	4	10.48%
Woody Wetlands (swamp)	D	663.40	5	9.40%

Table 11. VNC2 watershed land usage.

Land use	Soil group	Area(acres)	Rank	%
Deciduous Forest	B	1286.55	1	20.15%
Deciduous Forest	A	1195.15	2	18.72%
Grassland; Herbaceous	A	720.34	3	11.28%
Cropland generalized agriculture	B	688.09	4	10.78%
Cropland generalized agriculture	A	555.76	5	8.70%

Tribal Uses and Attainment

The following Tribal uses are applied to Van Creek: **PCR** (May through October)**, SCR, TCC, IAL, WLS, CDW, NAV, COM, IND, and AQA**. The primary use at both sites is **IAW.** The primary use and all other uses are supported at VNC2. All uses are supported at Van Creek except for **CDW**, due to temperatures and dissolved oxygen concentrations.

Data Summary Tables

Table 12. Data Summary Table for VNC1

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coolwater Fishery °C	February	0.02	--
		May	10.30	--
		July	21.68	--
		October	N/A	N/A
Specific Conductivity	450 µS/cm	February	312	--
		May	208	--
		July	390	--
		October	N/A	N/A
pH	6.5-9 pH units	February	6.20	X
		May	7.63	--
		July	7.11	--
		October	N/A	N/A
Dissolved Oxygen	≥6 mg/L	February	3.32	X
		May	8.28	--
		July	0.95	X
		October	N/A	N/A
Total Phosphorus	12 µg/L	February	20.10	X
		May	14.10	X
		July	15.70	X
		October	N/A	N/A
Total Nitrogen	0.4 mg/L	February	0.41	X
		May	0.41	X
		July	0.39	--
		October	N/A	N/A
Chloride	50 mg/L	February	8.47	--
		May	2.32	--
		July	12.53	--
		October	N/A	N/A
Total Suspended Solids	15 mg/L	February	4.55	--
		May	0.80	--
		July	51.8	X
		October	N/A	N/A

Table 13. Data Summary Table for VNC1B

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coolwater Fishery °C	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	14.81	--
		September	17.40	--
		October	16.58	X
Specific Conductivity	450 µS/cm	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	324	--
		September	346	--
		October	367	--
pH	6.5-9 pH units	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	7.09	--
		September	7.75	--
		October	7.99	--
Dissolved Oxygen	≥6 mg/L	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	4.60	X
		September	2.25	X
		October	3.96	X
Total Phosphorus	12 µg/L	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	12.80	X
		September	10.00	--
		October	12.90	X
Total Nitrogen	0.4 mg/L	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	0.35	--
		September	0.57	X
		October	0.40	--
Chloride	50 mg/L	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	reject	N/A

		September	2.57	--
		October	4.36	--
Total Suspended Solids	15 mg/L	May	N/A	N/A
		June	N/A	N/A
		July	N/A	N/A
		August	4.80	--
		September	3.80	--
		October	3.37	--

Table 14. Data Summary Table for VNC2

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coolwater Fishery °C	February	N/A	N/A
		May	N/A	N/A
		July	24.55	X
		October	15.67	X
Specific Conductivity	450 µS/cm	February	N/A	N/A
		May	N/A	N/A
		July	418	--
		October	380	--
pH	6.5-9 pH units	February	N/A	N/A
		May	N/A	N/A
		July	7.56	--
		October	7.66	--
Dissolved Oxygen	≥ 6 mg/L	February	N/A	N/A
		May	N/A	N/A
		July	5.55	X
		October	5.75	X
Total Phosphorus	12 µg/L	February	N/A	N/A
		May	62.00	X
		July	56.70	X
		October	52.50	X
Total Nitrogen	0.4 mg/L	February	N/A	N/A
		May	0.32	--
		July	0.34	--
		October	0.33	--
Chloride	50 mg/L	February	N/A	N/A
		May	1.73	--
		July	2.27	--
		October	2.40	--
Total Suspended Solids	15 mg/L	February	N/A	N/A
		May	reject	N/A
		July	6.30	--
		October	reject	N/A

Biological Data

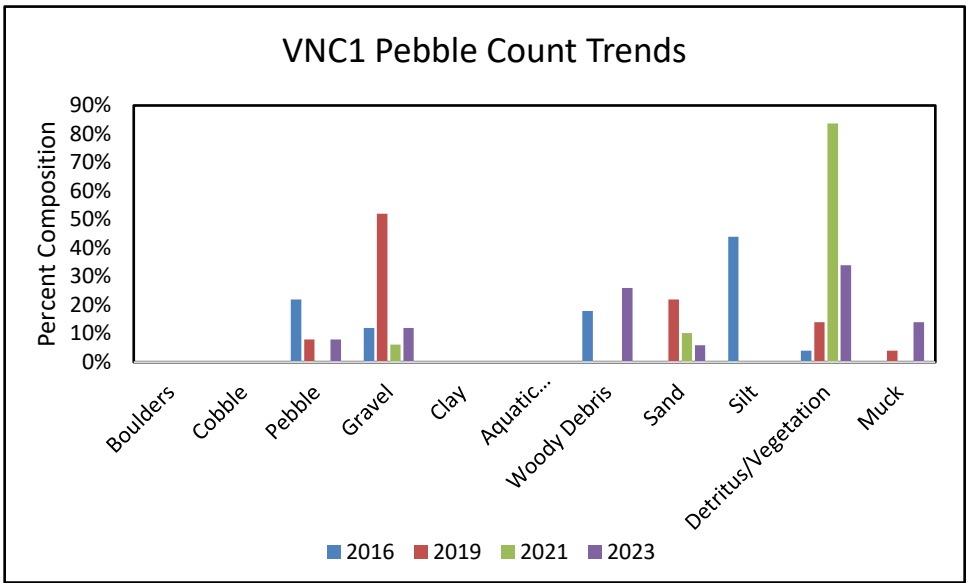


Figure 14. VNC1 pebble count trends

Macroinvertebrates

Macroinvertebrates were not collected at VNC1B or VNC2 in 2023.

Habitat Assessment

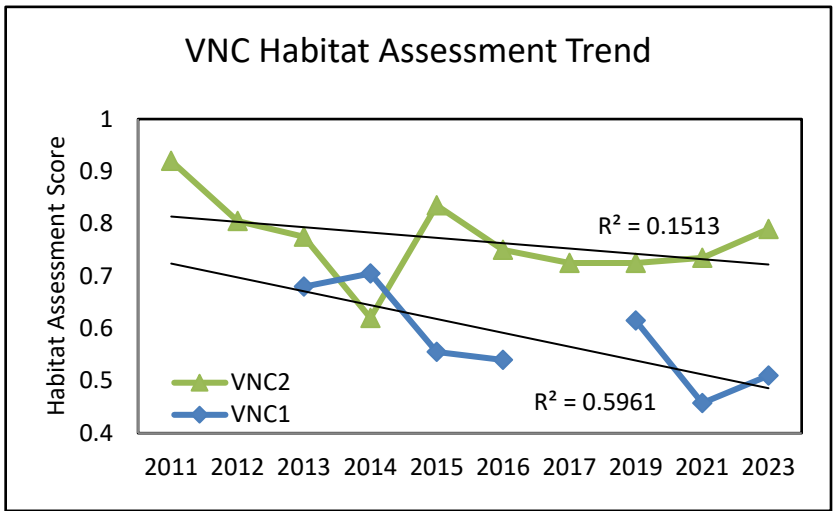


Figure 15. Van Creek habitat assessment trends

Discharge Rates

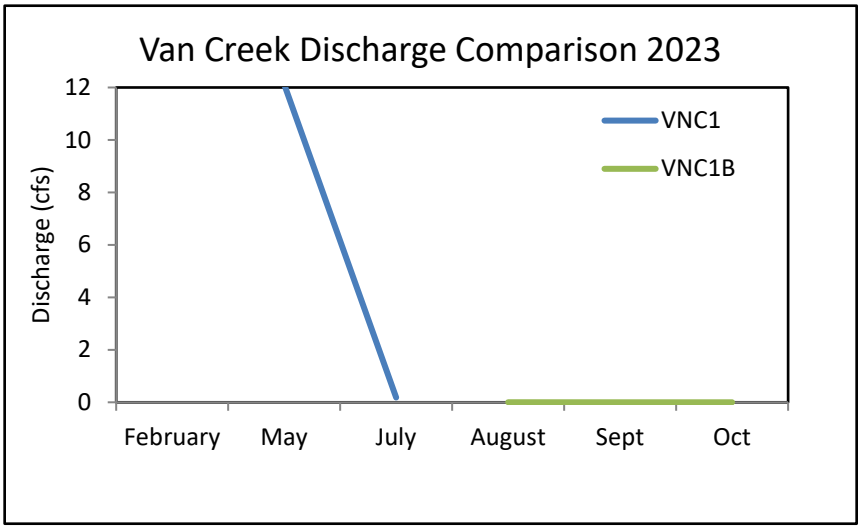


Figure 16. Van Creek discharge rates

Narrative Summary

Due VNC2's presence in a beaver pond, discharge measurements were not taken in 2023. Similarly, due to the unknown depth and substrate material, VNC2 was unsafe to complete a pebble count and collect macroinvertebrates. VNC2 was froze in February, so it was not sampled. VNC1 was mostly froze, so no discharge measurements were taken. The day prior to May and July sampling, there was intermittent rain. VNC1 was opaque in July and had little flow, due to a Van Creek-DNR bike trail road-stream crossing project which diverted the stream flow to the opposite ditch (Figure 16). This site was discontinued and VNC1B (further downstream) was sampled beginning in August. In August, there was a little flow in VNC1B, but most of the water was in pools. In September and October at VNC1B, there was no water at the actual site and no flow. The only water in the stream was in pools upstream and downstream of the site. Water was taken from the pool nearest the site for hydrolab readings and water samples in these months. It is assumed the creek, at VNC1B, may flow underground for at least part of the year.

For VNC1 and VNC2, there were total phosphorous exceedances in all months sampled (Table 12; Table 14). For VNC1, there were also the following exceedances: pH – February, dissolved oxygen – February and July, total nitrogen – February and May, and total suspended solids – July. For VNC2, there were also the following exceedances: temperature and dissolved oxygen both in July and October. VNC1B had the following exceedances: temperature – October; dissolved oxygen – August, September, and October; total phosphorous – August and October; and total nitrogen – August and September (Table 13). This is not surprising given the low gradient of the system. The WQPP are currently trying to get other programs on board to conduct a comprehensive shocking of the creek so as to determine what kinds of aquatic life, fish in particular, currently inhabit the river. This will help bolster our designation of either a cool-water or cold-water stream. Due to VNC1 moving to VNC1B mid-season, the macroinvertebrate samples for VNC1 were not sorted or sent to the taxonomist. A pebble count at VNC1 showed the substrate was dominated by detritus/vegetation and woody debris (Figure 14). Habitat assessment scores for VNC2 have remained fairly consistent, while VNC1 has begun gradual decline, though not significant at this

time (Figure 15). A habitat assessment and macroinvertebrate sampling were not conducted at VNC1B in 2023 due to its sampling beginning in August, and habitat assessments and pebble counts are done in July, with macroinvertebrate sampling done in May. All assessments and sampling will occur in 2024.

There are no reportable trends for VNC2. However, there was a sharp increase in total phosphorous levels in VNC2 in 2021 and 2023, which will result in a trend if the pattern continues. We believe this is associated with the beaver dam-pond complex throughout this part of the stream, which acts as a sink for total phosphorous. VNC1B will not have trends analyzed until its 5-year baseline sampling is complete. At VNC1, there were increasing trends in woody debris and muck, and a decreasing trend in detritus/vegetation in the substrate.

ZIC – Unnamed stream

Description & Background

The unnamed stream behind the Biindigen convenience store is a small, cold-water stream originating on the north end of Bear Creek Township. The creek's headwaters are located in a heavily developed area between a business/industrial park, RV Park, and gravel pit. It meanders its way northwest, crossing US-31, before flowing behind the Biindigen convenience store on LTBB land. From there, it continues north before running into a ditch along a roadside and eventually feeds into Iduna Creek, a connecting waterway from Round Lake to Crooked Lake. The land use of this watershed is primarily urban and wetland. The portion on LTBB land appears to be channelized, likely during the installation of a sanitary sewer line prior to LTBB's purchase of the property. This waterbody was added in July 2022 with the new site ZIC (Map 1) at the edge of the wetland we sample at Biindigen (Map 2). We are interested in restoring this stream similar to its condition on the immediate downstream property (a nature preserve), however, our efforts will be limited by the presence of the sanitary sewer.

Tribal Uses & Attainment

The Primary Tribal use on the unnamed stream at Biindigen convenience store is **CDW** and **SCR**. Other Tribal uses include **PCR** (May through October), **SCR**, **IAL**, **WLS**, **SUB**, **NAV**, **COM**, and **IND**. All uses are fully supported on the unnamed stream at Biindigen convenience store except **SUB**. **SUB** needs further evaluation because of a lack of toxin data in fish.

Data Summary Tables

Table 15. Data Summary Table for ZIC

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coldwater Fishery °C	May	9.92	--
		June	16.48	--
		July	17.37	--
		August	17.29	--
		September	17.35	X
		October	11.01	--
Specific Conductivity	450 µS/cm	May	519	X

		June	569	X
		July	516	X
		August	514	X
		September	524	X
		October	545	X
pH	6.5-9 pH units	May	7.67	--
		June	7.83	--
		July	8.04	--
		August	7.39	--
		September	7.98	--
		October	8.27	--
Dissolved Oxygen	≥7 mg/L	May	10.60	--
		June	9.35	--
		July	8.95	--
		August	9.05	--
		September	8.89	--
		October	9.88	--
Total Phosphorus	12 µg/L	May	15.50	X
		June	reject	N/A
		July	17.00	X
		August	20.30	X
		September	23.60	X
		October	12.30	X
Total Nitrogen	0.36 mg/L	May	0.42	X
		June	0.31	--
		July	0.49	X
		August	0.63	X
		September	0.44	X
		October	0.63	X
Chloride	50 mg/L	May	47.40	--
		June	53.60	X
		July	46.60	--
		August	41.40	--
		September	37.20	--
		October	55.40	X
Total Suspended Solids	15 mg/L	May	reject	N/A
		June	3.55	--
		July	5.80	--
		August	1.55	--
		September	3.30	--
		October	11.05	--

Biological Data

Substrate

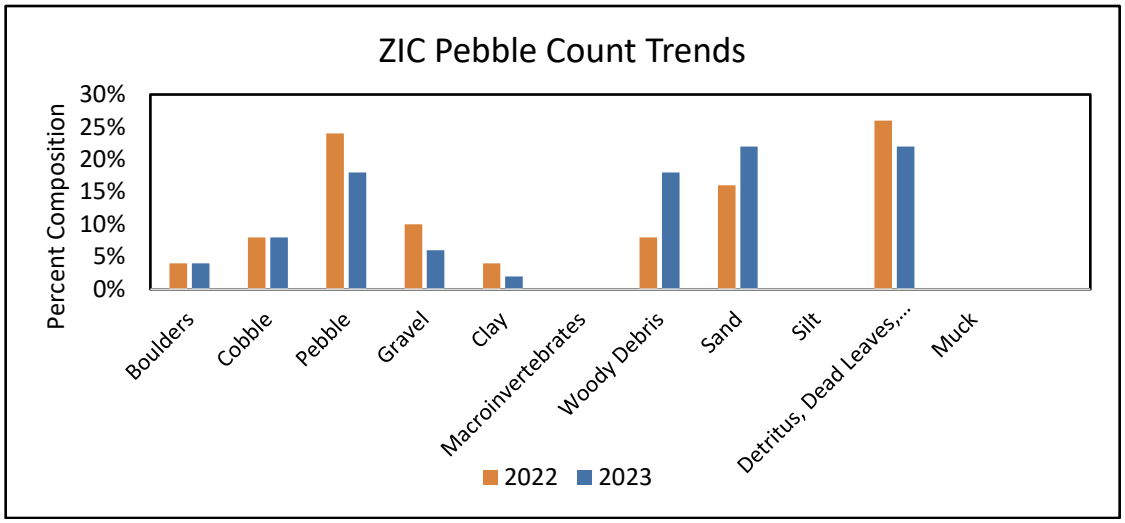


Figure 17. Pebble Count at ZIC in 2023

Habitat Assessment

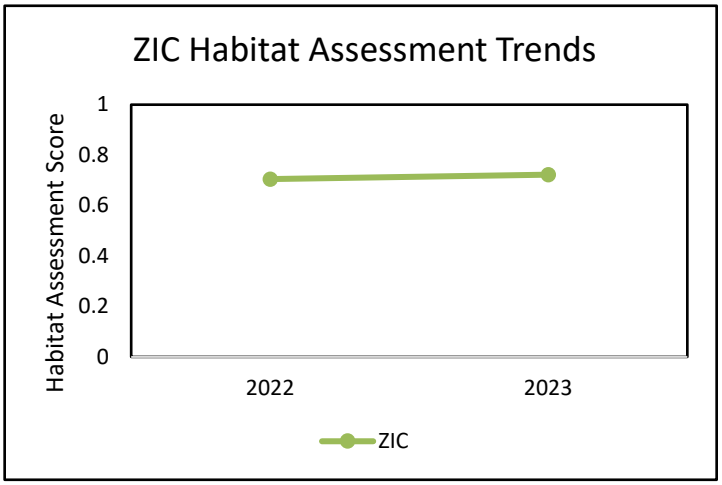


Figure 18. ZIC habitat assessment for 2023

Discharge Rates

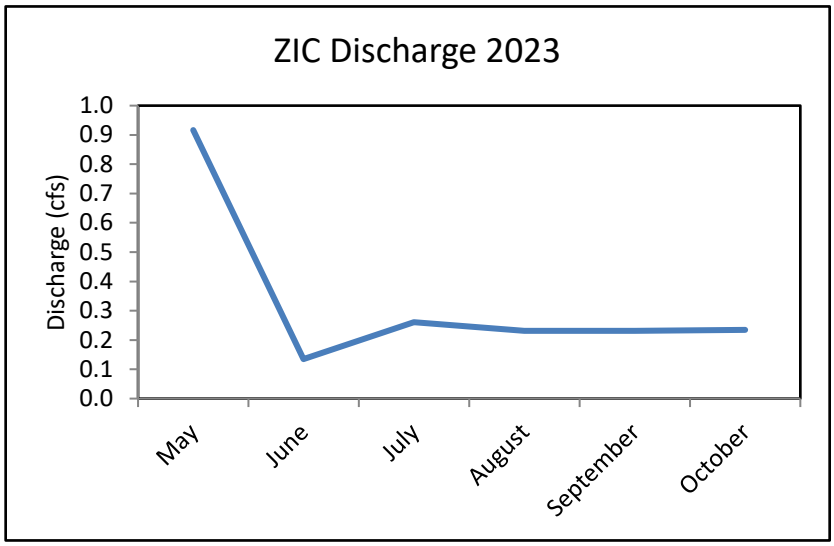


Figure 19. ZIC Discharge in 2023

Macroinvertebrates

Macroinvertebrates were collected for the first time in 2023. 2023 macros are currently at the taxonomist and results will be included in the next report.

Narrative Summary

2023 was the second year this stream was sampled. There were specific conductivity exceedances for every month sampled. There were total phosphorous and total nitrogen exceedances in May, July, August, September, and October. There was also a temperature exceedance in September and a chloride exceedance in June and October (Table 15). We are looking into how to mitigate these levels in the future. A pebble count determined the dominate substrate is sand, detritus/vegetation, pebbles, and woody debris (Figure 17). The habitat assessment score was expected considering its location in a disturbed, urban wetland (Figure 18). Discharge was relatively consistent and expected for the dry year we had in 2023 (Figure 19). 2023 macros are currently at the taxonomist and results will be included in the next report.

The day prior to June sampling there was intermittent rain. The day prior to October sampling, there was intermittent rain, with steady rain during sampling. In October, the water sample was turbid due to silt on the channel's edge, however, the majority of the water in the creek still remained clear. This turbidity is evident in the TSS results.

This is the second year of data for this site, so we will report any trends once the baseline assessment is completed, which should be in the 2027 report.

Horton Creek

Description & Background

Horton Creek is a cold-water stream, originating in Hayes Township just south of Bay Shore, MI. An intermittent stream and wetland at LTBB's Murray Rd housing parcel mark the headwaters of Horton Creek. From there, it meanders south-southeast, gaining water from several springs and intermittent streams before draining into Lake Charlevoix (Table 16). This waterbody was added in July 2022 with the new site HNC2 (Map 1).

Table 16. Main land uses within Horton Creek watershed

Land use	Soil group	Area(acres)	Rank	%
Cropland generalized agriculture	B	628.04	1	28.04%
Deciduous Forest	B	443.01	2	19.78%
Pasture/Hay	B	180.58	3	8.06%
Cropland generalized agriculture	A	173.02	4	7.73%
Grassland; Herbaceous	B	165.02	5	7.37%

Tribal Uses & Attainment

The Primary Tribal use on the Horton Creek is **CDW** and **SCR**. Other Tribal uses include **PCR** (May through October), **IAL**, **WLS**, **SUB**, **NAV**, **COM**, and **IND**. All uses are fully supported at both sites on Horton Creek except **PCR**. Horton Creek is a state-listed impaired waterbody for **PCR** due to high E. coli concentrations (EGLE 2020).

Data Summary Tables

Table 17. Data Summary Table for Horton Creek

Parameter	Threshold Criteria	Month Collected	Parameter Result	Exceedance
Temperature	Coldwater Fishery °C	May	8.93	--
		June	11.97	--
		July	12.20	--
		August	13.71	--
		September	13.43	--
		October	9.18	--
Specific Conductivity	450 µS/cm	May	434	--
		June	454	X
		July	440	--
		August	438	--
		September	450	X
		October	457	X
pH	6.5-9 pH units	May	7.65	--

		June	7.53	--
		July	7.82	--
		August	7.54	--
		September	7.56	--
		October	7.93	--
Dissolved Oxygen	≥7 mg/L	May	10.75	--
		June	9.79	--
		July	9.26	--
		August	9.61	--
		September	9.04	--
		October	9.59	--
Total Phosphorus	28.75 µg/L	May	10.10	--
		June	reject	N/A
		July	15.20	--
		August	16.10	--
		September	16.60	--
		October	12.70	--
Total Nitrogen	0.66 mg/L	May	0.67	X
		June	0.62	--
		July	0.57	--
		August	0.52	--
		September	0.53	--
		October	0.54	--
Chloride	50 mg/L	May	14.88	--
		June	5.91	--
		July	11.51	--
		August	16.73	--
		September	13.11	--
		October	reject	N/A
Total Suspended Solids	15 mg/L	May	1.80	--
		June	2.05	--
		July	4.55	--
		August	reject	N/A
		September	4.55	--
		October	4.30	--

Habitat Assessments

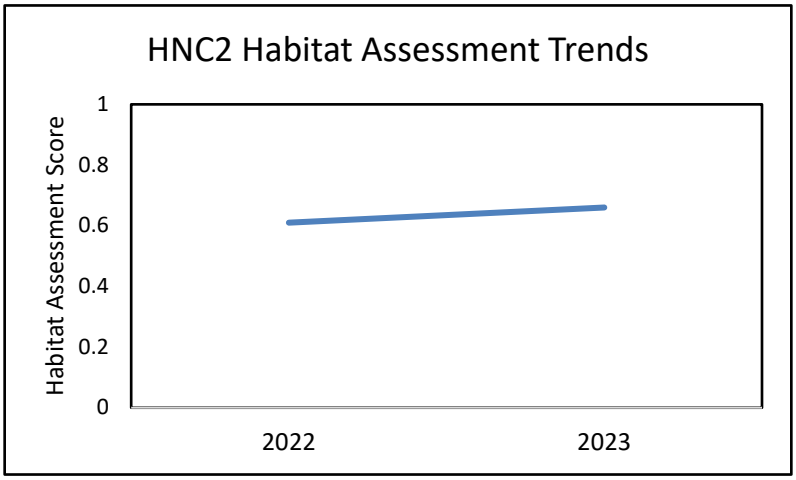


Figure 20. HNC2 habitat assessment for 2023

Biological Data

Substrate

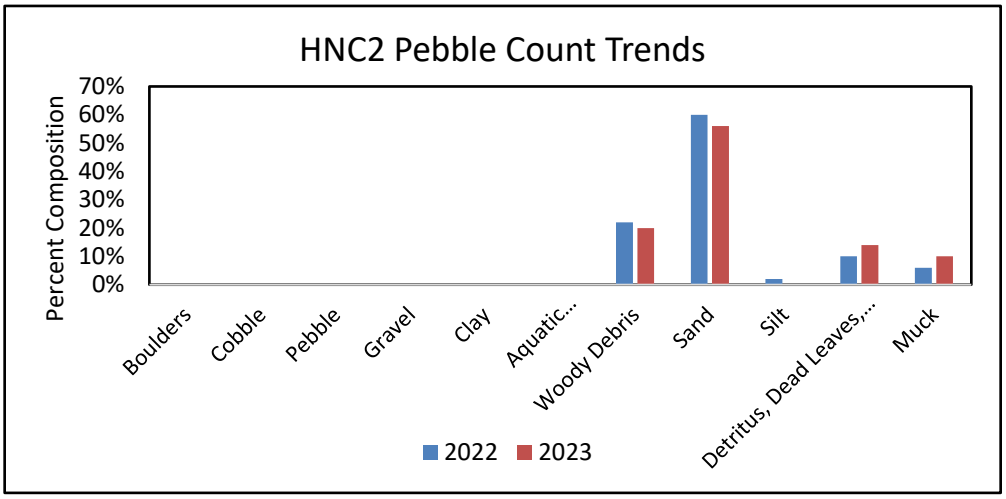


Figure 21. HNC2 pebble count for 2023

Discharge Rates

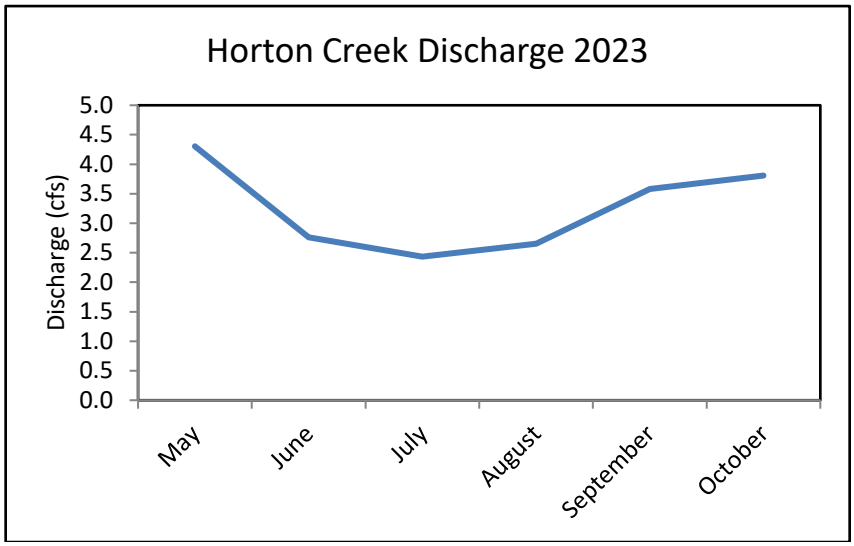


Figure 22. Horton Creek discharge rates

Macroinvertebrates

Macroinvertebrates were collected for the first time in 2023. 2023 macros are currently at the taxonomist and results will be included in the next report.

Narrative Summary

2023 was the second year this stream was sampled. There were exceedances for specific conductivity (June, September, October) and nitrogen (May) (Table 17). A pebble count determined the substrate is dominated by sand and woody debris (Figure 21). Discharge rates were as expected (Figure 22). The habitat assessment score was expected and consistent with last year due to the low sinuosity and lack of hydrological flow structure diversity (Figure 20). 2023 macros are currently at the taxonomist and results will be included in the next report.

Sampling went well in 2023. We began entering the stream below the site due to the abundance of silt at the channel's edge, which incidentally increased TSS values last year. We believe the 2023 TSS values are more representative of the stream's values. There was steady rain the day prior to sampling in June. There was intermittent rain the day prior to sampling in September. There was intermittent rain during sampling and the day prior to sampling in October.

This is the second year of data for this site, so we will report trends once the baseline assessment is completed, which should be in the 2027 report.

Wetlands

An FQI of 35 or higher is determined to be a high quality wetland. Those with a score lower than 35 are areas that experience disturbance and are less wet, as is evident by the wetness score. Cross Village and Taimi Hoag were sampled in 2023 (Table 18; Map 2). Both parcels include multiple wetland types (i.e. poor fen, rich conifer swamp, marsh, interdunal swales) and wetland-upland heterogeneity. Both sites were considered highly functional wetlands, due to Taimi Hoag being a Great Lakes coastal wetland (within 1000 feet of a Great Lake) and its high FQI scores, and due to Cross Village having USFWS critical habitat for Piping Plover, the presence of lake huron tansy (*Tanacetum bipinnatum* ssp. *huronense;* state-threatened), having a rare wetland type (S2 community – interdunal wetland), and being a Great Lakes coastal wetland. Both sites had a fairly diverse plant community, but the recent disturbance (i.e. LTBB campground) surrounding part of the Cross Village wetland led to a decreased buffer size and presumably lower MiRAM scores. Over four surveys beginning in 2010, Cross Village has decreasing trends for the native FQI (Rsq = 0.96) and total FQI (Rsq = 0.87). During the same time, Taimi Hoag had increasing trends for the native FQI (Rsq = 0.64) and total FQI (Rsq = 0.66). Goal uses include **PCR, SCR, TCC, IAL,** and **WLS** for all wetlands. All uses are fully supported.

Table 18. 2023 Wetlands FQA & MiRAM Summary.

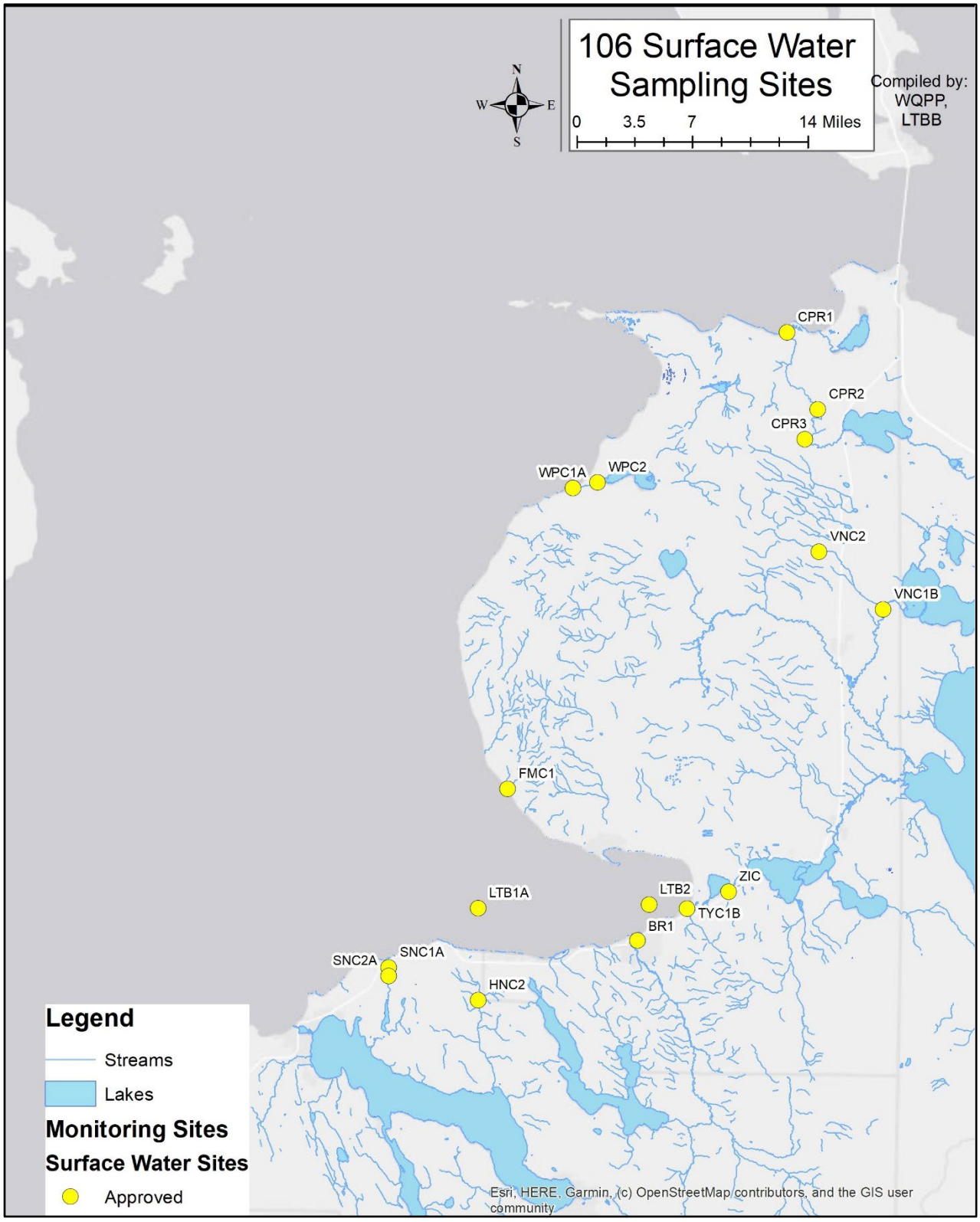
Site Name	Total # Acres	Total # of Plants	Total # of Native Plants	Total # of Non-native Plants	Native FQI	FQI - All Species
Cross Village	8	138	100	38	40.0	**34.1**
Taimi Hoag Natural Area	54	200	159	41	51.7	**46.7**
Site Name	**Native Mean C**	**Mean C All Plants**	**Native Mean Wetness (W)**	**Mean Wetness (W) All Plants**	**MiRAM Score**	
Cross Village	4.0	2.9	-1.7	-0.7	58.75	
Taimi Hoag Natural Area	**4.1**	**3.3**	**-1.6**	**-0.9**	**84.50**	

References

EGLE. 2020. Statewide E. coli Total Maximum Daily Load (TMDL) Addendum – 2020 Impaired Water Bodies and Percent Reductions. https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/WRD/SWAS/TMDL-Ecoli/statewide-ecoli-tmdl-2020-addendum.pdf. Last accessed June 2023.

Appendix A. Maps

Map 1. Water Quality Sites



Map 2. Wetland Sites