



2000–2024 Stream Monitoring Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

The Metropolitan Council Environmental Services (MCES), in partnership with the Bassett Creek Watershed Management Commission (BCWMC), monitored flow and water quality on the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek from 2000 through the present as a part of its Watershed Outlet Management Program (WOMP). This monitoring work is partially supported by the Minnesota Pollution Control Agency (MPCA) with funds from the Clean Water Land and Legacy Amendment. The monitoring station was located at Irving Avenue from 2000 through early December 2020, when it was moved a short distance downstream to a location near Van White Boulevard. In 2024, the BCWMC monitored three locations on the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek for macroinvertebrates (bottom-dwelling organisms such as bugs and snails) and habitat conditions. Macroinvertebrate data were used to assess overall community health using a biotic index that evaluates selected community attributes, assigns scores to each, and sums the scores to produce an overall stream health score. This report presents the results of these monitoring efforts.

Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek	
Stream length (miles)	12 ¹
Size of drainage area (acres)	24,9002 ²
Average flow (cubic feet per second)	25
Location of stream origin	Plymouth (origin), Golden Valley, Crystal, Minneapolis
Downstream receiving waterbody	Mississippi River
MPCA impairments	Chloride, fish bioassessments, macroinvertebrate bioassessments, fecal coliform bacteria

¹ Length of Main Stem from the outlet of Medicine Lake to the entrance of the tunnel near Van White Memorial Boulevard, between Olson Memorial Highway and Glenwood Avenue.

² Cumulative tributary area, not including landlocked basins.

1 Summary

The MCES, in partnership with the BCWMC, has monitored flow and water quality on the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek from 2000 through the present as a part of its WOMP program. The BCWMC completed habitat and macroinvertebrate monitoring on the creek in 2024. The monitoring program represents an ongoing effort by the BCWMC to conduct long-term assessments of the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek. Previous BCWMC efforts at the three Main Stem locations monitored in 2024 included:

- Collecting habitat data at all three stream locations in 2015 and at two locations—Rhode Island Avenue and east of Brookridge Avenue—in 2018 (Figure 1).
- Sampling macroinvertebrates on 11 occasions between 1980 and 2018.

The objectives of this stream monitoring are to assess flow and water quality, identify temporal changes, evaluate compliance with Minnesota Pollution Control Agency (MPCA) water quality and biological standards, and determine stressors affecting the biological community.

Water quality data were assessed during a 10-year period (2015–2024) to determine compliance with MPCA standards. Monitoring results show that during the assessment period, the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek did not meet MPCA standards for dissolved oxygen, *E. coli* bacteria, chloride, or total suspended solids. In contrast, MPCA standards were met for temperature, pH, river eutrophication standards (RES)—including total phosphorus and chlorophyll *a*—and metals, including total cadmium, chromium, copper, nickel, lead, and zinc.

Between 1980 and 2024, BCWMC sampled benthic macroinvertebrates (bottom-dwelling organisms) from the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek on 12 occasions. The Macroinvertebrate Index of Biotic Integrity (M-IBI), developed by the MPCA and incorporated into Minnesota’s water quality standards, was used to evaluate macroinvertebrate community health and identify whether the creek was biologically impaired. Streams with an M-IBI score of 37 or higher meet the standard (i.e., impairment threshold). None of the M-IBI scores from 1980 through 2024 met the M-IBI standard on the Main Stem.

Scores at the three monitoring locations were:

- Rhode Island Avenue: 13 to 23, with an average of 18.
- East of Brookridge Avenue: 15 to 31, with an average of 22.
- Irving Avenue: 11 to 28, with an average of 20.

Minnesota’s impaired waters list identifies water bodies that do not meet MPCA standards. In 2022, the MPCA listed the entire Main Stem as impaired for aquatic life based on benthic macroinvertebrate bioassessments.

BCWMC completed stream restoration projects on the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek between 2010 and 2022 (Figure 1). From 2012 to 2018, Main Stem M-IBI scores increased at all three sites, with improvements in seven of the 10 index metrics. These gains were likely associated with the stream restoration projects completed during that period. Clinger taxa (aquatic macroinvertebrates that can attach themselves to rocks, wood, and other smooth substrates to resist displacement by streamflow) increased substantially at all three Main Stem sites, indicating reduced sediment accumulation on the streambed. Clinger scores improved again at all three locations in 2024, suggesting that benefits from the restoration projects persisted over time.

From 2012 to 2024, tolerant metric scores increased at the Rhode Island and Irving Avenue sites, indicating improved water quality and/or habitat conditions. This metric reflects the percentage of collected taxa with tolerance values of 6 or greater; higher percentages indicate more degraded conditions and produce lower scores, while lower percentages indicate better conditions and produce higher scores. Increased scores at Rhode Island and Irving Avenue suggest that stream restoration resulted in sustained improvements in water quality and/or habitat conditions. East of Brookridge Avenue, tolerant metric scores increased from 2012 to 2018, suggesting similar restoration-related improvements, but declined in 2024, indicating that those gains were not sustained.

Although clinger scores improved at all three locations and tolerant metric scores improved at two locations in 2024, declines in other index metrics lowered overall M-IBI scores to levels comparable to

those observed before 2018. This pattern indicates declining water quality and/or habitat conditions from 2018 to 2024.

In 2024, the MPCA completed a Stressor Identification study for the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek to identify factors contributing to biological impairment. The study identified chloride, eutrophication, habitat degradation, and altered hydrology/connectivity as stressors. Suspended solids and dissolved oxygen were classified as inconclusive, indicating that additional data are needed to determine whether they also contribute to impairment.

Bassett Creek WOMP data from Irving Avenue for 2015–2024 support the MPCA’s conclusion that chloride contributes to biological impairment. The data also indicate that suspended solids and dissolved oxygen contribute to impairment, while eutrophication does not appear to be a stressor because RES criteria were met. Quantitative habitat surveys at Rhode Island Avenue (2015, 2018, and 2024) and Irving Avenue (2015 and 2024) further support the MPCA’s conclusion that habitat degradation may contribute to biological impairment in Ĥaĥá Wakpádaŋ/Bassett Creek. Comparison of the 2024 results with earlier surveys indicates improvement in some habitat metrics—likely associated with stream restoration projects—but degradation in others.

2 Recommendations

Because the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek did not meet MPCA standards for dissolved oxygen, *E. coli* bacteria, chlorides, and total suspended solids in 2024, and because 1980–2024 M-IBI scores fell below the MPCA impairment threshold, the following actions are recommended:

- Evaluate the sources of elevated total suspended solids and *E. coli* bacteria and develop strategies to improve water quality and support attainment of MPCA standards.
- Maintain ongoing initiatives aimed at reducing chloride (de-icing salt) usage in the watershed to achieve compliance with the MPCA chloride standard for the stream. Examples include encouraging the Smart Salting Level 1 Certification course and requiring newly permitted properties to implement a chloride management plan.

- Review the stream corridor for erosion issues and develop and implement management solutions to address and repair these areas.
- Continue partnership with MCES to complete WOMP water quality monitoring.
- Continue monitoring stream habitat and macroinvertebrates to track biological conditions over time and assess compliance with MPCA biological standards.

3 Stream water quality monitoring program

Water quality in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek was monitored by MCES in partnership with the BCWMC as part of its WOMP program from 2000 to 2020 at a station on Irving Avenue (River Mile 1.9). Later in 2020, the station was moved a short distance downstream to a location near Van White Boulevard (River Mile 1.7). This report discusses the following WOMP data collected from 2000 through 2024: flow, temperature, dissolved oxygen, pH, total phosphorus, chlorophyll *a*, chloride, *E. coli* bacteria, total suspended solids, and metals (total cadmium, total chromium, total copper, total nickel, total lead, and total zinc).

As shown in Figure 1, the water quality, biological, and habitat monitoring sites on the Main Stem are within reaches where stream restoration projects were completed by the BCWMC to enhance water quality and aquatic habitat (Table 1).

3.1 Evaluation of Main Stem 2000–2024 flow and water quality data

3.1.1 Flow

Figure 2 presents the average daily flow in the Main Stem from 2000 through 2024. During this period, daily average flow ranged from 0.09 cubic feet per second (cfs) in January 2020, to 554 cfs in April 2001, with an overall average of 30.0 cfs. Table 2 summarizes annual low, high, and average daily flows from 2015 through 2024.

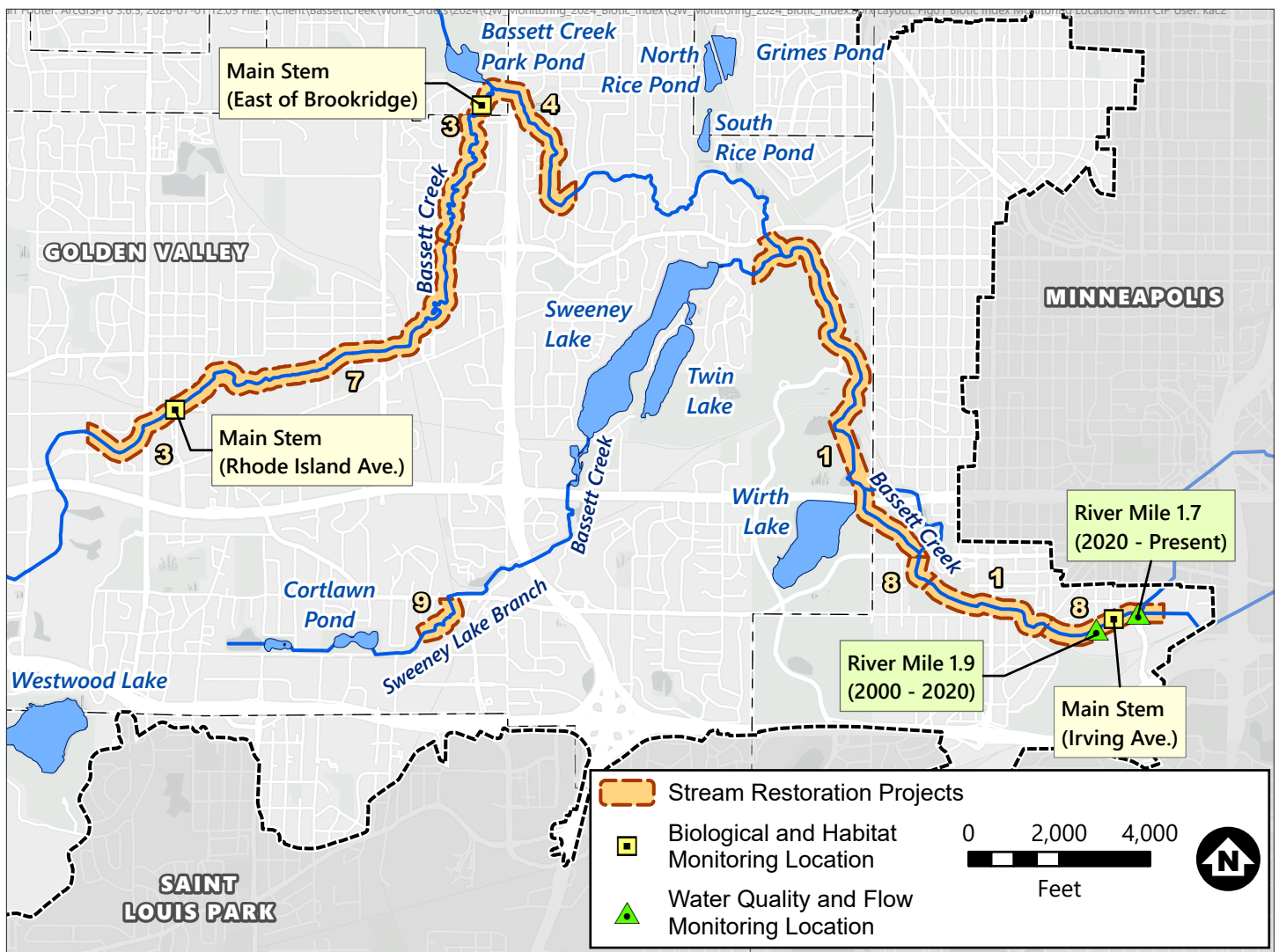


Figure 1 Water quality, biological, and habitat monitoring locations and locations of stream restoration projects along the Main Stem of Ĥaĥá Wakpádan/Bassett Creek

Table 1 Stream restoration projects along Ĥaĥá Wakpádan/Bassett Creek

#	Project Name	Status	Location
1	Main Stem Restoration Project, Golden Valley Road to Glenwood Avenue	Construction began in October 2014, with substantial completion in the spring of 2015; the project was completed in November 2015.	Golden Valley
3	Main Stem Restoration Project, Wisconsin Avenue to 10th Avenue and Duluth Street to the Crystal Border	Construction began in December 2012, with substantial completion by March of 2013; the project was officially completed in November 2013.	Crystal
4	Main Stem Restoration Project, Golden Valley/Crystal Border to Regent Avenue	Construction was completed in the winter of 2010–2011; final construction tasks and plantings were completed in the summer of 2012.	Golden Valley
7	Bassett Creek Main Stem Stream Restoration Project, 10th Avenue to Duluth Street	Construction began in the winter of 2015–2016 and was completed in 2016; establishment of native vegetation began in 2016 and continued throughout 2018.	Golden Valley
8	Main Stem Channel Restoration, Cedar Lake Road to Dupont Avenue N/2nd Avenue N., plus Fruen Mill Area	Construction began in late 2020 and was completed in December 2020; establishment of native vegetation occurred from 2021 through 2022.	Minneapolis
9	Sweeney Lake Branch Channel Restoration, Cortlawn Pond to Turner's Crossroad	Construction began and was completed in the spring of 2008.	Golden Valley

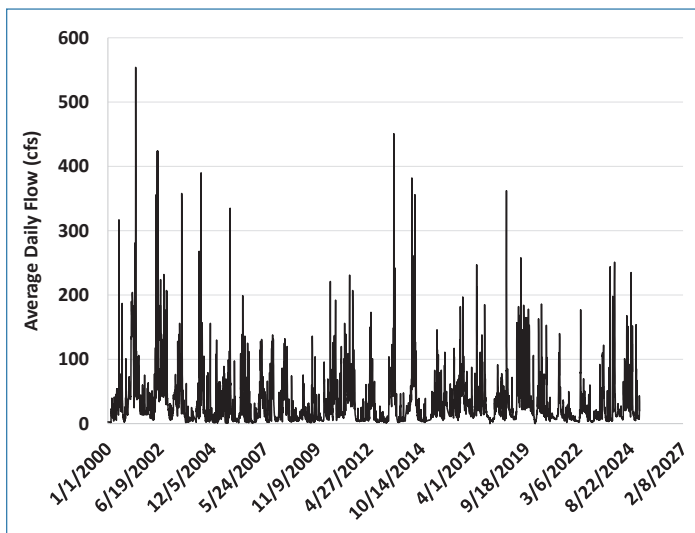


Figure 2 2000–2024 Main Stem average daily flow

Table 2 2015–2024 statistics for flow in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

Year	Average Daily Flow (cubic feet/second)		
	Low	High	Avg.
2015	4.2	146	23.3
2016	5.0	197	35.5
2017	5.0	247	31.6
2018	2.7	362	28.1
2019	6.1	158	53.3
2020	0.09	186	23.2
2021	1.8	140	17.2
2022	2.3	177	16.2
2023	3.3	251	28.8
2024	4.8	235	31.7

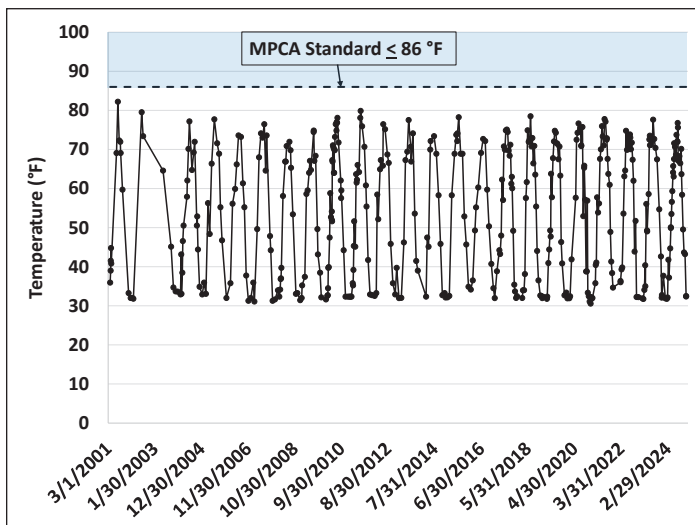


Figure 3 2001–2024 temperature in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

3.1.2 Temperature

Figure 3 presents the Main Stem temperature data from 2001 through 2024. During this period, water temperatures ranged from 31 °F to 82 °F, with an average of 54 °F. Stream temperatures were within the normal range for a warmwater stream.

3.1.3 pH

The pH of water is a measure of the degree of its acidic or alkaline reaction. The applicable pH standard for the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek is a minimum of 6.5 and a maximum of 9.0. A stream meets the pH standard if it meets the standard at least 90 percent of the days of the monitoring season.

Figure 4 shows Main Stem pH measurements from 2016 through 2024. Values ranged from 6.9 to 8.9, with an average of 7.7, and all measurements were within the MPCA standard of 6.5 to 9.0.

3.1.4 Dissolved oxygen

Dissolved oxygen is required for all aquatic organisms to live. When dissolved oxygen drops below acceptable levels, desirable aquatic organisms, such as fish, can be harmed or killed. The MPCA dissolved oxygen standard for the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek is at least 5 mg/L as a daily minimum. A stream meets the dissolved oxygen standard if at least 90 percent of the measurements are at least 5 mg/L and there are at least three such measurements.

Figure 5 summarizes Main Stem dissolved oxygen measurements collected from 2016 through 2024. Concentrations ranged from 3.1 to 14.2 mg/L and averaged 8.3 mg/L. Of the 189 measurements collected during this period, 167 met the MPCA standard (88 percent). Although the Main Stem is not currently listed on Minnesota's 303(d) impaired waters list for dissolved oxygen, based on this data, the stream would qualify as impaired because fewer than 90 percent of samples met the MPCA standard.

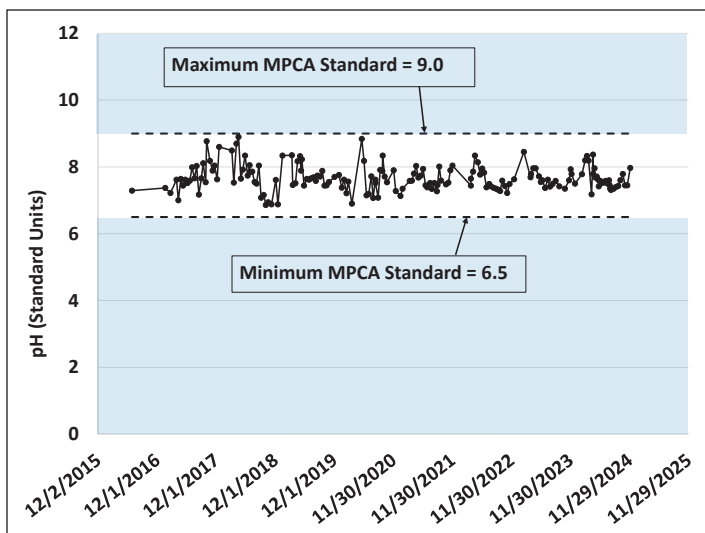


Figure 4 2016–2024 pH in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

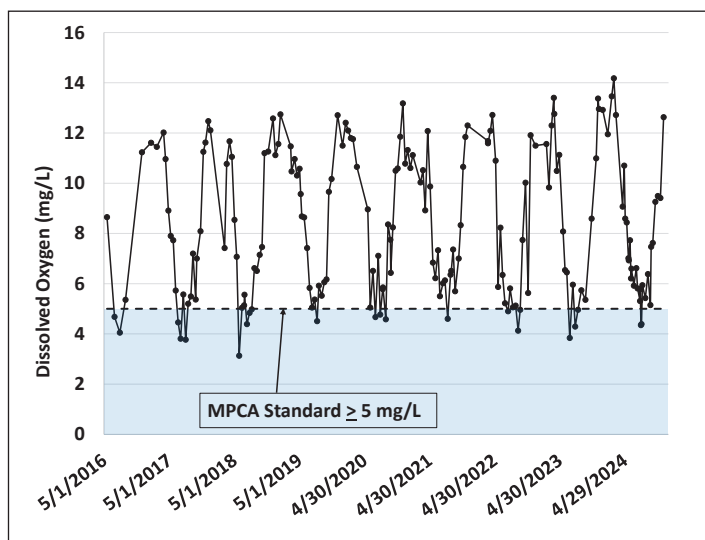


Figure 5 2016–2024 dissolved oxygen in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

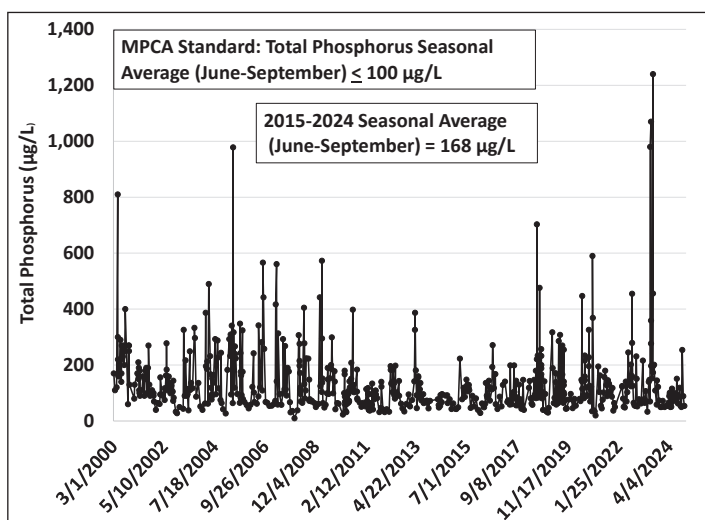


Figure 6 2000–2024 total phosphorus in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

3.1.5 River eutrophication standards (RES)

Total phosphorus, chlorophyll *a*, and dissolved oxygen (DO) flux (difference between daily maximum and daily minimum dissolved oxygen concentrations) data are used to determine compliance with RES. Phosphorus is essential for plant and algal growth; however, excessive phosphorus levels can lead to algal blooms, reduced water clarity, and overall degradation of water quality. Common sources of phosphorus include fertilizers, street leaves and grass clippings, atmospheric deposition, soil erosion, and decaying plant material. The concentration of algae in water is indicated by chlorophyll *a*, a pigment found within algae. The MPCA RES criteria for total phosphorus, chlorophyll *a*, and DO flux, require both the “causative variable” (total phosphorus) and the “response variables” (chlorophyll *a* and DO flux) to be evaluated together to determine eutrophication.

To assess stream impairment, data for total phosphorus and chlorophyll *a* must be collected in at least 2 separate years over a 10-year period, with a minimum of 12 measurements per parameter from June through September used to establish seasonal averages. These averages are compared to MPCA standards: a maximum of 100 µg/L for total phosphorus and 18 µg/L for chlorophyll *a*. A stream is considered compliant with RES if either the causative or the response variable meets the established thresholds.

DO flux is assessed using continuous dissolved oxygen measurements collected during at least one 4-day summer deployment to calculate the difference between the maximum and minimum DO concentrations within each 24-hour period. At least two deployments in different years are required to evaluate DO flux, and the maximum allowable flux is 3.5 mg/L. Because continuous dissolved oxygen measurements were not taken in the Main Stem during the monitoring period, DO flux could not be evaluated. Instead, chlorophyll *a* was used as the response variable to assess compliance with MPCA RES.

Figure 6 summarizes Main Stem total phosphorus concentrations from 2000 through 2024. Concentrations ranged from 10 to 1,240 µg/L and averaged 134 µg/L. The 2015–2024 seasonal average (June–September) was 168 µg/L.

Figure 7 summarizes Main Stem chlorophyll *a* concentrations from 2002 through 2024. Concentrations ranged from <1 to 78 µg/L and averaged 13 µg/L. The 2015–2024 seasonal average (June–September) was 12.1 µg/L.

The 2015–2024 seasonal average for total phosphorus in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek exceeded the MPCA standard of 100 µg/L (Figure 6), while the chlorophyll *a* seasonal average met the MPCA standard of 18 µg/L. Under the MPCA RES, a stream is considered compliant if either the causative variable (total phosphorus) or response variable (chlorophyll *a*) meets the applicable standard. Therefore, the Main Stem is considered compliant with the MPCA RES.

3.1.6 Chlorides

Chloride concentrations in area streams have increased since the early 1990s, when many government agencies switched from sand or sand/salt mixtures to salt for winter road maintenance. When snow and ice melt, the salt goes with it, washing into lakes, streams, wetlands, and groundwater. It only takes 1 teaspoon of road salt to pollute 5 gallons of water such that it can no longer support freshwater life. Once in the water, chloride pollution is essentially permanent, as there is no easy or affordable way to remove it.

Because high chloride concentrations can harm fish and plant life, the MPCA has established maximum and chronic chloride standards. The maximum standard is the highest concentration of chloride to which aquatic organisms can be exposed for a brief period, with zero to slight mortality. The chronic standard is the highest chloride concentration to which aquatic life can be exposed indefinitely without causing chronic toxicity. Chronic toxicity is defined as a stimulus that lingers or continues for a long period, often one-tenth the life span or more. A chronic effect can be mortality, reduced growth, impaired reproduction, harmful changes in behavior, and other nonlethal effects. A stream is considered impaired if two or more measurements exceed the chronic criterion (230 mg/L) within 3 years or if one measurement exceeds the maximum criterion (860 mg/L).

Figure 8 summarizes Main Stem chloride concentrations measured from 2001 through 2024. Concentrations ranged from 6 to 840 mg/L and averaged 159 mg/L. All samples met the MPCA

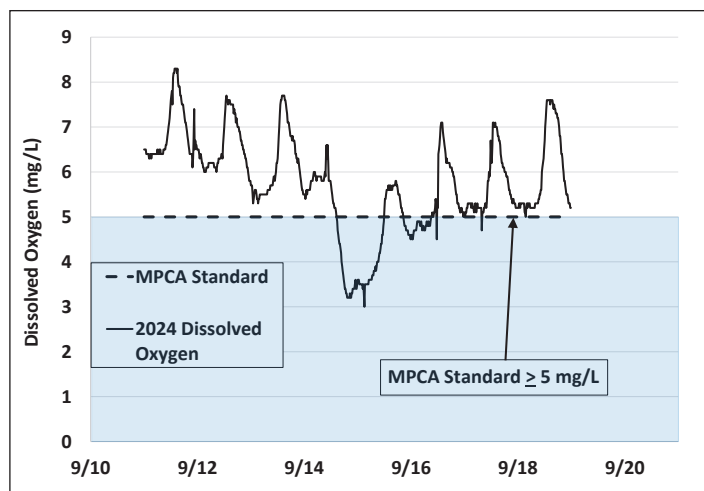


Figure 7 2002–2024 chlorophyll *a* in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

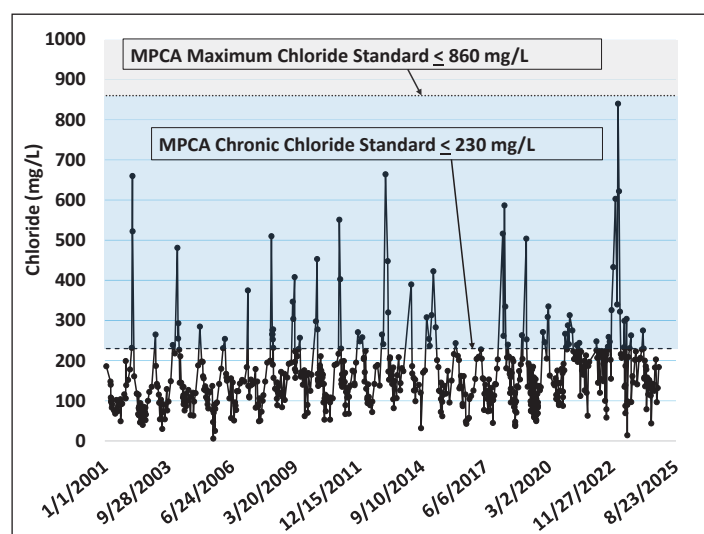


Figure 8 2001–2024 chloride concentrations in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

maximum chloride standard; however, 42 of 280 samples collected from 2015 through 2024 (15 percent) exceeded the MPCA chronic chloride standard. Exceedances occurred each year during this period, ranging from one to 10 measurements, except in 2017, when all samples met the chronic standard.

The Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek is listed as impaired for chloride on Minnesota's 303(d) impaired waters list, and the 2015–2024 data are consistent with that listing.

3.1.7 *E. coli* bacteria

The Environmental Protection Agency (EPA) has determined that *E. coli* is the preferred indicator of potential waterborne pathogens. The MPCA standard for *E. coli* protects streams used for two types of recreation: primary body contact (e.g., swimming, where inadvertent ingestion of water is likely) and secondary body contact (e.g., wading, where the likelihood of ingesting water is much smaller). The MPCA uses average and maximum *E. coli* values to determine impairment. *E. coli* standards are applicable only during the warmer months of April through October, since swimming or wading in Minnesota streams during the November through March period is not expected.

Average *E. coli* is assessed by a standard based on a geometric mean EPA criterion of 126 *E. coli* colony-forming units (cfu) per 100 milliliters (mL). Data are aggregated by individual month (e.g., all April values, all May values, etc.) for up to 10 years to determine impairment due to high average monthly *E. coli* values. At least 3 months of data must be collected, preferably between June and September, and at least five values must be collected during those 3 months (15 samples) to determine impairment due to high average *E. coli* levels.

Maximum *E. coli* is assessed using a maximum criterion of 1,260 cfu, not to be exceeded by 10 percent of all samples collected from April through October over the 10-year assessment period (independent of month). If either the geometric mean of the aggregated monthly values for one or more months exceeds 126 cfu per 100 mL, or more than 10 percent of individual values exceed 1,260 cfu per 100 mL over the 10-year assessment period, the waterbody is considered impaired.

Figure 9 summarizes *E. coli* data collected from 2006 through 2024. Concentrations ranged from 1 to 15,600 cfu per 100 mL, with an average of 612 cfu/100 mL. Of the 158 samples collected from April through October between 2015 and 2024, 37 samples (23 percent) exceeded the MPCA maximum *E. coli* standard (Figure 9). Because more than 10 percent of samples exceeded the maximum criterion during the 10-year assessment period, this portion of the standard was not met.

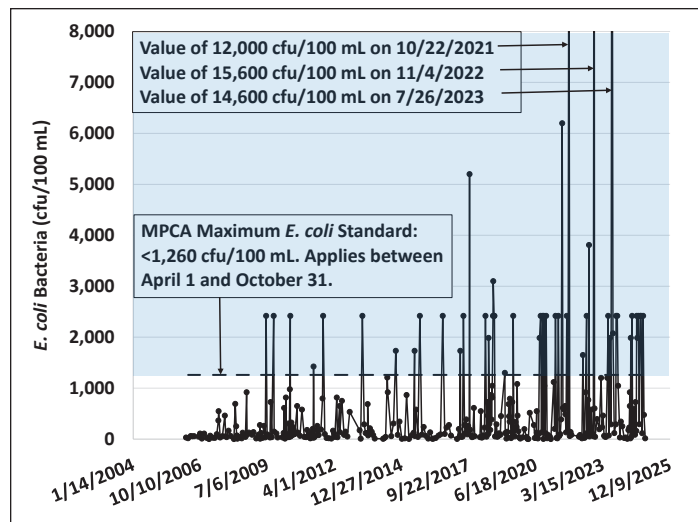


Figure 9 2006–2024 *E. coli* bacteria in the Main Stem of Ĥaĥā Wakpádaŋ/Bassett Creek

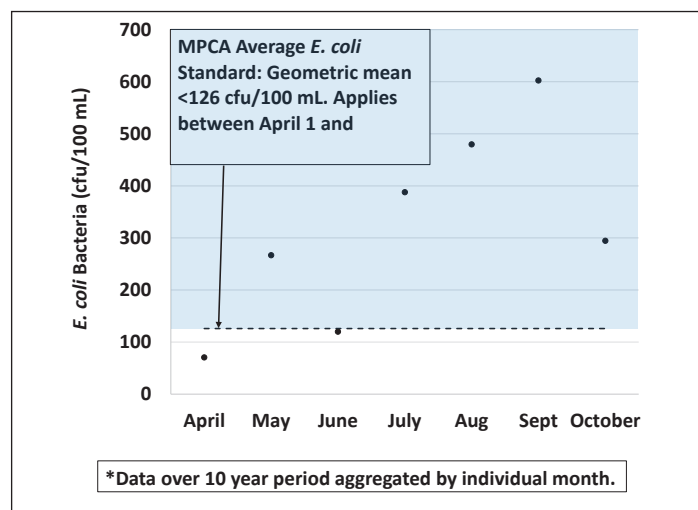


Figure 10 2015–2024 monthly geometric means of *E. coli* bacteria in the Main Stem

E. coli data collected from 2015 through 2024 were evaluated against the MPCA average impairment standard. Monthly geometric means from April through October ranged from 71 cfu/100 mL in April to 602 cfu/100 mL in September (Figure 10). The April and June means met the MPCA average *E. coli* standard of 126 cfu/100 mL; however, the May and July through October means exceeded the standard, based on 21 to 28 samples per month. Therefore, this portion of the MPCA standard was not met.

The 2015 to 2024 monitoring confirms elevated levels of bacteria in the Main Stem of Ĥaĥā Wakpádaŋ/Bassett Creek as evidenced by *E. coli* over the state standard and consistent with the creek's impairment listing for fecal coliform bacteria (the prior metric used to assess bacteria impairment).

3.1.8 Total suspended solids

Total suspended solids consist of soil particles, algae, and other materials that are suspended in water and reduce water clarity. They typically increase during rain events or snowmelt when runoff from the watershed flows into the stream. Excessive total suspended solids can harm aquatic life and degrade aesthetic and recreational qualities. A stream is considered to exceed the standard for total suspended solids (30 mg/L) if (1) the standard is exceeded more than 10 percent of the days of the assessment season (April through September) and (2) at least three such measurements exceed the standard.

Figure 11 summarizes Main Stem total suspended solids measurements collected from 2000 through 2024. Concentrations ranged from 1 to 786 mg/L, with an average of 27 mg/L. During the 2015–2024 MPCA assessment season (April–September), 36 of 196 measurements (18 percent) exceeded the MPCA standard. Although the Main Stem is not currently listed on Minnesota’s 303(d) impaired waters list for total suspended solids, the stream would qualify as impaired because the standard was exceeded on more than 10 percent of assessment-season days during the 10-year assessment period.

3.1.9 Metals

Metals are naturally occurring elements found throughout the Earth’s crust. Their multiple industrial, domestic, agricultural, medical, and technological applications have led to their widespread distribution in the environment. Because heavy metal toxicity can harm aquatic life, the MPCA established three standards for Class 2B waters—chronic, maximum, and final acute values (FAVs)—for each metal type. (The MPCA classified Ĥaĥá Wakpádaŋ/Bassett Creek as a Class 2B water.) The chronic standard (CS) is the highest toxicant concentration to which aquatic organisms can be exposed indefinitely without harmful effects. The maximum standard (MS) is a concentration that protects aquatic organisms from the potentially lethal effects of a short-term “spike” in toxicant concentrations. The MS is always equal to one-half of the FAV: the concentration that would kill about one-half of the exposed individuals of a very sensitive species. The FAV is most often used as an “end-of-pipe” effluent limit to prevent an acutely toxic condition in the effluent or the mixing zone. Because higher water hardness reduces metal toxicity, the MPCA metals standards vary with water hardness. To show this variation (Figures 12 through 17), metal concentrations are plotted on the y-axis and hardness on the x-axis.

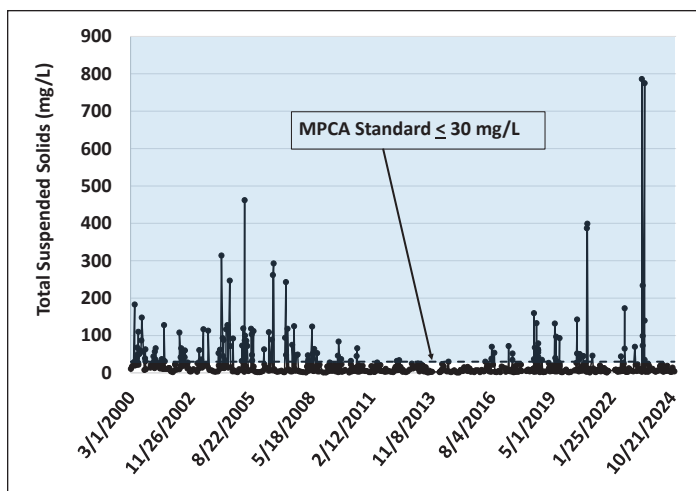


Figure 11 2000–2024 total suspended solids in the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek



From 2000 through 2024, Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek samples were analyzed for total cadmium, chromium, copper, nickel, lead, and zinc. All results met MPCA final acute value and maximum standards, and all total cadmium, chromium, nickel, and zinc concentrations met MPCA chronic standards (Figures 12–17). Between 2000 and 2007, five total copper results and 29 lead results exceeded the MPCA chronic standard; however, all copper and lead concentrations measured from 2008 through 2024 met the standard. These findings indicate that metals have not caused toxicity to aquatic organisms in the stream since 2007. During the 2015–2024 MPCA assessment period, all metal concentrations met the three MPCA standards.

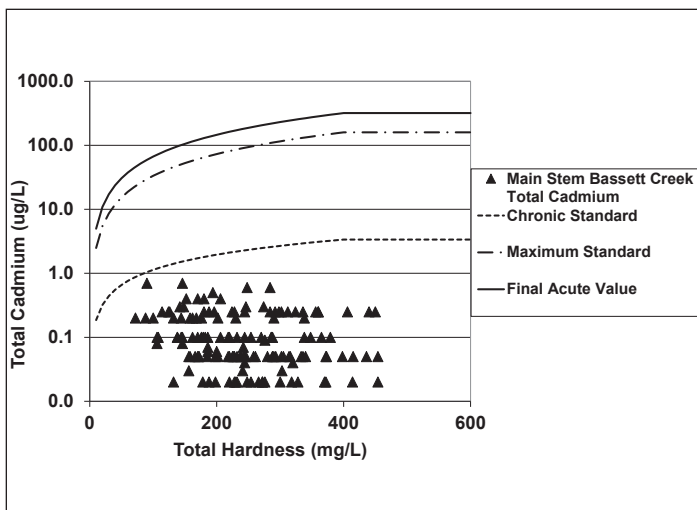


Figure 12 2000–2024 total cadmium in the Main Stem compared to MPCA standards

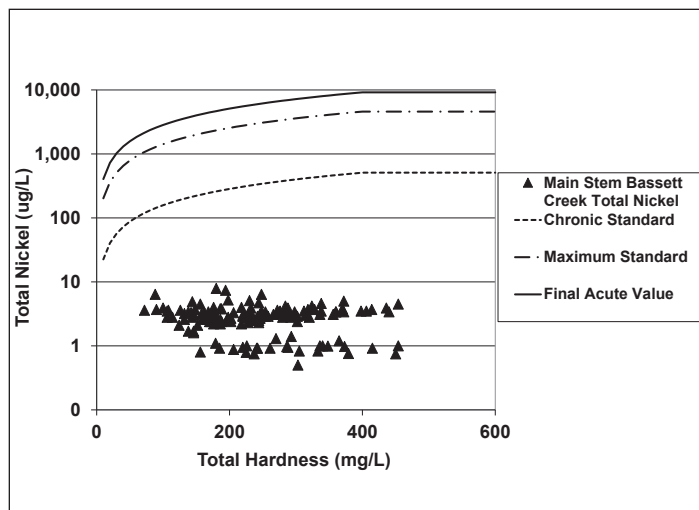


Figure 15 2000–2024 total nickel in the Main Stem compared to MPCA standards

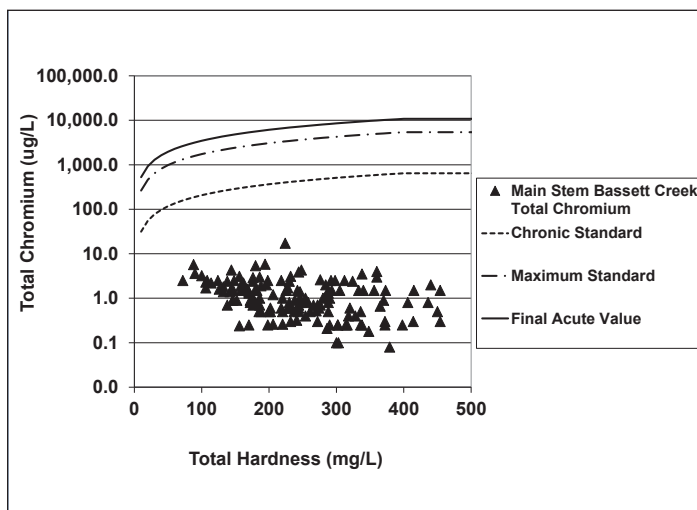


Figure 13 2000–2024 total chromium in the Main Stem compared to MPCA standards

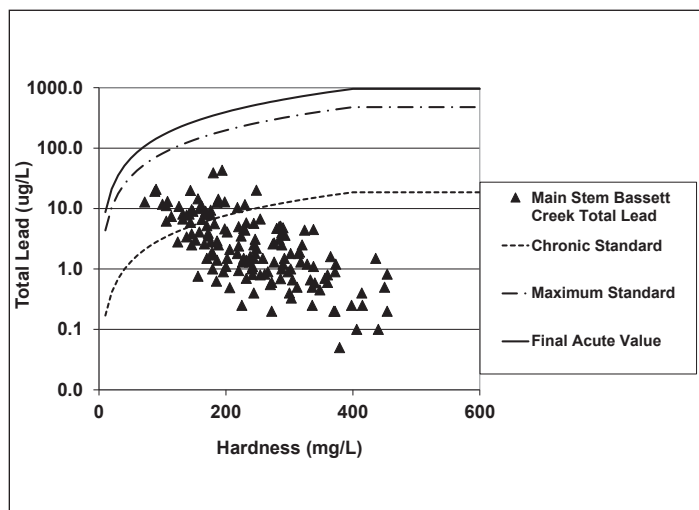


Figure 16 2000–2024 total lead in the Main Stem compared to MPCA standards

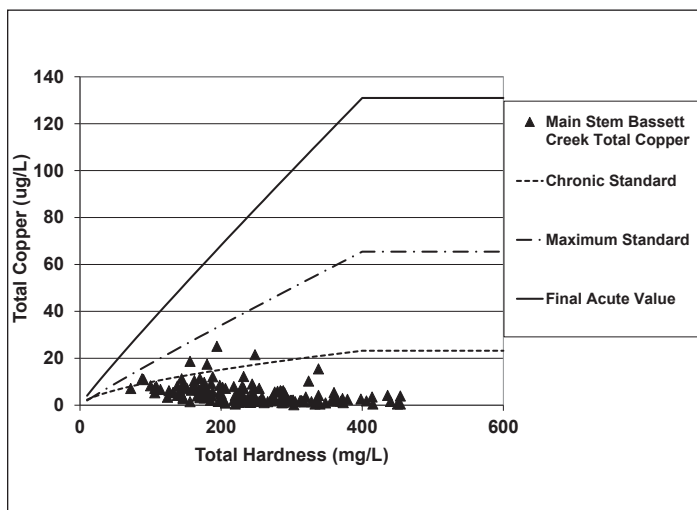


Figure 14 2000–2024 total copper in the Main Stem compared to MPCA standards

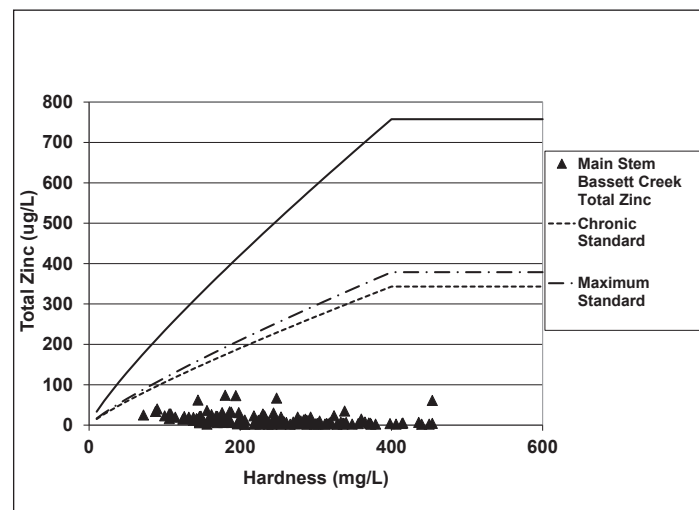


Figure 17 2000–2024 total zinc in the Main Stem compared to MPCA standards

4 Biotic index evaluation of the Main Stem

In 2024, the BCWMC monitored benthic macroinvertebrates (bottom-dwelling organisms like bugs and snails) and assessed habitat conditions in the Main Stem of Ĥaḥá Wakpádaŋ/Bassett Creek at the locations shown in Figure 1. This monitoring has been conducted 12 times between 1980 and 2024 to evaluate water quality and track changes in the macroinvertebrate community over time. Community health was assessed using the M-IBI, which was developed by the MPCA and incorporated into Minnesota's water quality standards to identify biologically impaired rivers and streams.

4.1 Main Stem habitat

Habitat strongly influences the presence and distribution of stream macroinvertebrates. Important habitat factors include substrate size and composition, the amount of fine sediment deposited on the substrate, and aquatic vegetation. Substrate provides food resources and refuge, while aquatic vegetation offers protection from predation by small fish. Habitat degradation can therefore negatively affect macroinvertebrate communities.

The BCWMC conducted Main Stem habitat surveys using MPCA quantitative methods at Rhode Island Avenue and east of Brookridge Avenue in 2015, 2018, and 2024, and at Irving Avenue in 2015 and 2024. Table 3 summarizes the survey results.

4.1.1 Rhode Island Avenue location

Macrophyte abundance in the Rhode Island Avenue sampling reach increased from 2018 to 2024, reflecting improved habitat conditions. Abundance also increased from 2015 to 2018, likely in response to the Main Stem restoration project between Tenth Avenue and Duluth Street. Construction began in winter 2015 and was completed in 2018, after which native vegetation was established along the restored streambanks. These results suggest that the restoration-related increase in macrophyte abundance has persisted.

However, some habitat metrics showed degradation at this location from 2018 to 2024, including:

- Greater fine sediment depth.

- Higher percent embeddedness (the degree to which larger, coarse substrate particles like gravel, cobbles, and boulders are surrounded, covered, or sunken into finer sediments like silt, sand, or mud).
- Greater extent and length of left and right bank erosion.
- Lower average filamentous algae abundance.
- Shorter transect length with overhanging vegetation, submergent macrophytes, and boulders in water deeper than 10 cm.

4.1.2 East of Brookridge Avenue location

Habitat conditions differed between the 2018 and 2024 surveys, with improvements in some metrics, but degradation in others. Habitat improvements included:

- Reduced fine sediment depth.
- Reduced extent of left bank erosion.
- Higher average filamentous algae abundance.
- Greater macrophyte abundance.
- Greater transect length with submergent vegetation and woody debris in water deeper than 10 cm.
- Woody debris in water deeper than 10 cm also increased from 2015 to 2018, indicating this habitat improvement was sustained through 2024.

Habitat degradation at the east of Brookridge Avenue location between 2018 and 2024 included:

- Higher percent embeddedness.
- Increased extent of right bank erosion (percent of transects that have erosion).
- Increased length of left bank erosion (average of the measurements of bank erosion).

4.1.3 Irving Avenue location

Habitat conditions differed between the 2015 and 2024 surveys, with improvements in some metrics, but degradation in others. Habitat improvements included:

- Reduced percent embeddedness.
- Reduced extent of right bank erosion and no change in extent of left bank erosion.

- Reduced length of right bank erosion.
- Greater macrophyte abundance.
- Greater transect length with submergent vegetation, woody debris, and boulders in water deeper than 10 cm.

Habitat improvements at the Irving Avenue location are likely attributable to two BCWMC stream restoration projects:

- Main Stem restoration project completed from 2014 to 2015, which included the reach from Golden Valley Road to Glenwood Avenue.

- Main Stem channel restoration completed from 2020 to 2022, which included the reach from Cedar Lake Road to Dupont Avenue N./Second Avenue N. and the Fruen Mill Area.

Habitat degradation at the Irving Avenue location between 2015 and 2024 included:

- Greater fine sediment depth.
- Greater length of left bank erosion.
- Lower average filamentous algae abundance.

Table 3 2015, 2018, and 2024 Ĥaĥá Wakpáday/Bassett Creek Main Stem habitat comparisons: Rhode Island Avenue, east of Brookridge, and Irving Avenue

Parameter	Rhode Island Ave.			East of Brookridge			Irving Ave.	
	2015	2018	2024	2015	2018	2024	2015	2024
Discharge (flow) (cfs) ¹	4.3	40.3	2.9	3.4	40.8	2.7	8.9	7.1
Average depth of water (cm)	18	39	13	19	34	16	22	22
Average depth of fine sediment (cm)	2.0	0.3	0.9	0.4	2.3	1.5	2.1	2.5
Average embeddedness of coarse sediment (%)	50	50	56	50	42	49	69	62
Percent of transects with left-bank erosion	92	0	46	54	77	62	69	69
Percent of transects with right-bank erosion	77	0	46	62	39	54	69	54
Average length of bank erosion per transect: left bank (m)	1.1	0	0.9	0.5	0.4	2.64	1	1.2
Average length of bank erosion per transect: right bank (m)	0.6	0	0.6	0.6	0.7	0.7	1.1	0.7
Average amount of algae (filamentous or attached) observed on quadrat (%)	0.0	2.9	0	8.0	1.8	5	9	8.1
Average number of macrophytes observed on quadrat (%)	0.0	5.8	8.5	0.0	0	4	0	1.2
Percent length of transect over at least 10 cm of water depth with overhanging vegetation	0.0	1.0	0.0	0.0	0.4	3.1	0	0
Percent length of transect over at least 10 cm of water depth with submergent vegetation	0.0	9.0	8.5	0.0	0.0	0.4	0.4	2.7
Percent length of transect over at least 10 cm of water depth with emergent vegetation	0.0	0.0	0.0	0.0	0.0	0.0	0	0
Percent length of transect over at least 10 cm of water depth with woody debris	2.7	0.0	0.0	0.0	0.4	0.8	0	0.8
Percent length of transect over at least 10 cm of water depth with boulders	0.0	6.0	0.0	6.7	4.2	1.2	0	0.8

¹Discharge when macroinvertebrates were collected

4.2 M-IBI biological metrics

The MPCA has established biological water quality standards for all Minnesota streams and rivers, including Ĥaĥá Wakpádaŋ/Bassett Creek. In 2018, the M-IBI and a fish index of biotic integrity (F-IBI) were added to these standards and approved by the United States Environmental Protection Agency on June 26, 2018.

The M-IBI helps identify biologically impaired rivers and streams by assessing the health of their macroinvertebrate communities. The M-IBI score is the sum of the scores from 10 individual metrics. Each metric assesses an attribute of the macroinvertebrate community; collectively, the metrics assess the community's overall health. Each M-IBI metric ranges from 0 to 10; the lowest possible score is 0, and the highest is 10. Increasing scores indicate improving conditions. Because 10 metrics are summed to attain the M-IBI score, and each metric has a maximum score of 10, the maximum possible score is 100. To meet the MPCA macroinvertebrate standard, the sum of the scores from the 10 individual metrics must equal or exceed the impairment threshold. The MPCA Macroinvertebrate Class 5 (Southern Streams) standard of 37 applies to the Main Stem of Bassett Creek.

On September 27, 2024, the BCWMC collected macroinvertebrate samples from two Main Stem Bassett Creek sites: Rhode Island Avenue and Irving Avenue. A third sample was collected east of Brookridge on September 30. The MPCA calculated M-IBI scores to evaluate whether the stream met the biological standard. The 2024 scores—18 at Rhode Island Avenue, 15 east of Brookridge, and 17 at Irving Avenue—did not meet the M-IBI standard (Figure 18).

The MPCA also calculated M-IBI scores from macroinvertebrate data collected by the following:

- BCWMC at the three Main Stem sites from 1980 through 2024 (except for 2008 and Irving Avenue in 2018).
- MPCA at Rhode Island Avenue and Irving Avenue in 2008.
- Metropolitan Council Environmental Services (MCES) at Irving Avenue in 2018.

None of the assessed scores met the MPCA standard (Figure 18):

- Rhode Island Avenue: 13 to 23, with an average of 18.
- East of Brookridge: 15 to 31, with an average of 22.
- Irving Avenue: 11 to 28, with an average of 20.

Minnesota's impaired waters list identifies water bodies that fail to meet MPCA standards. The MPCA completed macroinvertebrate sampling at Rhode Island Avenue and Pennsylvania Avenue in 2010 and 2020 and calculated M-IBI scores to assess the stream for biological impairment. At Rhode Island Avenue, scores declined from 23.0 in 2010 to 19.9 in 2020; at Pennsylvania Avenue, scores declined from 23.5 to 10.8 over the same period (Figure 18).

Because all scores were below the MPCA M-IBI standard, the MPCA listed the entire Main Stem as impaired for aquatic life in 2022 based on benthic macroinvertebrate bioassessments. Macroinvertebrate data collected by the BCWMC for the Main Stem from 1980 through 2024 are consistent with this impairment listing (Figure 18).

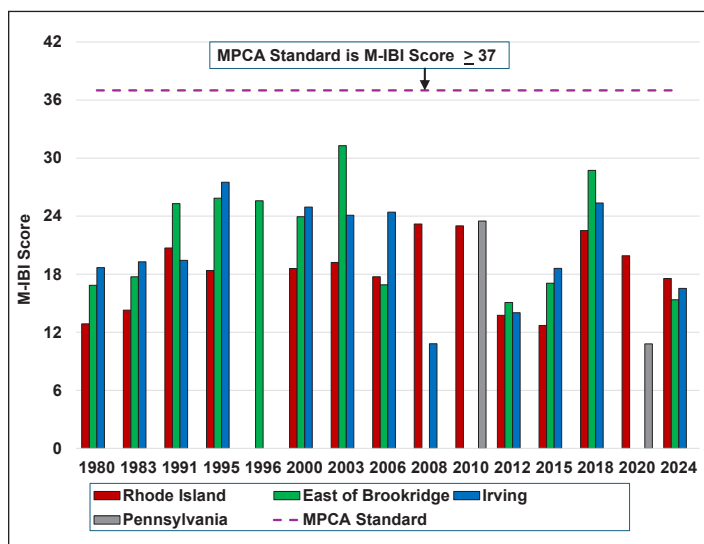
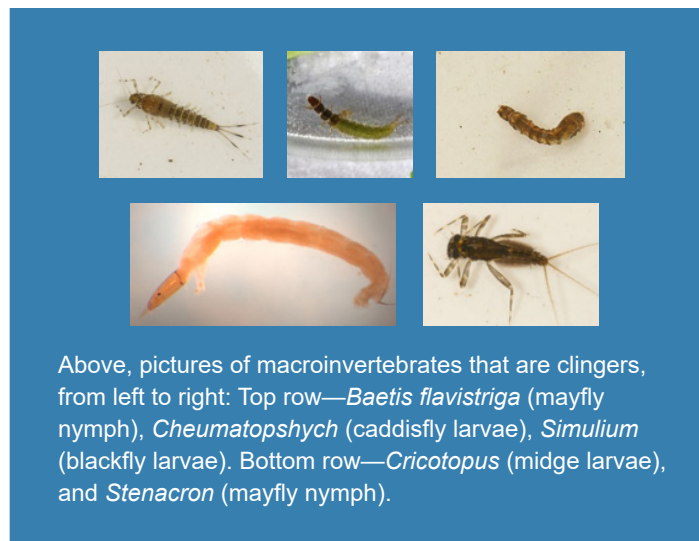


Figure 18 1980–2024 M-IBI metric scores from the Main Stem of Ĥaĥá Wakpádaŋ/Bassett Creek

MPCA M-IBI scores declined from 2010 to 2020, whereas BCWMC M-IBI scores improved from 2012 to 2018. The increase in BCWMC scores likely reflects the influence of stream restoration projects completed during that period (Figure 1 and Table 1):

- Crystal border to Regent Avenue, completed in 2012
- Wisconsin Avenue to 10th Avenue and Duluth Street to the Crystal border, completed in 2013
- Golden Valley Road to Irving Avenue, completed in 2015
- 10th Avenue to Duluth Street, construction completed in 2016; native vegetation establishment began in 2016 and continued through 2018

From 2012 to 2018, clinger taxa increased substantially at all three Main Stem sites, resulting in higher clinger scores and indicating reduced sediment accumulation on the streambed. These taxa attach to rocks and other stable substrates to resist displacement by stream flow, and lower sediment levels improve substrate stability by reducing surface slipperiness. Elevated clinger scores persisted at all three sites through 2024, suggesting that sediment-reduction benefits from the stream restoration projects continued over time. In 2024, Irving Avenue received the maximum clinger score of 10, while east of Brookridge scored 9.2, approaching the maximum score (Figure 19).



From 2012 to 2024, tolerant metric scores increased at the Rhode Island and Irving Avenue sites, indicating improved water quality and/or habitat conditions (Figure 20). The MPCA assigns Minnesota macroinvertebrate taxa tolerance values from 1 to 10, with higher values representing greater tolerance of degraded conditions. Taxa with values of 6 or higher are considered tolerant. This metric is based on the percentage of collected taxa with tolerance values of 6 or greater; higher percentages indicate more degraded conditions and lower scores, while lower percentages indicate better conditions and yield higher scores. The increased scores at Rhode Island Avenue and Irving Avenue suggest that stream restoration efforts produced sustained improvements in water quality and/or habitat conditions.

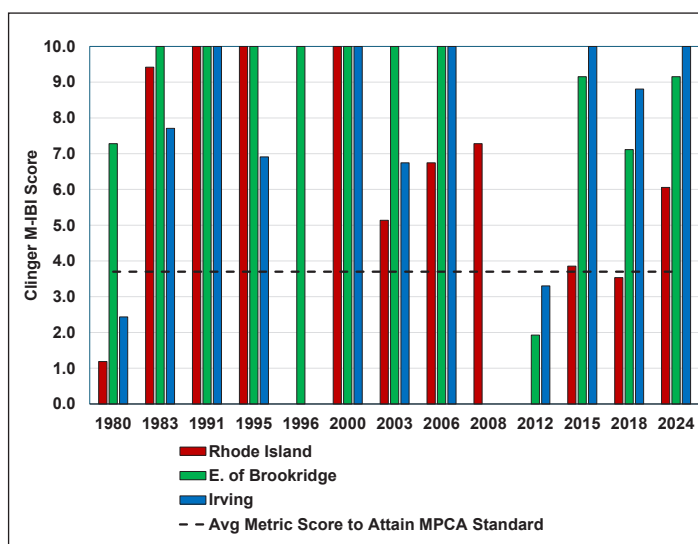


Figure 19 1980–2024 scores for clinger metric of M-IBI from the Main Stem of Ĥahá Wakpádan/Bassett Creek

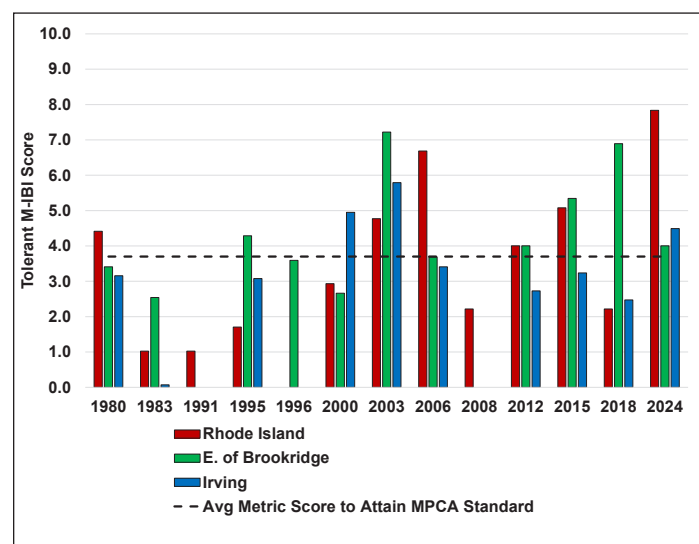


Figure 20 1980–2024 scores for tolerant metric of M-IBI from the Main Stem of Ĥahá Wakpádan/Bassett Creek

At the east of Brookridge Avenue location, tolerant metric scores increased from 2012 to 2018, suggesting that stream restoration improved water quality and/or habitat conditions. However, the decline in this score in 2024 indicates that these improvements were not sustained (Figure 20).



Above, taxa with tolerance values greater than 6, from left to right, *Baetis flavistriga* (mayfly larvae) and *Simulium* (black fly larvae).

Despite 2024 improvements in clinger metric scores at all three locations and tolerant metric scores at two locations, overall M-IBI scores for all three Main Stem locations declined in 2024 to levels similar to those observed before 2018 (Figure 8). This decline reflected poorer performance in five metrics at the Rhode Island Avenue site and seven metrics at both the east of Brookridge Avenue and Irving Avenue sites. Across all three sites, the 2024 decline included:

- Decreased diversity, and less even organism distribution; the five dominant taxa accounted for a greater proportion of the total sample (see Figure 21).
- Decreased scores for the Hilsenhoff Biotic Index (HBI_MN) metric, signifying a rise in the average tolerance value among stream organisms and suggesting habitat and/or water quality degradation (See Figure 22). (HBI_MN is Minnesota's adaptation of the Hilsenhoff Biotic Index and uses abundance-weighted average tolerance values of observed aquatic macroinvertebrates to assess stream water quality and habitat conditions.)
- Disappearance of dragonflies and damselflies (Odonata), further indicating degraded habitat and/or water quality (See Figure 23).
- Decreased numbers of predator taxa, correlating with a reduction in water quality or habitat. The absence of dragonflies and damselflies—a predator group—contributed to this decrease (See Figure 24).

- Decreased numbers of climber taxa, reflecting diminished habitats such as overhanging vegetation, submerged plants, boulders, and woody debris; the disappearance of dragonflies and damselflies, which are climbers, also impacted climber scores (See Figure 25).

Additional metric declines observed in 2024 included:

- Reduced caddisfly (*Trichoptera*) abundance at the east of Brookridge Avenue and Irving Avenue sites, suggesting degraded habitat and/or water quality (See Figure 26).
- A lower tolerance metric score east of Brookridge Avenue, where the proportion of macroinvertebrates with Minnesota tolerance values of 6 or greater increased in 2024, indicating a shift toward more disturbance-tolerant taxa (See Figure 20). The MPCA assigns Minnesota macroinvertebrate taxa tolerance values from 1 to 10, with higher values representing greater tolerance of degraded conditions. Taxa with values of 6 or higher are considered tolerant.
- Decreased percentage of macroinvertebrates classified as insects at Irving Avenue, indicating reduced stream health (See Figure 27).

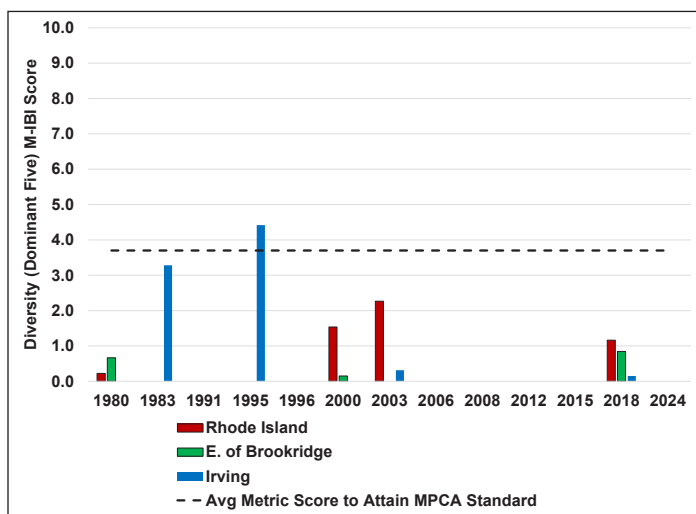


Figure 21 1980–2024 scores for diversity (dominant five) metric of M-IBI from the Main Stem of Hañá Wakpádan/Bassett Creek

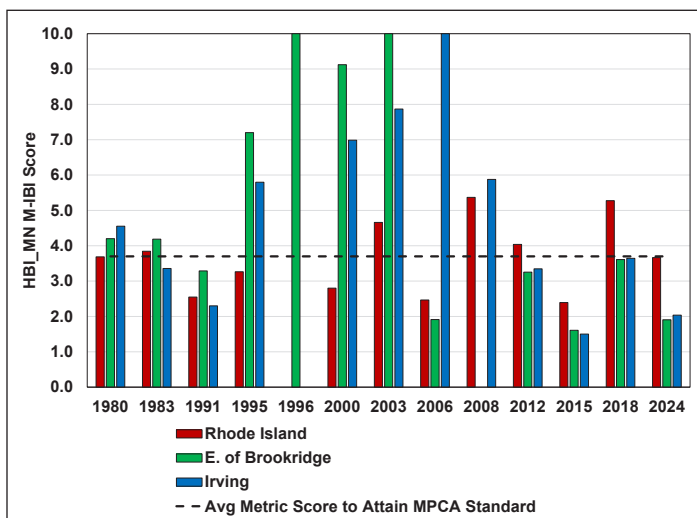


Figure 22 1980–2024 scores for HBI_MN metric of M-IBI from the Main Stem of Ħaĥá Wakpádaŋ/Bassett Creek

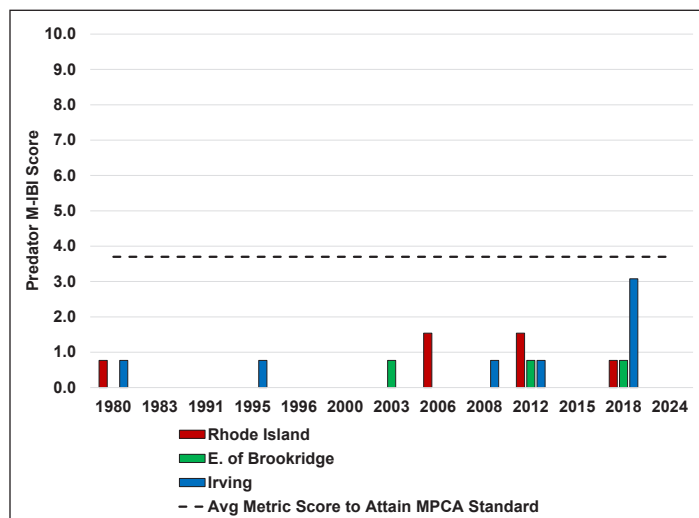


Figure 24 1980-2024 scores for predator metric of M-IBI from the Main Stem of Ħaĥá Wakpádaŋ/Bassett Creek

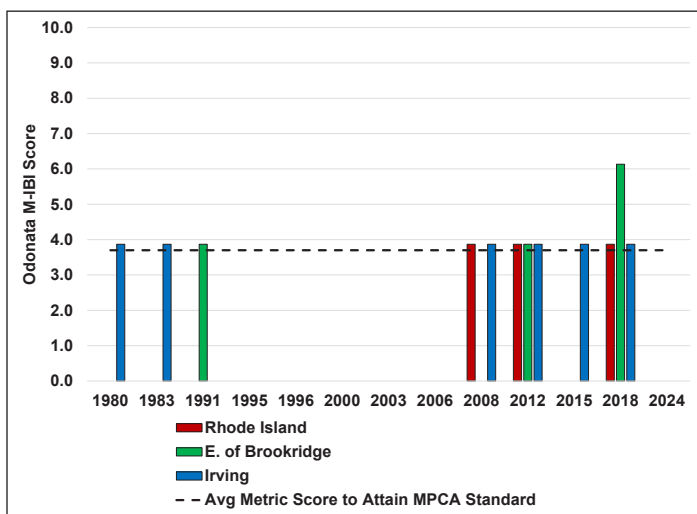


Figure 23 1980–2024 scores for dragonfly and damselfly (odonata) metric of M-IBI from the Main Stem of Ħaĥá Wakpádaŋ/Bassett Creek

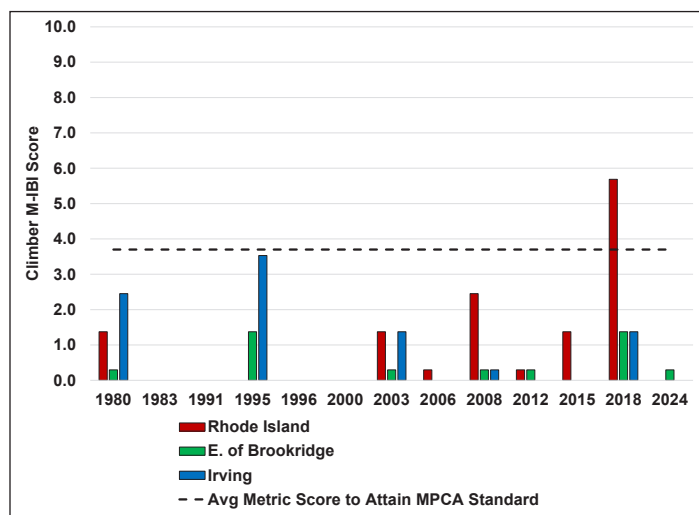
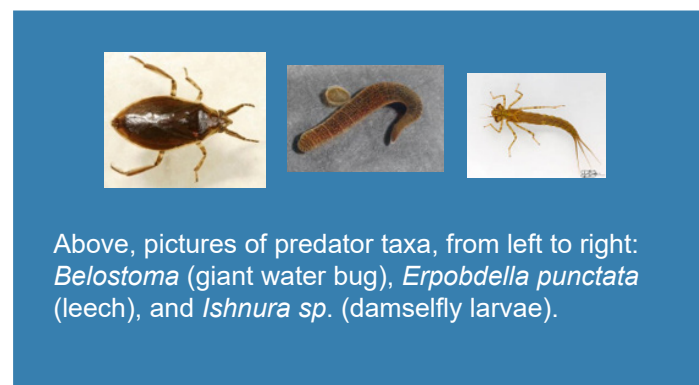
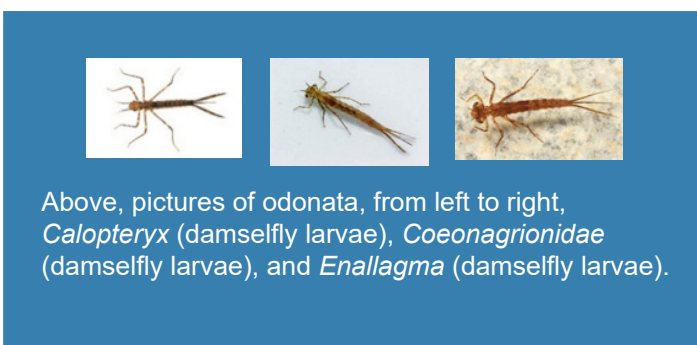


Figure 25 1980–2024 scores for climber metric of M-IBI from the Main Stem of Ħaĥá Wakpádaŋ/Bassett Creek

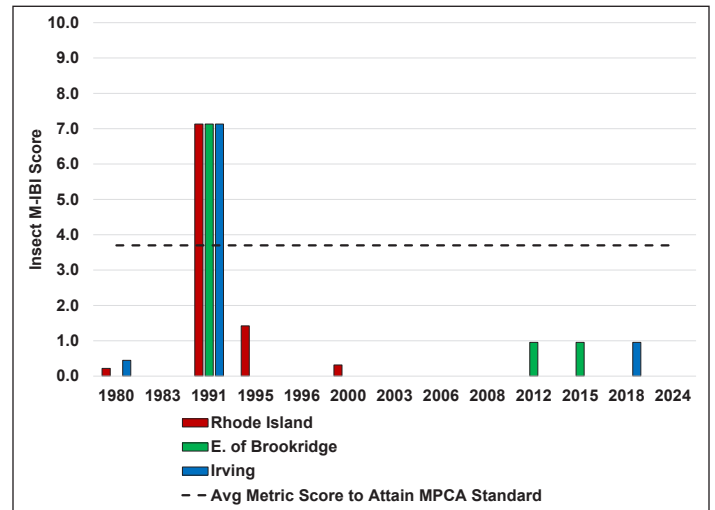
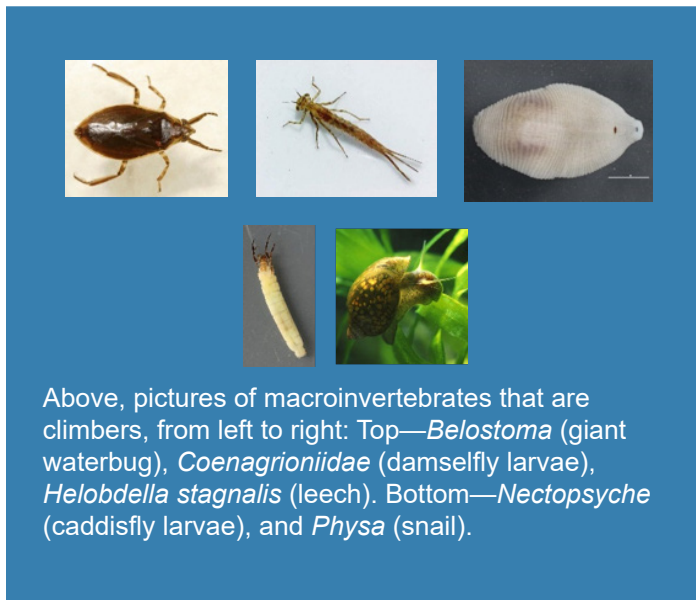


Figure 27 1980-2024 scores for insect metric of M-IBI from the Main Stem of Ĥaḥá Wakpádaŋ/Bassett Creek

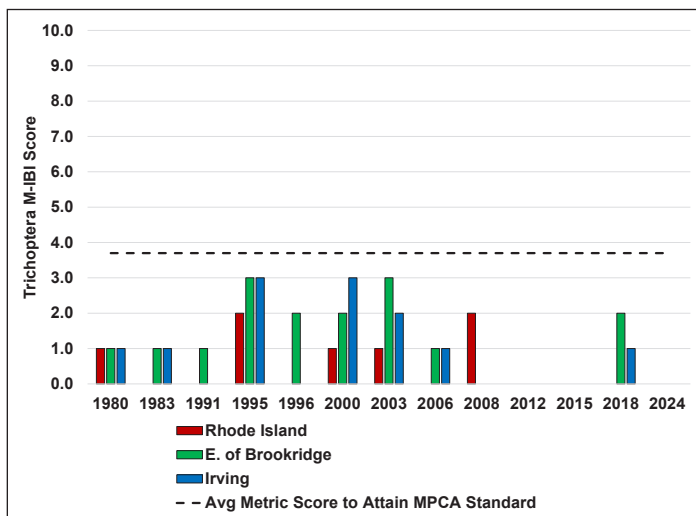
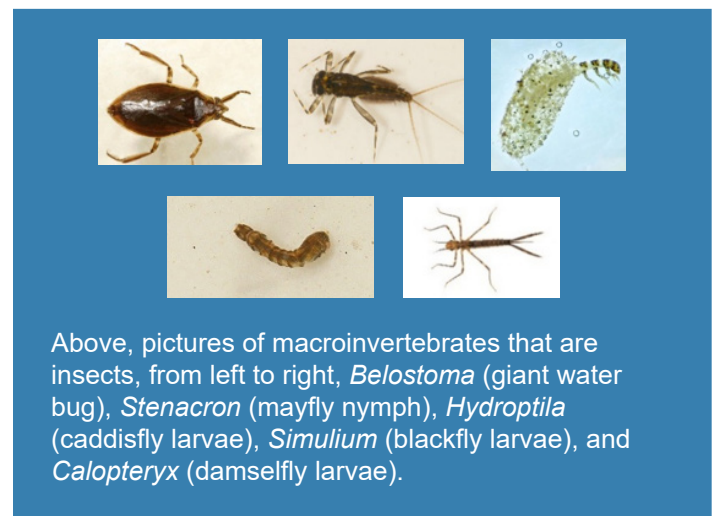
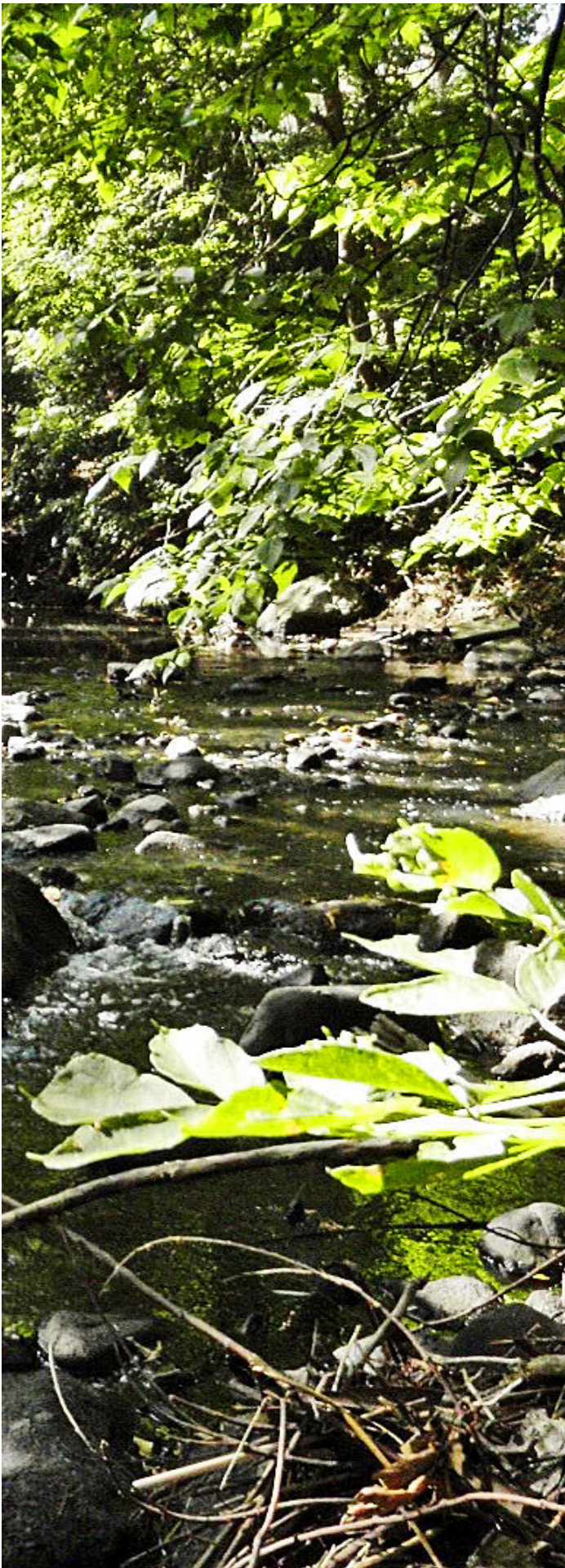


Figure 26 1980-2024 scores for caddisfly (*Trichoptera*) metric of M-IBI from the Main Stem of Ĥaḥá Wakpádaŋ/Bassett Creek





In 2024, the MPCA completed a Stressor Identification study for the Main Stem of Ĥaḥá Wakpádaŋ/Bassett Creek Bassett Creek to evaluate factors contributing to biological impairment. The study identified chloride, eutrophication, habitat degradation, and altered hydrology/connectivity as stressors. Suspended solids and dissolved oxygen were classified as inconclusive, indicating that additional data are needed to determine whether they also contribute to impairment.

Water quality data from the Bassett Creek WOMP station at Irving Avenue were assessed for the 10-year period from 2015 through 2024 to evaluate compliance with MPCA standards. The results support the MPCA's conclusion that chloride is contributing to biological impairment.

During the assessment period, the Main Stem of Ĥaḥá Wakpádaŋ/Bassett Creek did not meet MPCA standards for dissolved oxygen, *E. coli* bacteria, chloride, or total suspended solids. Standards were met for temperature, pH, river eutrophication—including total phosphorus and chlorophyll *a*—and metals, including total cadmium, chromium, copper, nickel, lead, and zinc. These results indicate that suspended solids and dissolved oxygen, along with chloride, are contributing to biological impairment, while eutrophication does not appear to be a stressor because the stream met RES criteria.

Quantitative habitat surveys completed at Rhode Island Avenue in 2015, 2018, and 2024 and at Irving Avenue in 2015 and 2024 support the MPCA's conclusion that habitat degradation may contribute to biological impairment in Ĥaḥá Wakpádaŋ/Bassett Creek. Comparison of the 2024 results with previous surveys indicates a combination of habitat improvements (likely related to stream restoration projects) and habitat degradation occurred leading up to the 2024 monitoring.