

SWEENEY LAKE 2023 WATER QUALITY MONITORING



Bassett Creek Watershed Management Commission



Monitoring water quality in Sweeney Lake

About Sweeney Lake

BCWMC classification	Priority-1 deep lake
Watershed area	2,397 acres
Lake size	67 acres
Average depth	12 feet
Maximum depth	25 feet
MNDNR ordinary high water level	827.7 feet
Normal water level	827.5 feet
Downstream receiving waterbody	Bassett Creek
Location (city)	Golden Valley
MPCA impairments	Chloride
Aquatic invasive species	Curly-leaf pondweed and Eurasian watermilfoil
Public access	Yes (non-motorized boat launch)

The Bassett Creek Watershed Management Commission (BCWMC) has monitored water quality conditions in the watershed's 10 priority lakes since 1972. The purpose of this monitoring is to detect changes or trends in water quality and evaluate the effectiveness of efforts to preserve or improve water quality.

At a glance: 2023 monitoring results

In 2023, the BCWMC monitored Sweeney Lake for the following:

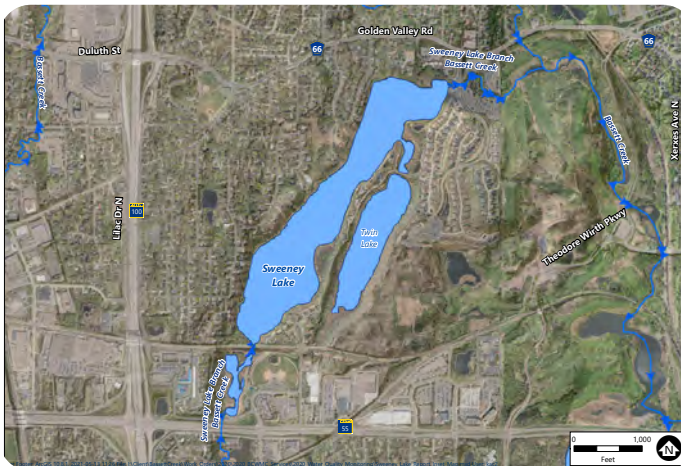
- Water chemistry (nutrients, chlorophyll *a*, chloride)
- Water clarity and dissolved oxygen
- Phytoplankton and zooplankton (microscopic plants and animals)
- Macrophytes (aquatic plants)

The 2023 monitoring results indicate that water quality improvement projects partially funded by a federal grant from the MPCA and completed by the BCWMC and cooperators (City of Golden Valley and the Sweeney Lake Association) improved the lake's water quality and overall ecological health. These projects included the following:

- A Schaper Pond project in 2015 to improve the pond's removal of phosphorus
- Turning off the lake aeration system in 2017
- Removal of carp from Sweeney Lake and Schaper Pond in 2020 to reduce internal phosphorus loading
- Alum treatments of Sweeney Lake during the fall of 2020 and fall of 2022 to reduce internal phosphorus loading
- Implementation of more than 50 watershed best management practices since 1980 by the City of Golden Valley.

Improvements to the lake's water quality and ecological health include the following:

- Decreasing phytoplankton numbers and total phosphorus and chlorophyll *a* concentrations and increasing water clarity
- Increased numbers of plant species and improved quality of the plant community



2023 monitoring results show that Sweeney Lake met the applicable Minnesota Pollution Control Agency (MPCA) and BCWMC water quality standards for total phosphorus, chlorophyll *a*, and Secchi disc depth (a measure of clarity). Sweeney Lake was placed on the MPCA's impaired waters list for nutrients in 2004 but was removed from the list (delisted) in 2024 due to improved water quality.

Trend analyses show improving water quality with statistically significant (95 percent confidence level) decreases in total phosphorus and chlorophyll *a* concentrations and a statistically significant (95 percent confidence level) increase in water clarity (Secchi disc depth) over the last 10 years. The improved water quality is a result of BCWMC water quality improvement projects.

The lake met the MPCA maximum standard for chloride in 2023 but failed to meet the MPCA chronic standard for chloride. Chloride measurements from both the surface and bottom of the North and South Basins have been above the chronic criterion with increasing frequency since 2017, and all measurements were above the chronic criterion during 2023. Average chloride concentrations in the lake have approximately doubled since 2017 in both the North and South Basin. The increasing chloride concentrations since 2017 and increased frequency of measurements exceeding the chronic criterion are a significant concern for the lake.

Eurasian watermilfoil (EWM), an aquatic invasive species (AIS), was first observed at a single location in southwestern Sweeney Lake on August 25, 2023. The EWM was treated with the herbicide ProcellaCOR on August 30. A fall plant survey did not find EWM within the treated area; however, it was found along the north shore of the lake near the boat landing. This EWM was treated with ProcellaCOR in the spring of 2024.

Other AIS species observed in 2023 were curly-leaf pondweed, yellow iris, purple loosestrife, reed canary grass, and narrow-leaved cattail.

The results of an AIS suitability analysis indicate that the water quality of Sweeney Lake meets the suitability requirements for rusty crayfish, faucet snails, zebra mussels, spiny water fleas, and starry stonewort and partially meets the suitability requirements for the Chinese mystery snail.



Recommendations

- Complete plant surveys to determine whether EWM was eradicated. If not eradicated, assist the City of Golden Valley and/or the Sweeney Lake Association with development of a long-term management plan by providing data, technical assistance, and/or review of the plan.
- Identify management measures to reduce chloride runoff from the lake's watershed.
- Communicate with landowners to request the removal of yellow iris.
- Continue water quality and biological monitoring at a 3-year frequency.

Definitions

- **Hypereutrophic:** Nutrient-rich lake conditions characterized by frequent and severe algal blooms and low water clarity; excessive algae can significantly reduce lake oxygen levels
- **Eutrophic:** Lake condition characterized by abundant accumulation of nutrients supporting dense growth of algae and other organisms; decay of algae can reduce lake oxygen levels
- **Mesotrophic:** Lake condition characterized by medium levels of nutrients and clear water
- **Oligotrophic:** Lake condition characterized by a low accumulation of dissolved nutrients, high oxygen content, sparse algae growth, and very clear water

Water chemistry monitoring: 2023

Total phosphorus levels

While phosphorus is necessary for plant and algae growth, too much phosphorus leads to excessive algae, decreased water clarity, and water impairment. Some common sources of phosphorus are fertilizers, leaves and grass clippings, atmospheric deposition, soil erosion, and plant die-off (such as curly-leaf pondweed). Phosphorus can also be released from lake sediments when oxygen is absent or concentrations are very low.

- **BCWMC/MPCA standard:** 40 micrograms per liter ($\mu\text{g/L}$) or less.
- **Range:** Low of 11 $\mu\text{g/L}$ during August in both North and South Basins; high of 15 $\mu\text{g/L}$ in North Basin and 20 $\mu\text{g/L}$ in South Basin during April.
- **Summer average of North and South Basins:** 12 $\mu\text{g/L}$ (met BCWMC/MPCA standard)

Chlorophyll a levels

Chlorophyll a is a pigment in algae and generally reflects the amount of algae growth in a lake. Lakes which appear clear generally have chlorophyll a levels less than 15 micrograms per liter ($\mu\text{g/L}$).

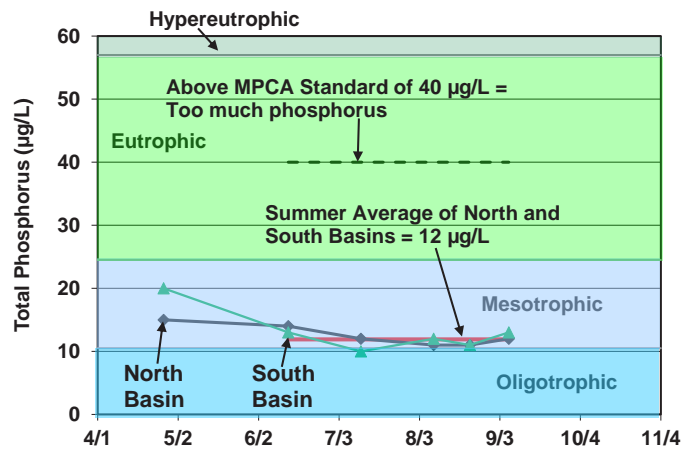
- **BCWMC/MPCA standard:** 14 micrograms per liter ($\mu\text{g/L}$) or less
- **Range:** North Basin low of 1.1 $\mu\text{g/L}$ in late June and high of 11.9 $\mu\text{g/L}$ in late August; South Basin low of 2.1 $\mu\text{g/L}$ in July and high of 7.1 $\mu\text{g/L}$ in April
- **Summer average of North and South Basins:** 4.5 $\mu\text{g/L}$ (met BCWMC/MPCA standard)

Water clarity

Water clarity is often affected by sediment and the amount of algae in a lake. It is usually measured by lowering an 8-inch "Secchi" disc into the lake; the depth at which the disc's alternating black-and-white pattern is no longer visible is considered a measure of the water's transparency (or clarity). The higher the Secchi depth, the better the clarity.

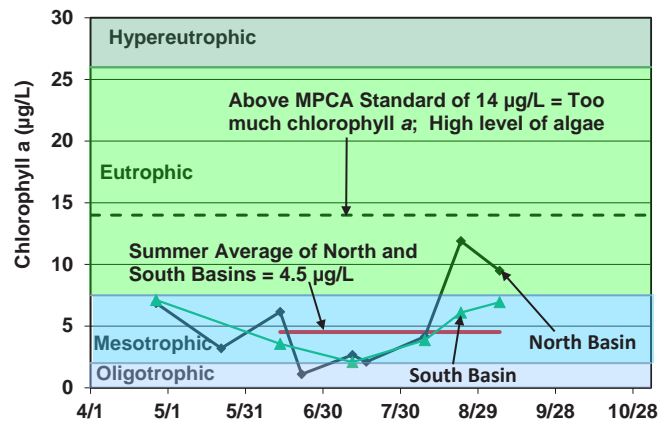
- **BCWMC/MPCA standard:** 1.4 meters or more
- **Range:** Low during April of 1.7 meters in the North Basin and 1.8 meters in the South Basin; high of 4.7 meters at both North and South Basins during late August
- **Summer average of North and South Basins:** 3.3 meters (met BCWMC/MPCA standard)

Total Phosphorus

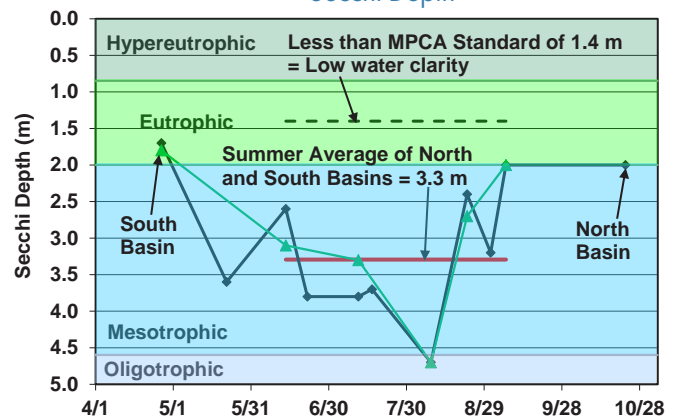


Note: The graphs below include Citizen Assisted Monitoring Program (CAMP) data collected from the north basin of Sweeney Lake and BCWMC data collected from the north and south basins of the lake.

Chlorophyll a



Secchi Depth



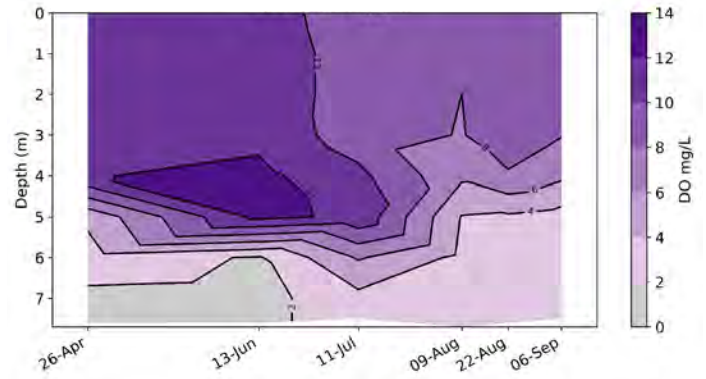
Phosphorus loading from sediment

The release of phosphorus stored in lake-bottom sediments when oxygen levels are low is described as internal loading from sediment. The Sweeney Lake total maximum daily load (TMDL) study found internal phosphorus loading from sediment to be a significant source of lake phosphorus—about one-third of the lake’s total annual phosphorus load.

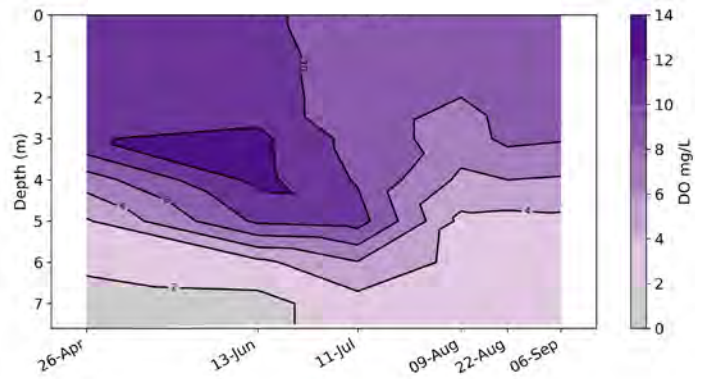
In the fall of 2020 and fall of 2022, BCWMC completed an alum treatment to reduce internal phosphorus loading from sediment. BCWMC also removed 452 carp in 2020. The bottom-feeding fish disturb the phosphorus-rich lake sediment, releasing phosphorus into the water column.

The 2023 data show the success of the projects. Despite low near-bottom total oxygen levels (<2 mg/L) during April through June, near-bottom total phosphorus levels were low. The 2023 summer average bottom total phosphorus concentration was 26 µg/L, much lower than the summer average bottom concentration of 562 µg/L measured in 2020 prior to the alum treatment.

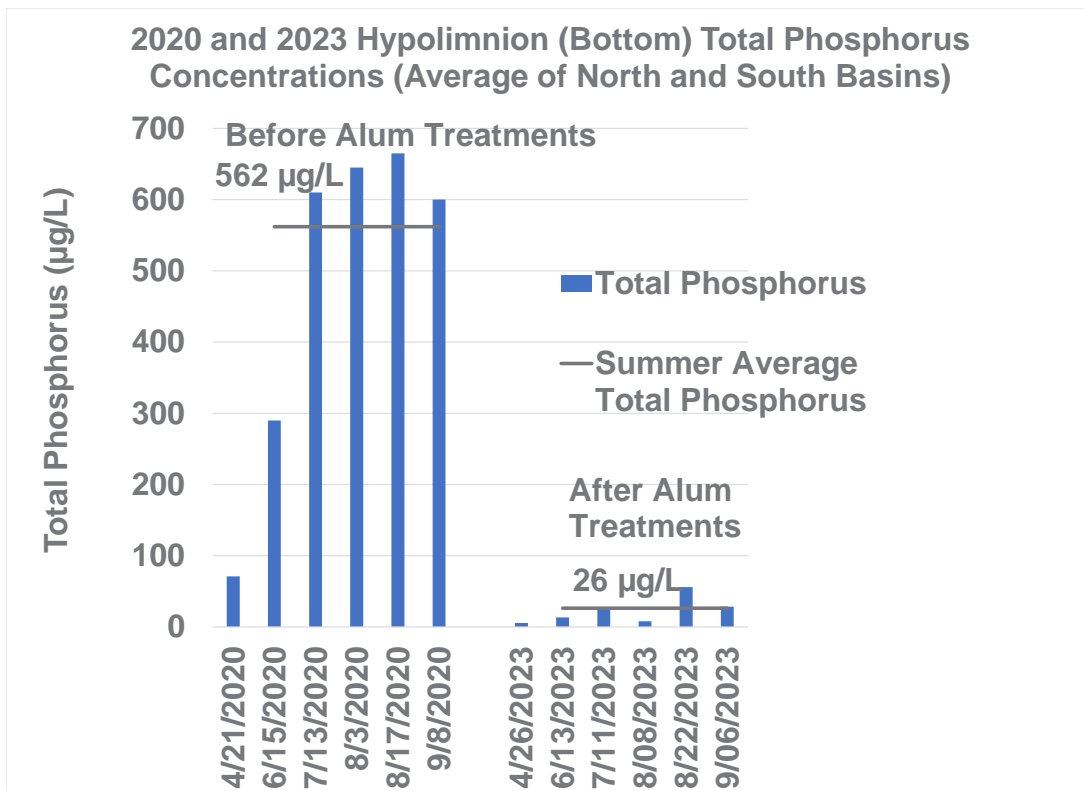
North Basin Dissolved Oxygen



South Basin Dissolved Oxygen



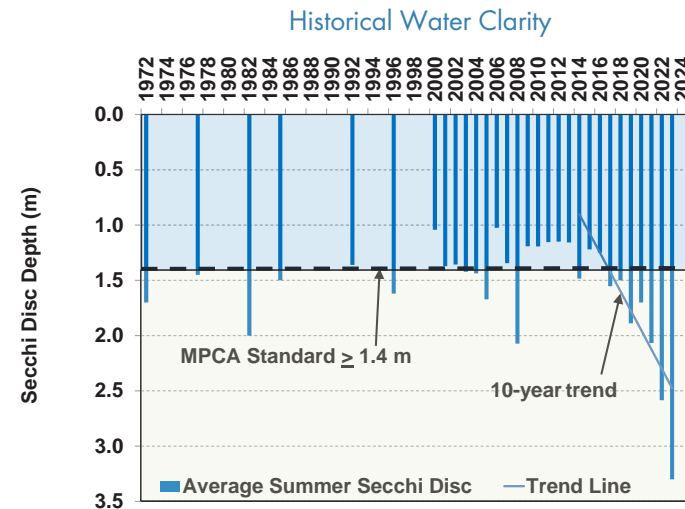
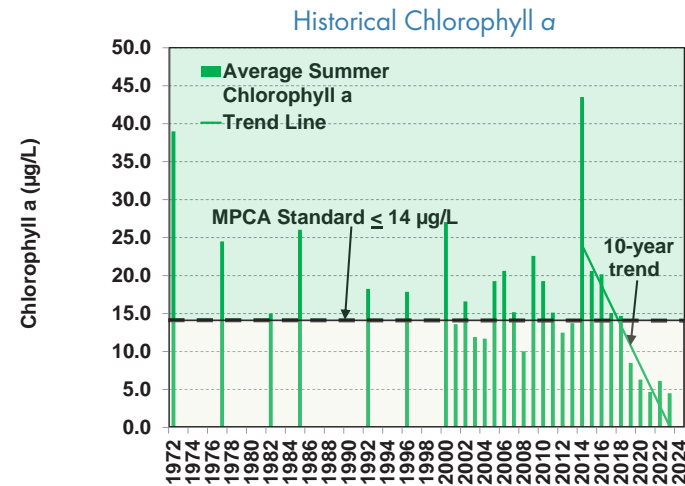
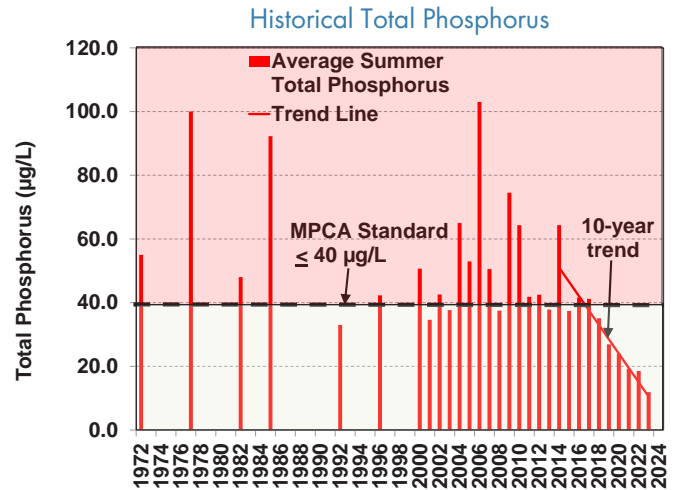
2020 and 2023 Hypolimnion (Near-Bottom) Total Phosphorus Concentrations (Average of North and South Basins)



Water chemistry monitoring from 1972–2023: historical trends

Water quality in Sweeney Lake has been monitored since 1972. Summer averages (June through September) of total phosphorus, chlorophyll a, and Secchi disc depth from 1972–2023 are shown in the figures at right. During the period of record, 60 percent of total phosphorus, 63 percent of chlorophyll a, and 33 percent of Secchi disc summer averages failed to meet Minnesota State Water Quality Standards for lakes in the North Central Hardwood Forest Ecoregion, as published in Minnesota Rules 7050 (Minn. R. Ch. 7050.0222 Subp 4). All values measured from 2019 through 2023 have met the standards.

Trend analyses show improved water quality with statistically significant (95 percent confidence level) decreases in total phosphorus and chlorophyll a concentrations and a statistically significant (95 percent confidence level) increase in water clarity (Secchi disc depth) over the last 10 years. The lake’s improved water quality is a result of the Sweeney Lake Association’s efforts to end the lake’s aeration program and water quality improvement efforts by the BCWMC and the City of Golden Valley.

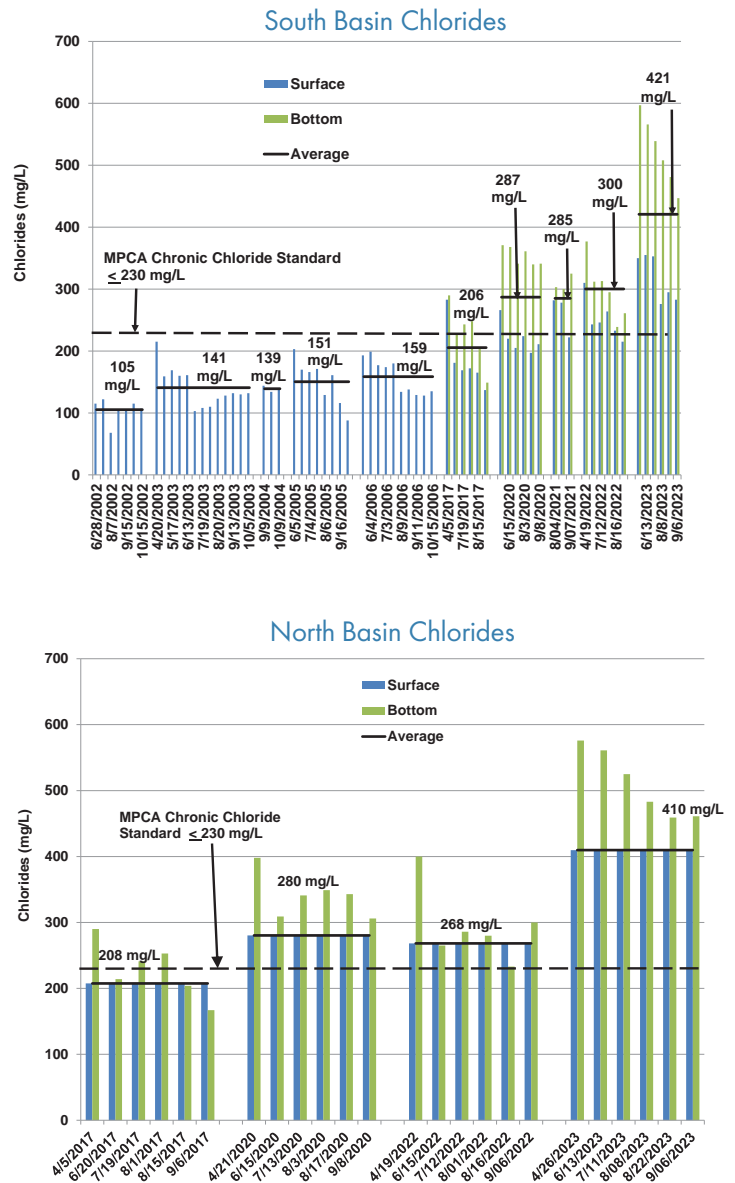


Chloride levels

Chloride concentrations in lakes and streams have increased since the early 1990s when winter maintenance practices largely switched from using sand and/or sand/salt mixtures to salt for roads and parking lots. When snow and ice melts, the salt goes with it, washing into lakes, streams, wetlands, and groundwater. It only takes one teaspoon of salt to pollute 5 gallons of water such that it can no longer support freshwater life. That pollution is essentially permanent, as there is no easy or affordable way to remove chloride from water.

Because high concentrations of chloride can harm fish and plant life, the MPCA established maximum and chronic chloride standards. The maximum standard is the highest concentration of chloride that aquatic organisms can be exposed to for a brief time with zero to slight mortality. The chronic standard is the highest chloride concentration that aquatic life can be exposed to indefinitely without causing chronic toxicity. Chronic toxicity means a condition that lingers or continues for a long period. A chronic effect can be mortality, reduced growth, reproduction impairment, harmful changes in behavior, and other nonlethal effects. A lake is considered impaired if two or more measurements exceed the chronic criterion (230 mg/L) within a 3-year period or one measurement exceeds the maximum criterion (860 mg/L). Sweeney Lake was placed on the state's 303(d) list of impaired waters in 2014 for chloride.

The figures at right show chloride measurements from the North and South Basins during the period of record. All chloride measurements were below the maximum criterion. Chloride measurements from both the surface and bottom of the North and South Basins have been above the chronic criterion with increasing frequency since 2017, and all measurements were above the chronic criterion during 2023. Average chloride concentrations in the lake have approximately doubled since 2017 in the North Basin (from 208 mg/L in 2017 to 410 mg/L in 2023) and in the South Basin (from 206 mg/L in 2017 to 421 mg/L in 2023). The increasing chloride concentrations since 2017 and increased frequency of measurements exceeding the chronic criterion are a significant concern for the lake.



Macrophytes

Lake Plant Eutrophication Index of Biological Integrity (IBI)

Eutrophication (excessive nutrients) may have detrimental effects on a lake, including reductions in the quantity and diversity of aquatic plants. The Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake and (2) the “quality” of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric. Lakes that score below the thresholds contain degraded plant communities and are likely stressed from anthropogenic (human-caused) eutrophication.

Plant survey data from 1992 to 2023 were assessed to determine plant IBI trends. The figures below show the number of species and the Sweeney Lake FQI scores for that period compared to the MNDNR Plant IBI thresholds.

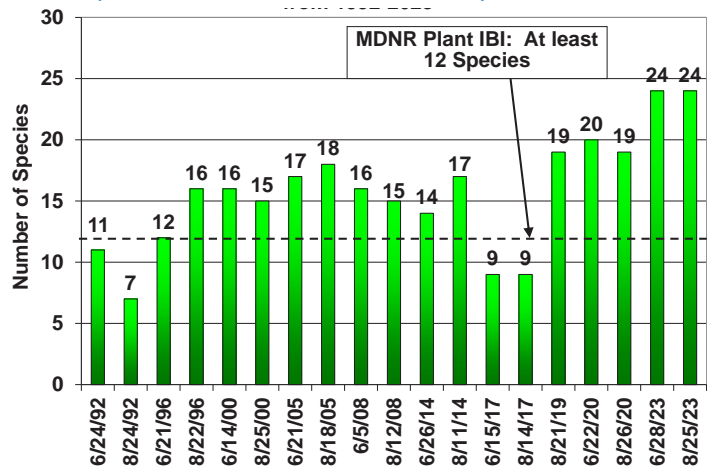
- Number of species:** A deep water lake, such as Sweeney Lake, meets the MNDNR Plant IBI threshold when it has 12 or more species. During the period examined, the number of species in Sweeney Lake ranged from seven to 24, meeting or exceeding the MNDNR Plant IBI threshold during all but June and August of 1992 and 2017. Twenty-four species, the highest number to date, were observed in the lake in 2023.
- FQI values (quality of species):** The MNDNR Plant IBI threshold for deep water lakes, as measured by FQI, is a minimum value of 18.6. During the period examined, FQI values in Sweeney Lake ranged from 15.3 to 27.8, bettering the MNDNR Plant IBI threshold during all but August of 1992 and June and August of 2017. FQI scores during June and August of 2023 were 27.8, the highest score to date.

High quality plants observed in Sweeney Lake in 2023 include southern naiad (*Najas guadalupensis*), Fries' pondweed (*Potamogeton friesii*), muskgrass (*Chara sp.*), small pondweed (*Potamogeton pusillus*), long-leaf pondweed (*Potamogeton nodosus*), common bladderwort (*Utricularia vulgaris*), northern watermilfoil (*Myriophyllum sibiricum*), and watermeal (*Wolffia sp.*)

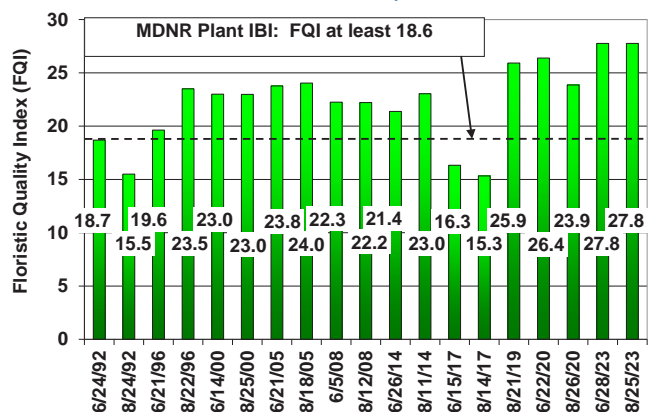


A bed of southern naiad, one of the high-quality plants observed in Sweeney Lake in 2023.

Species Richness of Plant Community from 1992-2023



FQI of Plant Community from 1992-2023



Aquatic invasive species

In 2023, six invasive species were found in Sweeney Lake.

- **Eurasian watermilfoil:** Eurasian watermilfoil (EWM) was first observed at a single location in the southwestern area of Sweeney Lake on August 25, 2023. A 0.8-acre area, shown in the figure on page 10, was treated with the maximum allowable dose of the herbicide ProcellaCOR on August 30. The treatment was successful, and a post-treatment plant survey on October 14 did not find EWM within the treated area. However, the October plant survey did find an area of EWM along the north shore of the lake near the boat landing. This 2.6-acre area of EWM, shown in the figure on page 10, was treated with the maximum allowable dose of the herbicide ProcellaCOR on May 15, 2024.

The BCWMC received a Hennepin County Aquatic Invasive Species Prevention grant to help fund the 2024 treatment, pre- and post-treatment plant surveys of Sweeney Lake, and spring 2024 plant surveys of Twin Lake and four ponds within the Sweeney Lake watershed. EWM was not observed in Twin Lake, Lilac Pond, Chicago Pond, Spring Pond, Toledo/ Angelo Pond, or Schaper Pond during the spring plant surveys.

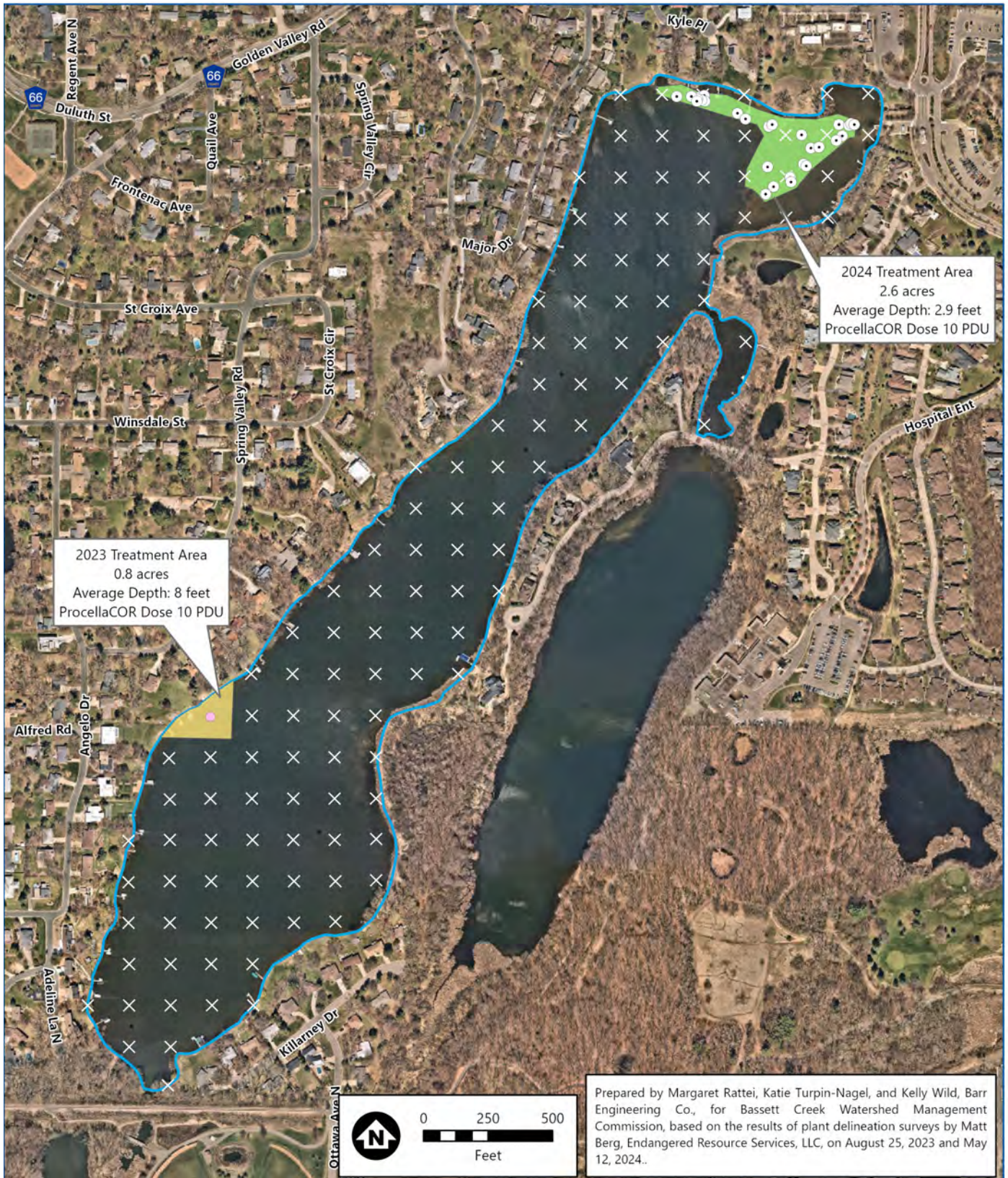
- **Yellow iris (*Iris pseudacorus*):** Yellow iris was first observed at two locations along the southeast shore of Sweeney Lake in August 2019. It was at a single location along the southwest shore in June and August 2020. In 2023, it was observed at four locations in June (two along the southeast shore, one along the southwest shore, and one in the northwest corner) and one location in August (the southeast corner of the lake). The presence of yellow iris is concerning because it spreads rapidly and competes with native shoreland vegetation. Its root system forms a dense mat that compacts the soil and inhibits seed germination of other plants. The BCWMC or the City of Golden Valley will ask landowners to remove the yellow iris. The landowners could either dig it up or spray it with glyphosate. An MNDNR permit would be required for either method of removal.
- **Curly-leaf pondweed (*Potamogeton crispus*):** Curly-leaf pondweed was first observed during the 1992 plant surveys and has consistently been in the lake throughout the monitoring period. In June of 2017, the curly-leaf pondweed extent was estimated at 5.6 acres. In May 2020, an herbicide (diquat) was used within 5.64 acres of Sweeney Lake to control curly-

leaf pondweed. The treatment reduced the curly-leaf pondweed from 5.6 acres in June 2017 to 1.0 acres in June 2020. In 2023, curly-leaf pondweed extent was estimated at 1.2 acres.

- **Reed canary grass (*Phalaris arundinacea*):** Reed canary grass has been observed at different locations in the lake since June 2014, ranging from one to three locations (a single location in June and August 2014, August 2019, and August 2020; two locations in June 2020 and August 2023; and three locations in June 2023).
- **Purple loosestrife (*Lythrum salicaria*):** Purple loosestrife was first observed during the August 1992 plant survey and has been sporadically observed (1992, 2005, 2008, 2014, 2019, and 2020) in different locations during the monitoring period. It was observed at two locations along the western and northern shorelines in June and August 2023 and at a third location along the southeast shoreline in August.
- **Narrow-leaved cattail (*Typha angustifolia*):** Narrow-leaved cattail has been consistently observed along the northern, northeast, and southeast shorelines since 2014.



Yellow iris



2023 Treatment Area
0.8 acres
Average Depth: 8 feet
ProcellaCOR Dose 10 PDU

2024 Treatment Area
2.6 acres
Average Depth: 2.9 feet
ProcellaCOR Dose 10 PDU

Prepared by Margaret Rattei, Katie Turpin-Nagel, and Kelly Wild, Barr Engineering Co., for Bassett Creek Watershed Management Commission, based on the results of plant delineation surveys by Matt Berg, Endangered Resource Services, LLC, on August 25, 2023 and May 12, 2024.

EWM Rake Fullness Rating (August 2023)

BARR

- × Not Observed
- Visual Only (None on Rake)
- Density = 1
- Density = 2
- Density = 3
- 2023 Treatment Area
- EWM Plant Location (May 2024)
- 2024 Treatment Area

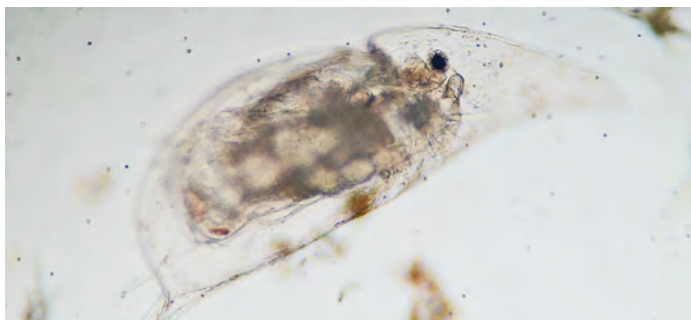
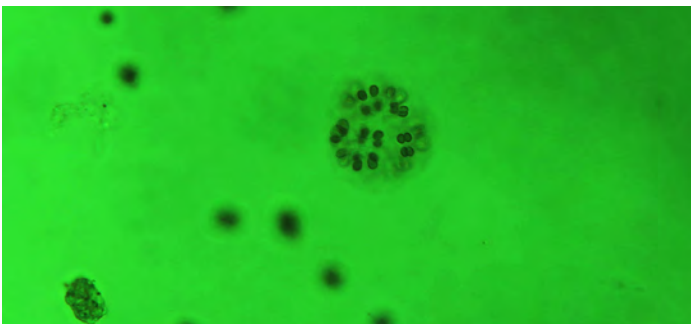
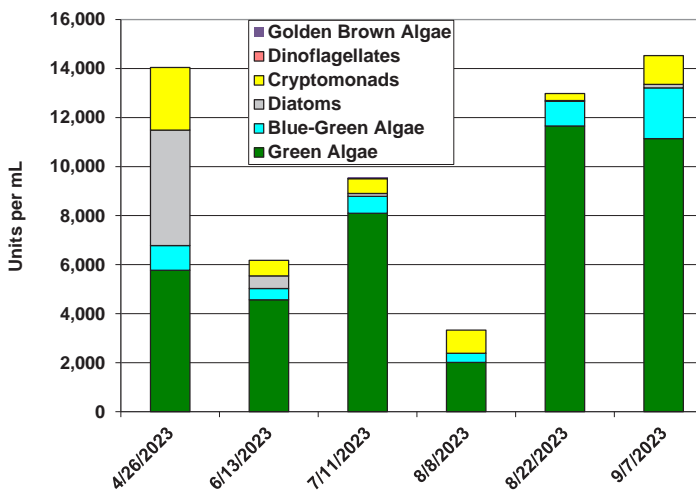
2023 & 2024 SWEENEY LAKE EURASIAN WATERMILFOIL TREATMENT AREAS
Bassett Creek Watershed Management Commission
Golden Valley, MN
FIGURE 1

Phytoplankton

Samples of phytoplankton (microscopic aquatic plants) were collected from Sweeney Lake to evaluate water quality and the quality of food available to zooplankton (microscopic animals). As shown below, the community was co-dominated by green algae and diatoms in April and green algae from June through September. Blue-green numbers were low throughout 2023. Green algae and diatoms are a better quality food source than blue-green algae and contribute towards a healthier zooplankton community.

As shown in the figure on page 11, 2023 phytoplankton numbers were within the range observed since 1982 but, on average, were lower than in 2009 through 2020. The lower phytoplankton numbers are a result of improved water quality from Sweeney Lake improvement projects.

2023 Phytoplankton



Woronichinia, a blue-green algae (top) and Daphnia retrocurva (bottom), zooplankton

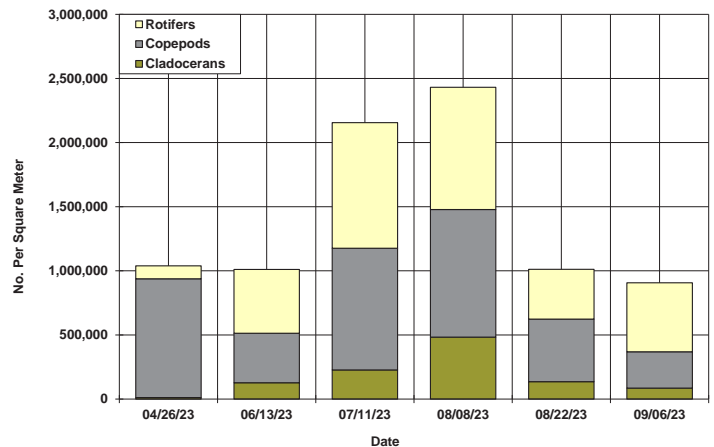
Zooplankton

Unlike phytoplankton, zooplankton do not produce their own food. As “filter feeders,” they eat millions of small algae; given the right quantities and species, they can filter the volume of an entire lake in a matter of days. They are also valuable food for planktivorous fish and other organisms. Fish generally select the largest zooplankters they see and prefer cladocerans to copepods because they swim slowly and lack the copepods’ ability to escape predation by jerking or jumping out of the way. Rotifers are the least preferred food for fish due to their small size.

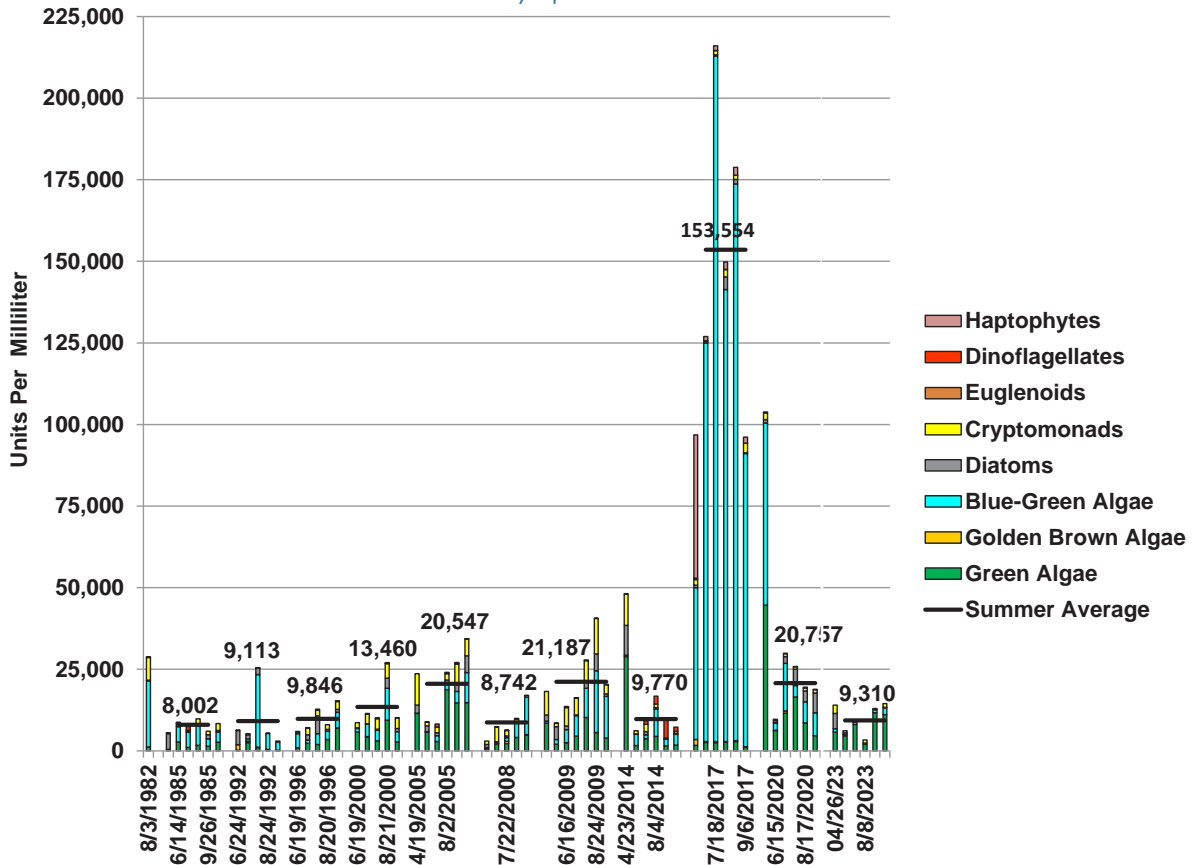
The 2023 community composition reflects the impact of fish predation. Copepods dominated the zooplankton community in April, and the community was generally co-dominated by copepods and rotifers from June through September (see figure below). Cladocerans were present throughout 2023, increasing in number from April through early August and decreasing during August and September.

The 2023 numbers of zooplankton in Sweeney Lake were within the range observed since 1982 (see figure on page 11) but, on average, were lower in 2023 than in 2017 and 2020. The lower numbers are likely a result of fewer phytoplankton, the food source for the zooplankton, and increased fish predation in 2023. The lower phytoplankton numbers are a result of improved water quality from Sweeney Lake improvement projects. Fewer phytoplankton improved water clarity, which helped fish see and capture their prey.

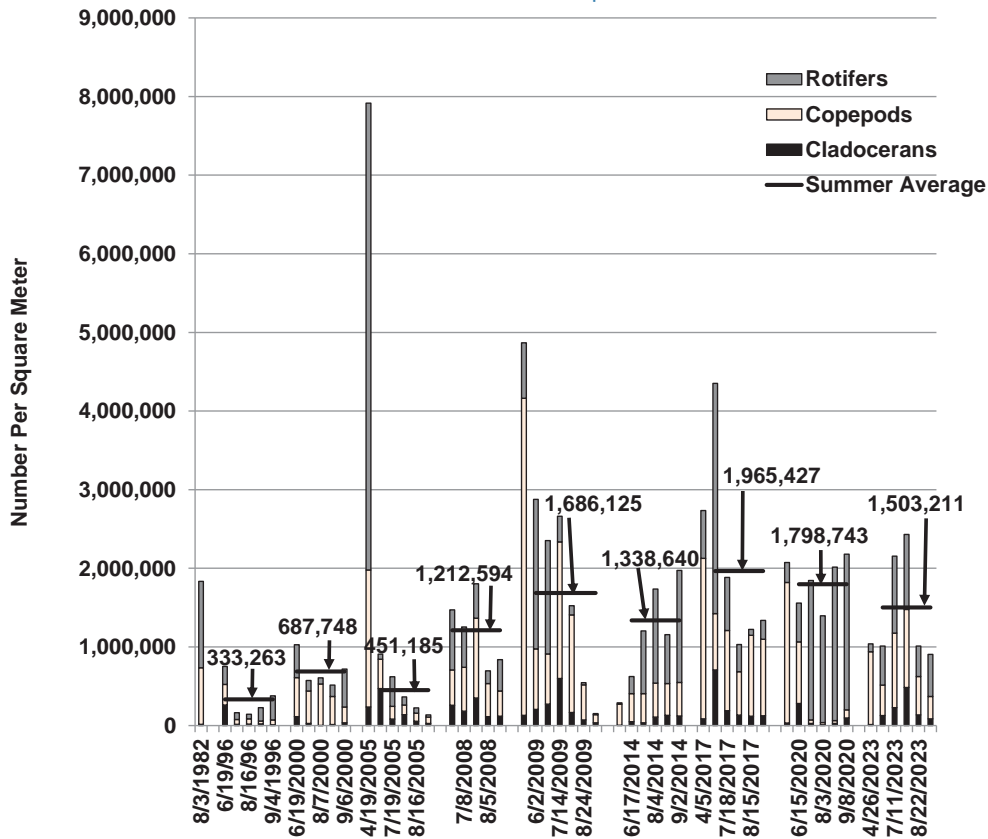
2023 Zooplankton



Historical Phytoplankton



Historical Zooplankton



Suitability of Sweeney Lake for Aquatic Invasive Species (AIS)

A large number of AIS residing in Minnesota have not yet been seen in Sweeney Lake but could be introduced. For example, both zebra mussels and starry stonewort are in nearby Medicine Lake but have not been seen in Sweeney Lake. To determine whether Sweeney Lake water quality would support the introduction of six AIS (starry stonewort, zebra mussels, spiny waterfleas, faucet snails, Chinese mystery snails, and rusty crayfish), a suitability analysis for each species was performed.

The analysis compared water quality data collected during 2023 with the water quality conditions required for each species, specifically evaluating total phosphorus, chlorophyll *a*, Secchi disc depth, trophic state index, water temperature, dissolved oxygen, specific conductance, calcium, magnesium, sodium, alkalinity, hardness, and calcium carbonate. The results indicate that the water quality of Sweeney Lake meets the suitability requirements for rusty crayfish, faucet snails, zebra mussels, spiny waterfleas, and starry stonewort. However, the water quality of Sweeney Lake only partially meets the suitability requirements for the Chinese mystery snail. This species would likely survive but may not thrive in Sweeney Lake.



Starry Stonewort



Zebra Mussels



Spiny Waterflea



Faucet Snail



Chinese Mystery Snail



Rusty Crayfish



Bassett Creek Watershed Management Commission
bassettcreekwmo.org



Stewardship of water resources to protect and enhance our communities