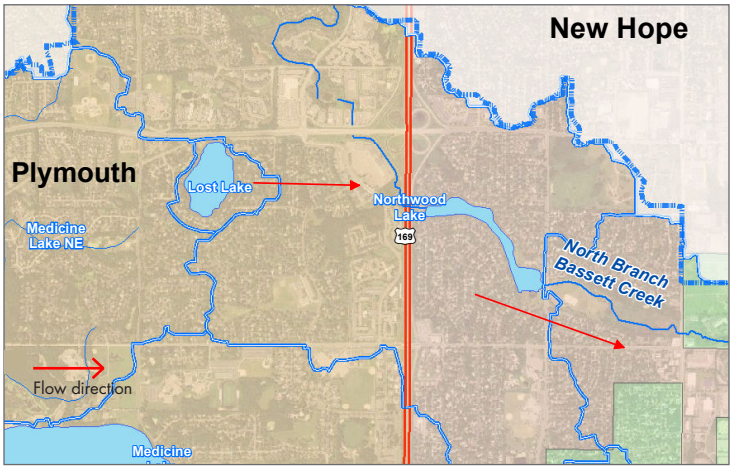
Northwood Lake 2016 water quality monitoring



About Northwood Lake

BCWMC classification	Priority-1 shallow lake
Watershed area	1,294 acres
Lake size	15 acres
Average depth	2.7 feet
Maximum depth	5 feet
Ordinary high water level	885.5 feet
Normal water level	884.4 feet
Downstream receiving waterbody	Bassett Creek
Location (city)	New Hope
MPCA impairments	Nutrients
Aquatic invasive species	Curly-leaf pondweed, purple loosestrife, hybrid cattail, reed canary grass
Public access	Yes

Monitoring water quality in Northwood Lake

The Bassett Creek Watershed Management Commission (BCWMC) has monitored water quality conditions in the watershed's 10 priority lakes and six ponds since 1972. This monitoring is done to detect changes or trends in water quality and evaluate the effectiveness of efforts to preserve or improve water quality. A summary of 2016 monitoring efforts on Northwood Lake is provided below; more comprehensive information can be found on pages 2–6.

At a glance: 2016 monitoring results

In 2016, the BCWMC monitored Northwood Lake for:

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

Results of 2016 monitoring show that Northwood Lake did not meet applicable Minnesota Pollution Control Agency (MPCA) and BCWMC water quality standards for lakes. Trend analyses indicate that water clarity has significantly declined over the past 17 years. In addition, the plant community does not meet the Minnesota Department of Natural Resources (MDNR) plant index of biotic integrity (IBI) standards (see page 4). However, the plant community has consistently improved since 2000 and the number of species in the lake is close to meeting the minimum impairment threshold.

Recommendations

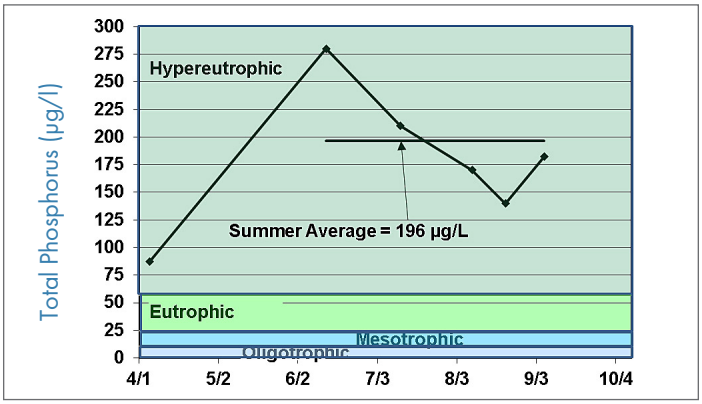
- Continue efforts to improve the lake's water quality.
- Continue water quality and biological monitoring.
- Continue to implement best management practices and capital improvement projects in the lake's watershed.

Water chemistry monitoring: 2016

Total phosphorus levels

While phosphorus is necessary for plant and algae growth, excessive phosphorus leads to excessive growth, decreased water clarity, and water quality impairment.

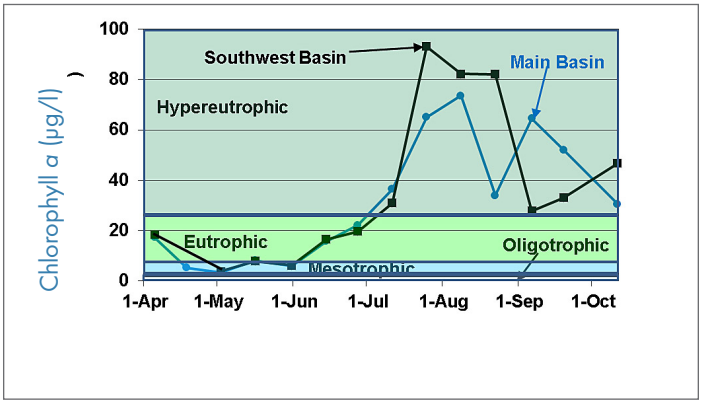
- BCWMC/MPCA standard: 60 micrograms per liter (µg/L) or less.
- Range: Total phosphorus concentrations ranged from a low of 87 µg/L in April to a high of 280 µg/L in June. All concentrations were within the hypereutrophic category (high nutrient content).
- Summer average: 196 µg/L (did not meet BCWMC/MPCA 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 (µg/L).

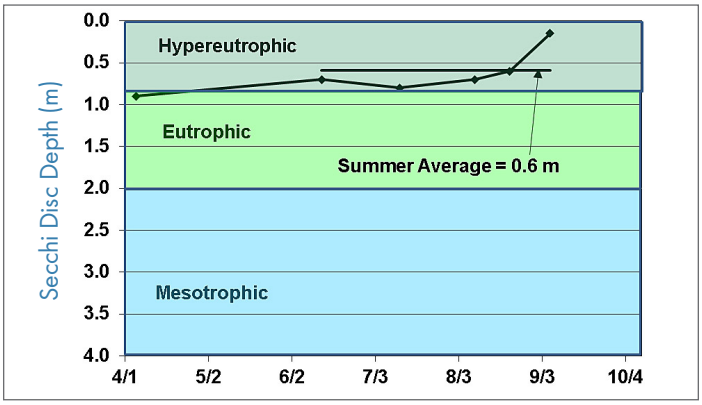
- BCWMC/MPCA standard: 20 µg/L or less.
- Range: Chlorophyll *a* concentrations ranged from a low of 7.9 µg/L in September to a high of 41.9 µg/L in April. Throughout 2016, chlorophyll *a* concentrations were in the hypereutrophic or eutrophic category, indicating poor water quality.
- Summer average: 22.5 µg/L (did not meet BCWMC/MPCA standard).



Water clarity

Water clarity is often affected by sediment and the amount of algae or other photosynthetic organisms 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.

- BCWMC/MPCA standard: 1.0 meters or more.
- Range: From 0.9 meters in April to 0.2 meters in September, corresponding with high quantities of sediment in the lake.
- Summer average: 0.6 meters (did not meet BCWMC/MPCA standard).



Definitions

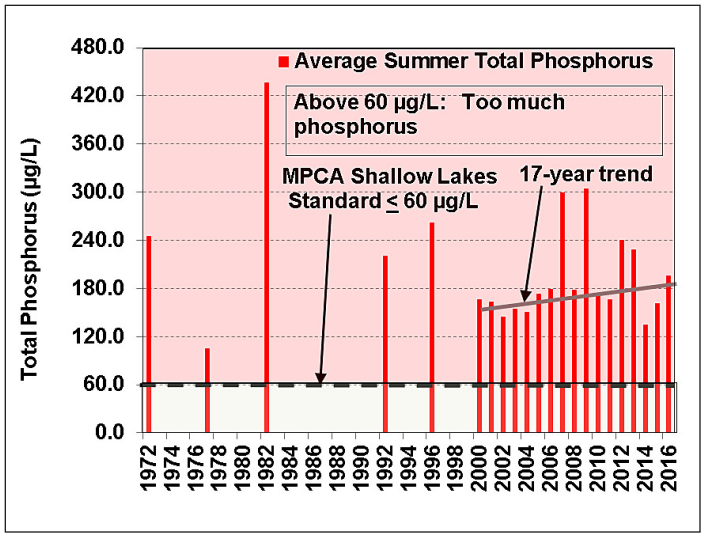
- ***Eutrophic:*** Lake condition characterized by abundant accumulation of nutrients supporting dense growth of algae and other organisms; decay of algae can reduce lake oxygen levels
- ***Hypereutrophic:*** Nutrient-rich lake conditions characterized by frequent and severe algal blooms and low transparency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

Water chemistry monitoring from 1972–2016: historical trends

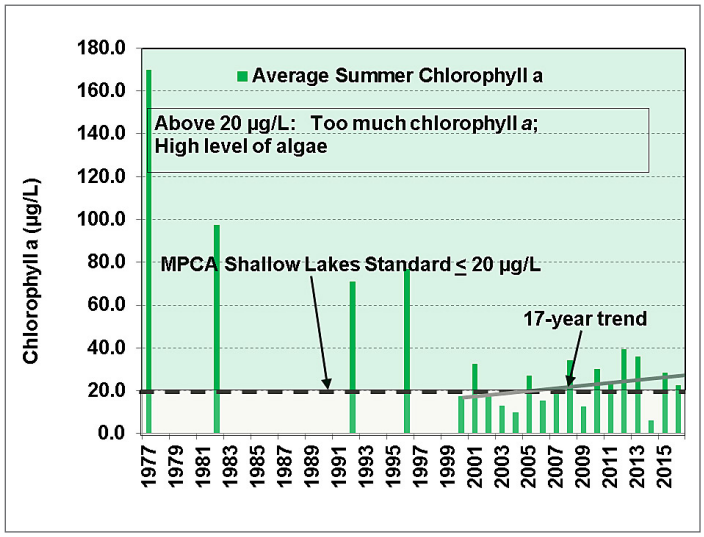
Water quality in Northwood Lake has been monitored since 1972. Summer averages (June through September) of total phosphorus, chlorophyll a, and Secchi disc depth from 1972–2016 are shown in the figures at right. Summer averages for phosphorus have failed to meet BCWMC/MPCA standards for the entire period of record. Chlorophyll *a* concentrations and Secchi disc depth failed to meet the standard 67 and 38 percent of the time, respectively.

Trend analyses show declining water quality with statistically significant decreases (95 percent confidence level) in Secchi disc depth over the last 17 years. Total phosphorus and chlorophyll *a* concentrations have also increased during this period, but not at statistically significant levels.

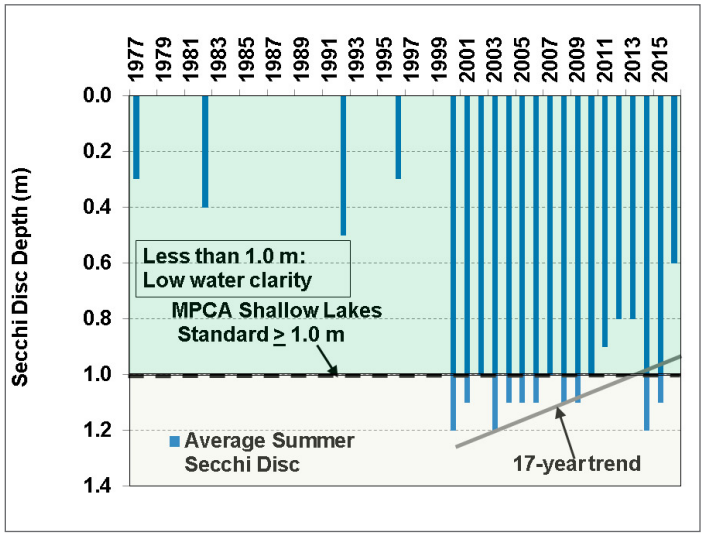
Total phosphorus trends



Chlorophyll *a* trends



Water clarity trends



Macrophytes

Lake Plant Eutrophication Index of Biological Integrity (IBI)

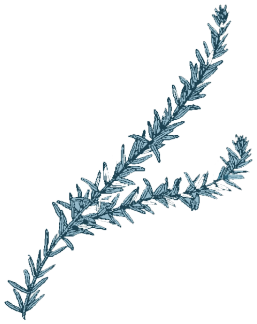
The MDNR recently developed metrics to determine the overall health of a lake's aquatic plant community. The *Lake Plant Eutrophication Index of Biological Integrity (IBI)* is used by the MPCA to determine whether a lake is meeting the federal Clean Water Act standards intended to protect aquatic life. The plant 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).

Plant survey data from 1992 through 2016 were assessed to determine plant IBI trends. The figures below show the Northwood Lake FQI scores and number of species for that period compared to the MDNR plant IBI impairment threshold.

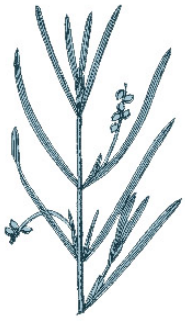
- **Number of species:** The number of species in Northwood Lake has increased from four species in 2000 to 10 species in 2016. Some of the most commonly seen plants are shown below. The increase is attributed to a management technique implemented by the city of New Hope in 2000. From 2000 to 2003 the city placed barley straw at predetermined locations throughout the lake. As barley straw decays, it inhibits algal growth. This increases the water's transparency, allowing sunlight to reach the lake's bottom and aquatic plants to become established. Despite the effectiveness of this treatment, Northwood Lake is still below the impairment threshold minimum of 11 species.
- **FQI values (quality of species):** The impairment threshold, as measured by FQI, is a minimum value of 17.8. Similar to the number of species, FQI values for Northwood Lake have increased from 11 in 2005 to 14 in 2016, but still fail to meet the threshold.
- **2016 results:** Because both the number of species in the lake and FQI values are below impairment thresholds, Northwood Lake may be considered impaired for aquatic plants.

Commonly found aquatic species

Coontail
Ceratophyllum demersum

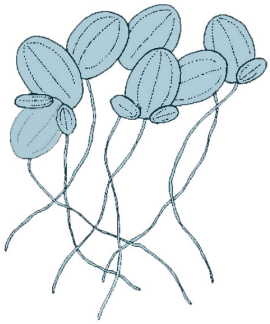


Canadian waterweed
Elodea canadensis

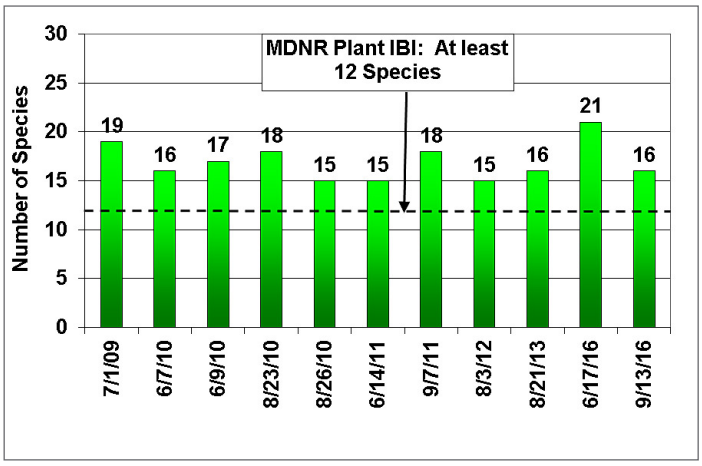


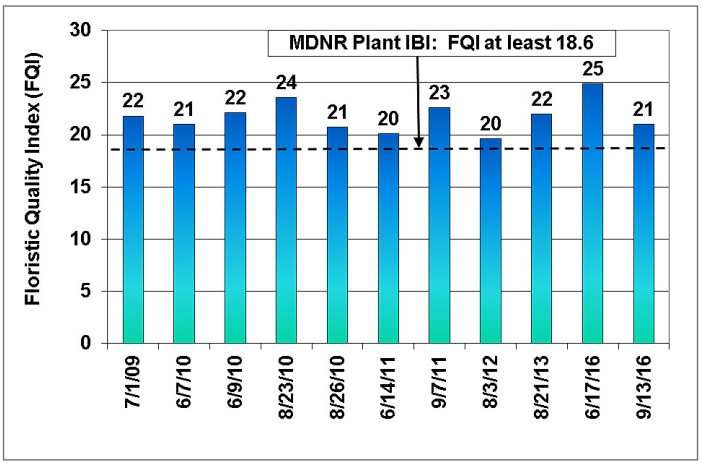
Flatstem pondweed
Potamogeton zosteriformis

Curly-leaf pondweed
Potamogeton crispus



Common duckweed
Lemna minor

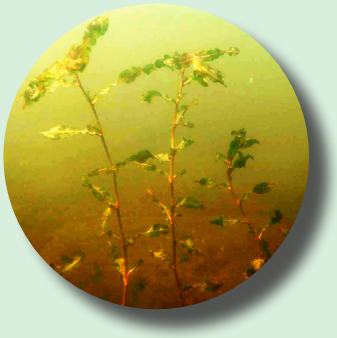




Aquatic invasive species

In 2016, four invasive species were known to be present in Northwood Lake; no species was considered problematic.

- ***Curly-leaf pondweed (Potamogeton crispus):*** Though prevalent, the curly-leaf pondweed coexisted with native plants at relatively low densities.
- **Purple loosestrife (*Lythrum salicaria*):** This emergent species was scattered around the lake. Most plants appeared to suffer damage from beetles introduced to control the purple loosestrife population, suggesting that the beetles are having the desired effect.
- **Hybrid cattail (*Typha glauca*):** Hybrid cattail was observed at a couple locations along the shoreline.
- **Reed canary grass** (*Phalaris arundinacea*): Reed canary grass was common in unmowed areas.



Curly-leaf pondweed

Purple loosestrife

Hybrid cattail

Reed canary grass

Increased use of chloride for road maintenance has had an impact on chloride levels in Twin Cities metro area lakes, including Northwood Lake.

Chloride levels in 2016

Chloride concentrations in area lakes 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 melts, the salt goes with it, washing into lakes, streams, wetlands, and groundwater. It only takes 1 teaspoon of road salt to permanently pollute 5 gallons of water. And, once in the water, there is no way to remove chloride.

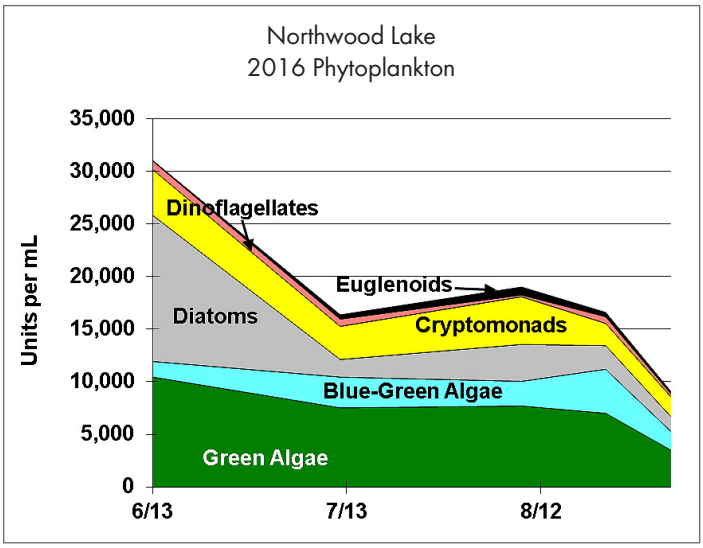
Because high concentrations of chloride can harm fish and plant life, the MPCA has established a chronic exposure chloride standard of 230 mg/l or less.

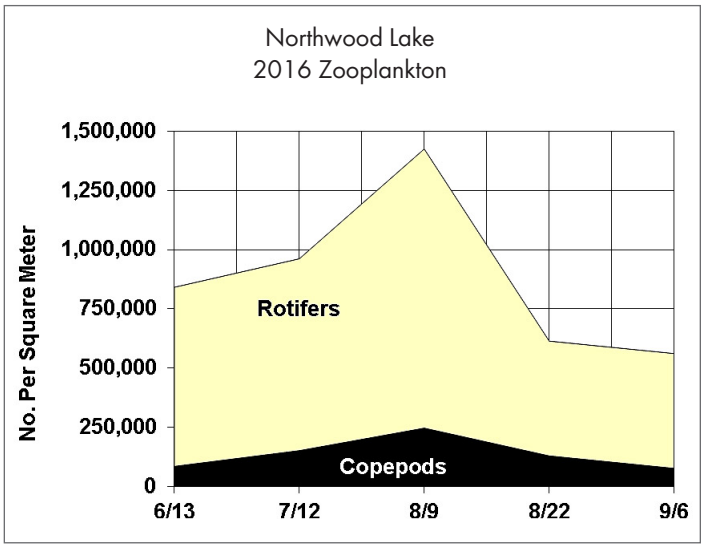
- **Range of chloride concentrations in Northwood Lake:** From a high of 274 mg/L , measured in April, to a low of 43 mg/L, measured in August
- **Average concentration:** 110 mg/L (meets MPCA standard)

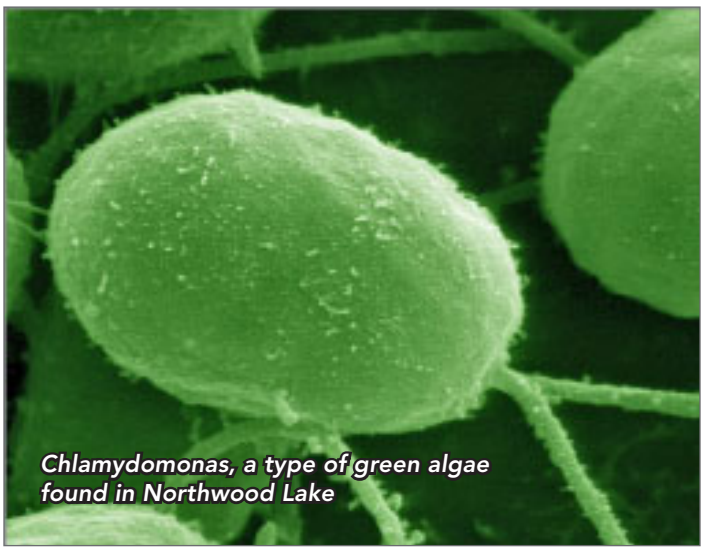
Phytoplankton and zooplankton

Samples of phytoplankton, microscopic aquatic plants, were collected from Northwood Lake to evaluate water quality and the quality of food available to zooplankton (microscopic animals). As shown in the figure below, phytoplankton numbers declined in July, increased in early August, and declined again in late August and September. The community was dominated by green algae, diatoms, and cryptomonads—all considered a good source of food for the lake's zooplankton. Blue-green algae, which is associated with water quality problems and can be a source of health concerns, was present in very low numbers.

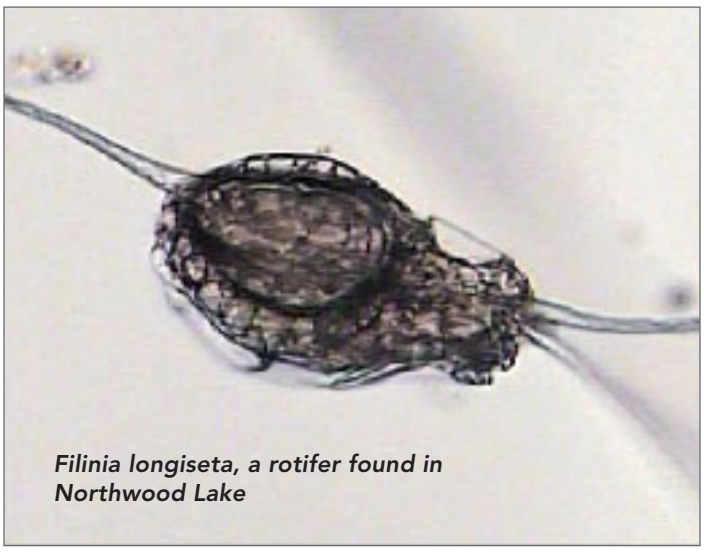
Unlike phytoplankton, zooplankton do not produce their own food. As "filter feeders," they eat millions of small algae; given the right quantities and species they can filter the volume of an entire lake in a matter of days. They are also a valuable food source for planktivorous fish and other organisms. The numbers and community composition of zooplankton in Northwood Lake were consistent with previous years. Small rotifers and copepods were prevalent throughout the summer, while cladocerans were observed only in June (5,040/mL) and September (4,281/mL); their numbers were so low they are not visible on the figure below.







Chlamydomonas, a type of green algae found in Northwood Lake



Filinia longiseta, a rotifer found in Northwood Lake

Bassett Creek Watershed Management Commission
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