Barton Lake
2021 Water Quality Report

A publication of the Barton Lake Association and the Schoolcraft Township Board

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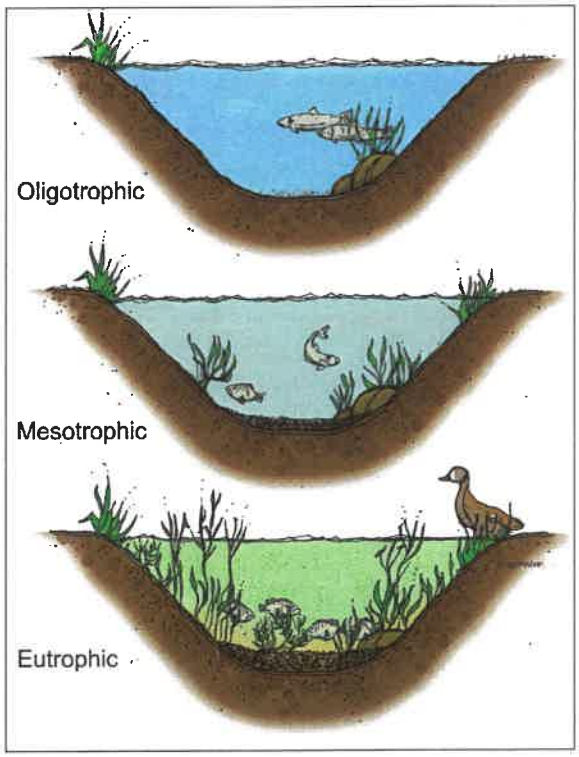
Water quality monitoring on Barton Lake has been ongoing since 2016. This report provides background information on lake water quality and a discussion of sampling results.

Lakes can be classified into three broad categories based on their productivity or ability to support plant and animal life. The three basic lake classifications are oligotrophic, mesotrophic, and eutrophic.

Oligotrophic lakes are generally deep and clear with little aquatic plant growth. These lakes maintain sufficient dissolved oxygen in the cool, deep bottom waters during late summer to support cold water fish such as trout and whitefish.



Lake trophic states.

Eutrophic lakes have poor clarity, and support abundant aquatic plant growth. In deep eutrophic lakes, the cool bottom waters usually contain little or no dissolved oxygen. Therefore, these lakes can only support warm water fish such as bass and pike.

Lakes that fall between the two extremes of oligotrophic and eutrophic are called *mesotrophic* lakes.

Under natural conditions, most lakes will ultimately evolve to a eutrophic state as they gradually fill with sediment and organic matter transported to the lake from the surrounding watershed. As the lake becomes shallower, the process accelerates. When aquatic plants become abundant, the lake slowly begins to fill in as sediment and decaying plant matter accumulate on the lake bottom. Eventually, terrestrial plants become established and the lake is transformed to a marshland. The natural lake aging process can be greatly accelerated if excessive amounts of sediment and nutrients (which stimulate aquatic plant growth) enter the lake from the surrounding watershed. Because these added inputs are usually associated with human activity, this accelerated lake aging process is often referred to as *cultural eutrophication*.

For more information, visit:
www.michiganlakeinfo.com/trophic-state

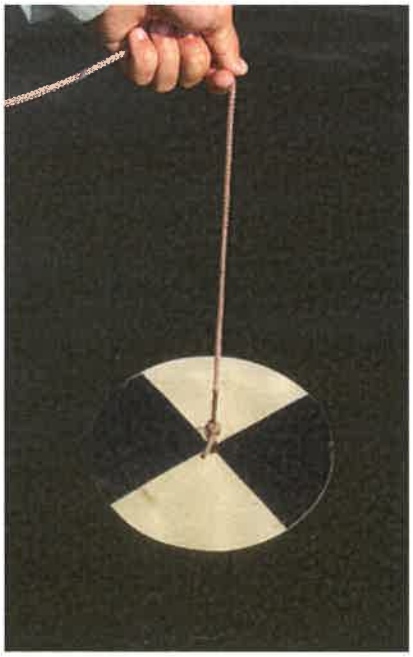
Key parameters used to evaluate a lake's productivity or trophic state include total phosphorus, chlorophyll-*a*, and Secchi transparency.

Phosphorus is the nutrient that most often stimulates excessive growth of aquatic plants and causes premature lake aging. By measuring phosphorus levels, it is possible to gauge the overall health of a lake.

Chlorophyll-a is a pigment that imparts the green color to plants and algae. A rough estimate of the quantity of algae present in the water column can be made by measuring the amount of chlorophyll-*a* in the water column.

A *Secchi disk* is a round, black and white, 8-inch disk that is used to estimate water clarity. Generally, it has been found that plants can grow to a depth of about twice the Secchi disk transparency.

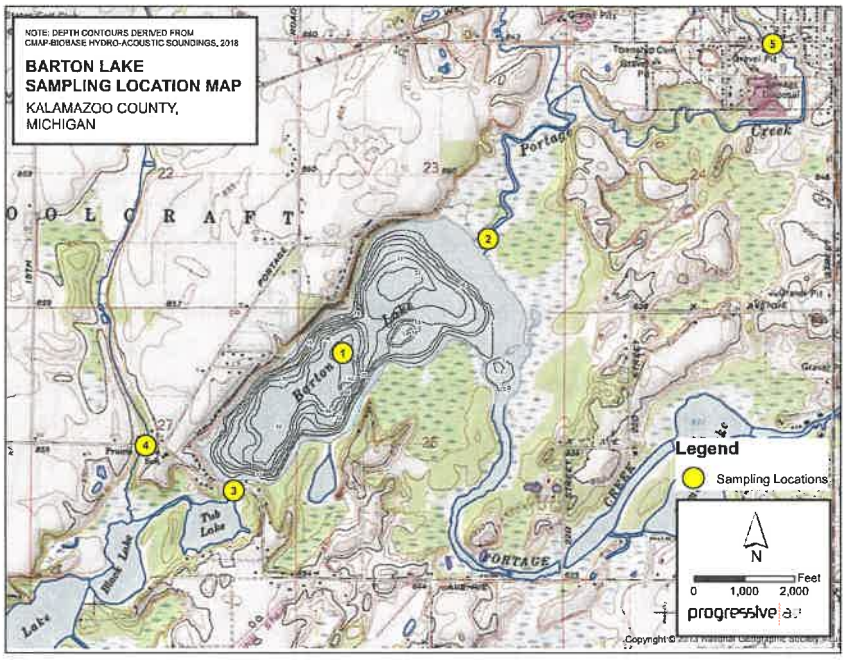
Generally, as phosphorus inputs to a lake increase, algae growth and chlorophyll-*a* increase and Secchi transparency decreases.



A Secchi disk measures water clarity.

TROPHIC CLASSIFICATION CRITERIA

Lake Classification	Total Phosphorus (µg/L)[1]	Chlorophyll-*a* (µg/L)[1]	Secchi Transparency (feet)
Oligotrophic	Less than 10	Less than 2.2	Greater than 15.0
Mesotrophic	10 to 20	2.2 to 6.0	7.5 to 15.0
Eutrophic	Greater than 20	Greater than 6.0	Less than 7.5



In 2021, samples were collected during spring and summer at 10-foot depth intervals over the deepest basin of Barton Lake. Samples were also collected from the three primary tributaries to Barton Lake during the same time frame.

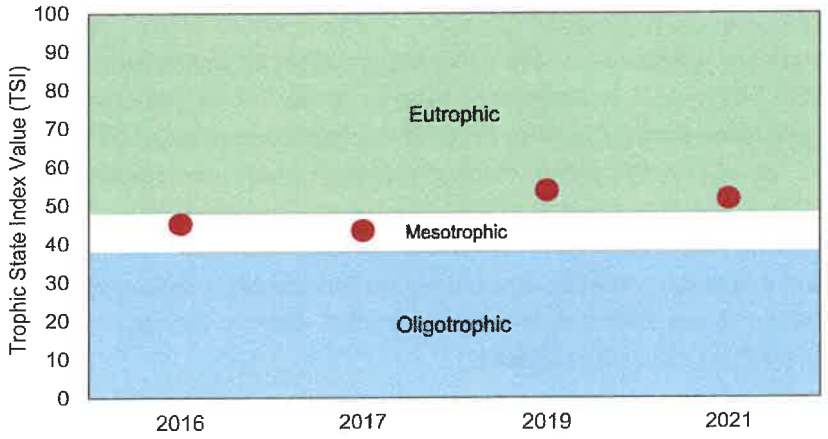
1 µg/L = micrograms per liter = parts per billion.

Carlson's Trophic State Index (TSI) was developed from mathematical relationships that allowed phosphorus, chlorophyll-*a*, and Secchi transparency readings to be converted to a numerical scale from 0 to 100, with increasing numbers indicating more productive lakes. The TSI can be used to rate the trophic state of Michigan lakes as follows:

TSI INDEX FOR MICHIGAN

Trophic State	TSI Value
Oligotrophic	Less than 38
Mesotrophic	38 to 48
Eutrophic	Greater than 48

The average TSI values for Barton Lake based on spring phosphorus, summer chlorophyll-*a* and Secchi transparency data collected between 2016 and 2021 are shown below.



Barton Lake average Trophic State Index (TSI) values.

Based upon data collected during 2021 and historical water quality data, Barton Lake is meso-eutrophic. That is, Barton Lake has both mesotrophic and eutrophic charecteristics. Limited tributary monitoring conducted since 2016 does not give an indication of excessive sediment and nutrient loading from Barton Lake's watershed during this time frame.

Spring sampling was not conducted during the 2020 field season due to the COVID-19 pandemic restrictions. Therefore, TSI could not be calculated.

Temperature and dissolved oxygen strongly influence lake water quality and are very important to a lake's fishery.

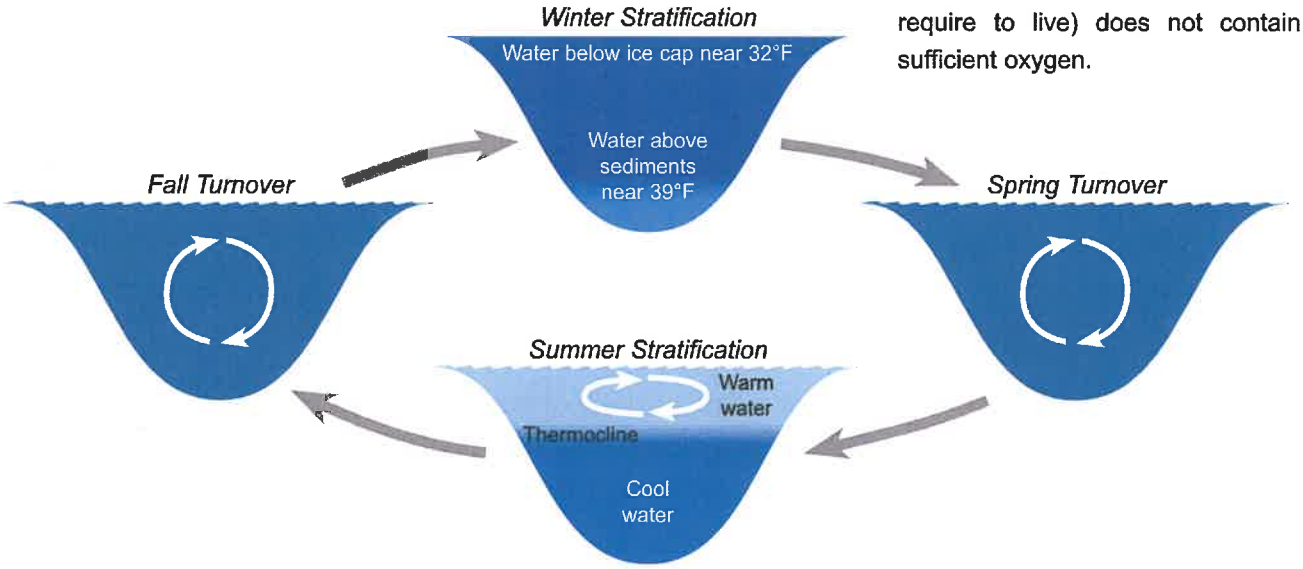
For more information, visit:
michiganlakeinfo.com/turnover-and-stratification

Temperature

Temperature is important in determining the type of organisms that may live in a lake. For example, trout prefer temperatures below 68°F. Temperature also determines how water mixes in a lake. As the ice cover breaks up on a lake in the spring, the water temperature becomes uniform from the surface to the bottom. This period is referred to as *spring turnover* because water mixes throughout the entire water column. As the surface waters warm, they are underlain by a colder, more dense layer of water. This process is called thermal stratification. In deeper lakes during summer there are three distinct layers. This is referred to as *summer stratification*. Once thermal stratification occurs, there is little mixing of the warm surface waters with the cooler bottom waters. The transition layer that separates these layers is referred to as the *thermocline*. The thermocline is characterized as the zone where temperature drops rapidly with depth. As fall approaches, the warm surface waters begin to cool and become more dense. Eventually, the surface temperature drops to a point that allows the lake to undergo complete mixing. This period is referred to as *fall turnover*. As the season progresses and ice begins to form on the lake, the lake may stratify again. However, during *winter stratification*, the surface waters (at or near 32°F) are underlain by slightly warmer water (about 39°F). This is sometimes referred to as *inverse stratification* and occurs because water is most dense at a temperature of about 39°F. As the lake ice melts in the spring, these stratification cycles are repeated. These stratification cycles occur in deep lakes but not in shallow lakes or ponds. Lakes that are about 15 to 30 feet deep may stratify and destratify with storm events several times during the year. Barton Lake's thermocline set up between 10 and 20 feet in the summer of 2021. Oxygen was depleted below this depth for most of the season.

Dissolved Oxygen

An important factor influencing lake water quality is the quantity of *dissolved oxygen* in the water column. The major inputs of dissolved oxygen to lakes are the atmosphere and photosynthetic activity by aquatic plants. An oxygen level of about 5 mg/L (milligrams per liter, or parts per million) is required to support warm-water fish. In lakes deep enough to exhibit thermal stratification, oxygen levels are often reduced or depleted below the thermocline once the lake has stratified. This is because deep water is cut off from plant photosynthesis and the atmosphere, and oxygen is consumed by bacteria that use oxygen as they decompose organic matter (plant and animal remains) at the bottom of the lake. Bottom-water oxygen depletion is a common occurrence in eutrophic and some mesotrophic lakes. Thus, eutrophic and most mesotrophic lakes cannot support cold-water fish because the cool, deep water (that the fish require to live) does not contain sufficient oxygen.



Seasonal thermal stratification. Stratification cycles occur in deep lakes but not in shallow lakes or ponds.

Barton Lake Aquatic Plant Control Program 2021 Activity Summary

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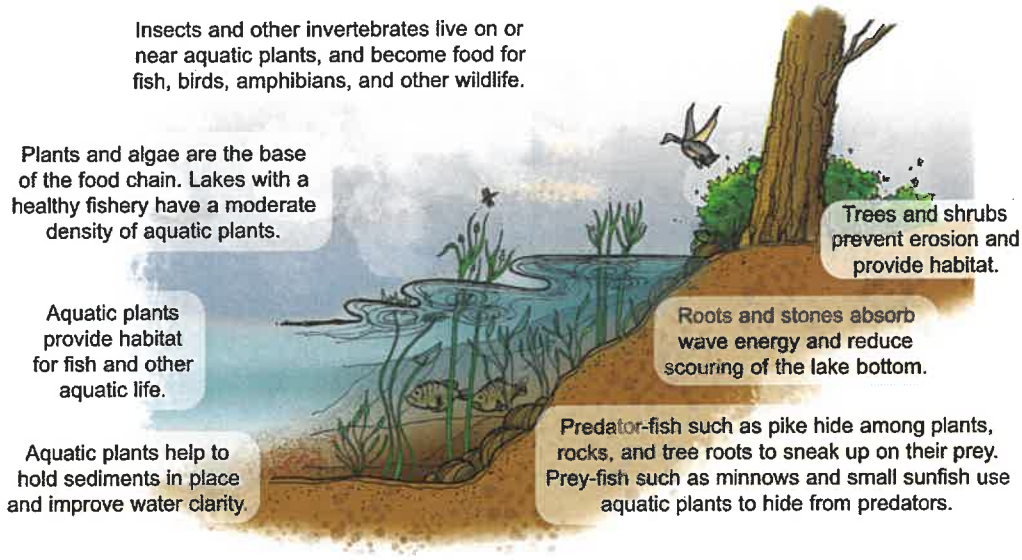
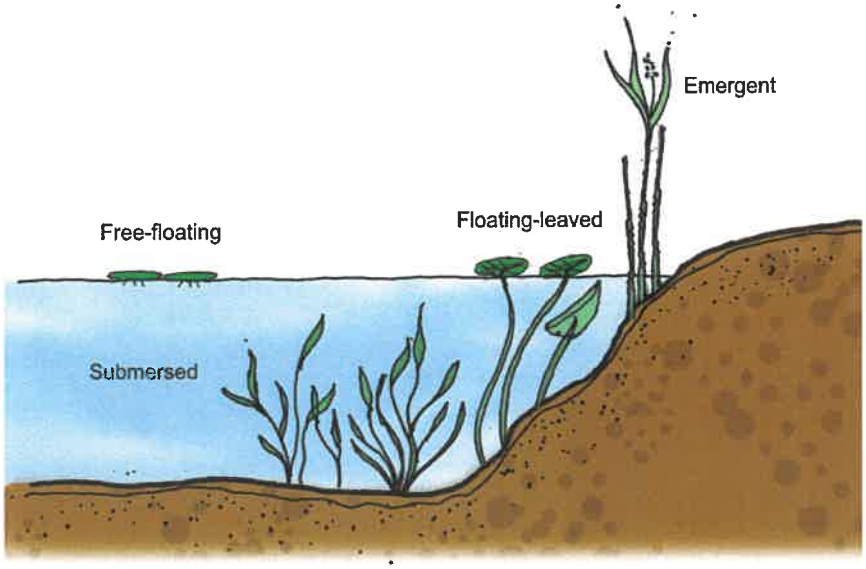
For the past several years, a nuisance plant control program has been ongoing on Barton Lake. The primary objective of the program is to prevent the spread of invasive aquatic plants while preserving beneficial plant species. This report contains an overview of plant control activities conducted on Barton Lake in 2021.

Aquatic plants are an important component of lakes. They produce oxygen during photosynthesis, provide food, habitat and cover for fish, and help stabilize shoreline and bottom sediments.



There are four main aquatic plant groups: submersed, floating-leaved, free-floating, and emergent. Each plant group provides important ecological functions. Maintaining a diversity of aquatic plants is important to sustaining a healthy fishery and a healthy lake.



Plant control activities are coordinated under the direction of an environmental consultant, Progressive AE. Biologists from Progressive conduct GPS-guided surveys of the lake to identify problem areas, and georeferenced plant control maps are provided to the plant control contractor.

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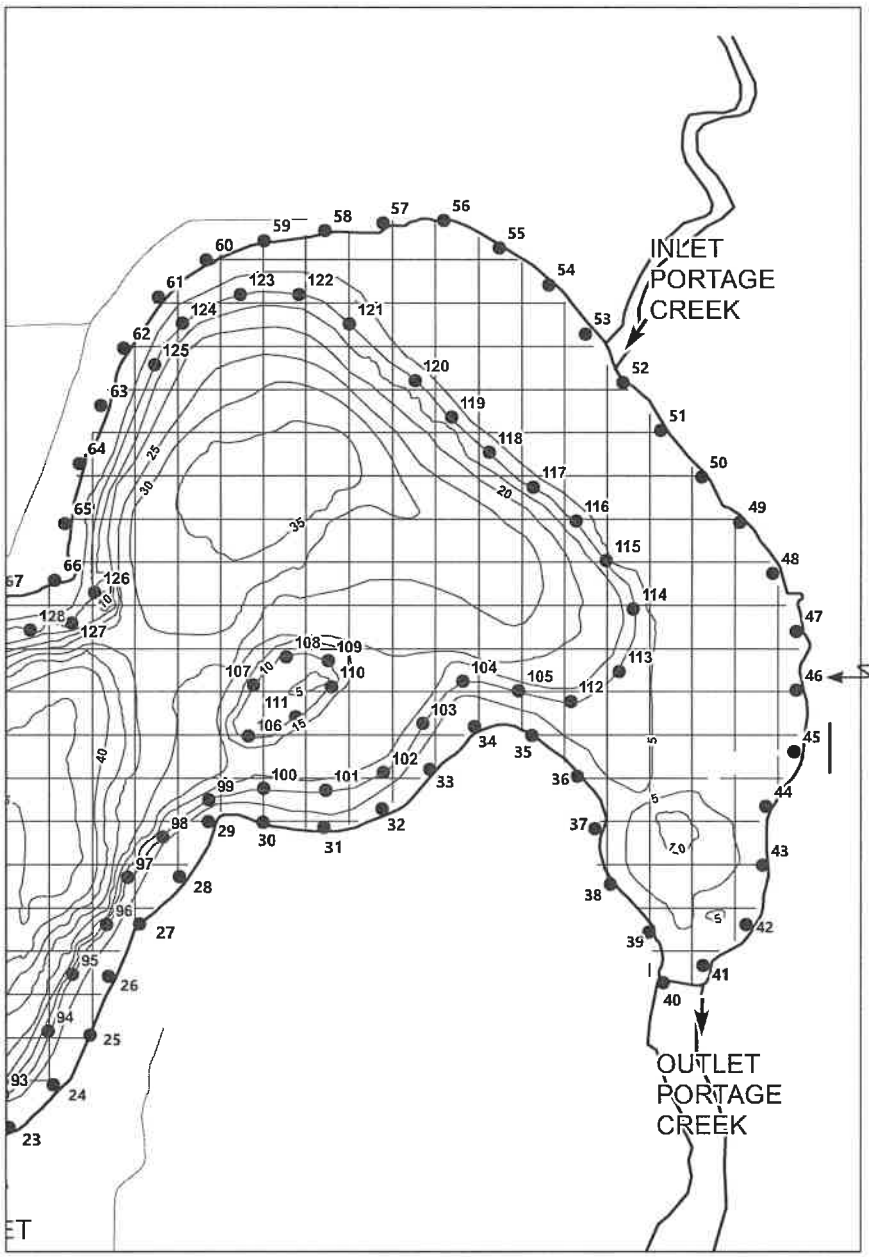

GPS reference points established along the shoreline and offshore drop-off points of Barton Lake are used to guide plant surveys and to accurately identify the location of nuisance plant growth areas.

Plant control in Barton Lake involves the select use of herbicides to control invasive plant growth. Primary plants targeted for control in Barton Lake include Eurasian milfoil and starry stonewort. Both of these plants are non-native (exotic) species that tend to be highly invasive and have the potential to spread quickly if left unchecked.

Eurasian milfoil (*Myriophyllum spicatum*)

Starry stonewort (*Nitellopsis obtusa*)

Plant control activities conducted on Barton Lake in 2021 are summarized in the table below.

BARTON LAKE
2021 NUISANCE AQUATIC PLANT CONTROL SUMMARY

Work Type	Date	Plants Targeted	Acres
Survey	May 17		
Herbicide	May 25	E. milfoil, curly-leaf pondweed	17
Survey	June 9		
Herbicide	June 15	E. milfoil, nuisance natives	18
Herbicide	June 21	Nuisance natives	2
Survey	July 8		
Herbicide	July 15	Starry stonewort, nuisance natives	14
Survey	July 26		
Herbicide	August 4	E. milfoil, starry stonewort, nuisance natives	17
Survey	August 25		
Herbicide	August 31	E. milfoil, starry stonewort, nuisance natives	9
Total			77

In addition to the surveys of the lake to identify invasive plant locations, a vegetation survey of Barton Lake was conducted on August 25 to evaluate the type and abundance of all plants in the lake. The table below lists each plant species observed during the survey and the relative abundance of each. At the time of the survey, 15 submersed species, two floating-leaved species, and seven emergent species were found in the lake. Barton Lake maintains a good diversity of beneficial, native plants species.

BARTON LAKE AQUATIC PLANTS
August 25, 2021

Common Name	Scientific Name	Group	Percent of Sites Where Present
Chara	*Chara* sp.	Submersed	79
Slender naiad	*Najas flexilis*	Submersed	76
Wild celery	*Vallisneria americana*	Submersed	76
Variable pondweed	*Potamogeton gramineus*	Submersed	32
Coontail	*Ceratophyllum demersum*	Submersed	32
Flat-stem pondweed	*Potamogeton zosteriformis*	Submersed	27
Eurasian milfoil*	*Myriophyllum spicatum*	Submersed	18
Carolina fanwort*	*Cabomba caroliniana*	Submersed	15
Illinois pondweed	*Potamogeton illinoensis*	Submersed	14
Starry stonewort*	*Nitellopsis obtusa*	Submersed	11
Bladderwort	*Utricularia vulgaris*	Submersed	8
Water stargrass	*Heteranthera dubia*	Submersed	6
Whitestem pondweed	*Potamogeton praelongus*	Submersed	1
Thin-leaf pondweed	*Potamogeton* sp.	Submersed	1
Curly-leaf pondweed*	*Potamogeton crispus*	Submersed	1
White waterlily	*Nymphaea odorata*	Floating-leaved	54
Yellow waterlily	*Nuphar* sp.	Floating-leaved	25
Cattail	*Typha* sp.	Emergent	42
Purple loosestrife*	*Lythrum salicaria*	Emergent	31
Arrowhead	*Sagittaria latifolia*	Emergent	14
Phragmites*	*Phragmites australis*	Emergent	14
Bulrush	*Schoenoplectus* sp.	Emergent	7
Swamp loosestrife	*Decodon verticillatus*	Emergent	4
Iris	*Iris* sp.	Emergent	1

*Invasive exotic species