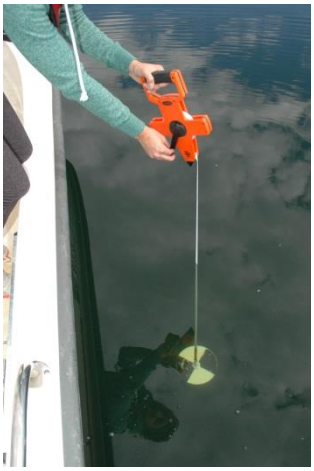
Water Quality Summary: Water Clarity

2019 Barr Lake & Milton Reservoir

Twenty times a year since 2003, **Barr Lake** and **Milton Reservoir** have been sampled for water quality. These 340 trips to both reservoirs have produced an abundance of data and information. This is Part 7 of 8 of a water quality summary series for 2019 calendar year for both reservoirs. The other summaries focused on pH, Chl-a, oxygen, temperature, phosphorus, and nitrogen; this one discusses water clarity.

The Big Picture – Eutrophication is the addition of nutrients to water bodies resulting in nuisance algae growth and sedimentation. This natural process usually occurs over a long geological period of time. Many lakes, reservoirs, and even estuaries and bays throughout the world experience "*cultural eutrophication*". This term means that water bodies tend to become more productive and shallower over relatively short periods of time due to increased inputs of nutrients and sediments from human activities. Accelerated aging of lakes causes a quick biological response – severe algae growth. This response then leads to other chemical and physical changes within the water – pH, oxygen, water clarity and color, fish, plants, and aesthetics can all change.

Secchi Depth – This is the measurement of water clarity. There are many things that influence water clarity - algae, zooplankton, silt/dirt, precipitants, and anything else that is suspended in the water. Water also has dissolved elements (e.g., tannic acids from decomposing organic matter) that change the color of water and impact clarity. Water clarity is mostly influenced by planktonic algae in Barr and Milton. During major rain events, incoming water can be turbid from dirt and urban runoff. Clarity is another response variable reflecting the overall condition of the reservoir and the watershed.



Measuring water clarity with a Secchi Disk on the shady side of the boat

Water clarity is expressed in units of meters (m) or feet (ft) and measured with a Secchi disk. The disk is an 8" diameter, black and white disk that is lowered in the water until it disappears. This practice of measuring water clarity has been around since 1865, and it is a useful way to quickly measure the health of a lake and track water quality changes. Volunteers across the country use the Secchi disk as part of citizen science-based lake monitoring programs.

People are comfortable getting into the water and being able to see their feet. Water clarity of two meters or better is considered desirable. There is no state wide standard for water clarity, but any clarity over 2 meters would be desirable for **Barr** and **Milton**.

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2019 Water Clarity Data – Secchi depth is measured from the shady side of the boat during each visit. The disk is attached to a tape measure. The disk is first lowered until it disappears, at which point a measurement is taken, representing the lowering depth. The disk is lowered a couple of meters deeper and raised until the disk reappears, representing the raising depth. The average of the lowering and raising depth is the Secchi depth. For 2019, there were 20 depths recorded for each reservoir (Table 1).

Table 1. Barr Lake and Milton Reservoir 2019 clarity data (m and ft). Bold values are less than 2 meters.

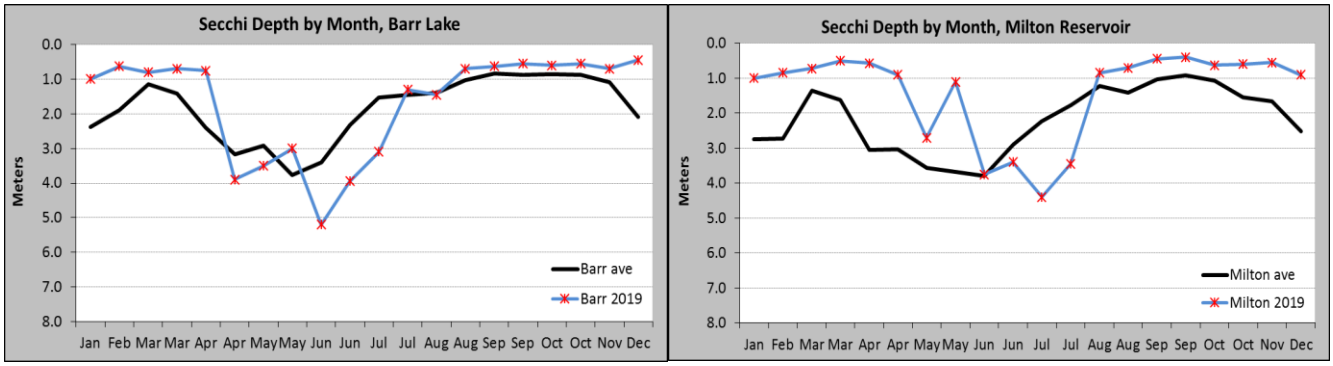
Month	Secchi Depth (Barr)	Secchi Depth (Milton)
Jan	**1.00 m (3.3 ft)**	**1.00 (3.3 ft)**
Feb	**0.63 (2.1)**	**0.85 (2.8)**
Mar	**0.80 (2.6)**	**0.72 (2.4)**
Mar	**0.70 (2.3)**	**0.50 (1.6)**
Apr	**0.75 (2.5)**	**0.57 (1.9)**
Apr	3.90 (12.8)	**0.90 (3.0)**
May	3.50 (11.5)	2.70 (8.9)
May	3.00 (9.8)	**1.10 (3.6)**
Jun	5.20 (17.1)	3.75 (12.3)
Jun	3.95 (13.0)	3.40 (11.2)
Jul	3.10 (10.2)	4.40 (14.4)
Jul	**1.30 (4.3)**	3.45 (11.3)
Aug	**1.45 (4.8)**	**0.85 (2.8)**
Aug	**0.70 (2.3)**	**0.70 (2.3)**
Sep	**0.63 (2.1)**	**0.45 (1.5)**
Sep	**0.55 (1.8)**	**0.40 (1.3)**
Oct	**0.60 (2.0)**	**0.63 (2.1)**
Oct	**0.55 (1.8)**	**0.60 (2.0)**
Nov	**0.70 (2.3)**	**0.55 (1.8)**
Dec	**0.45 (1.5)**	**0.90 (3.0)**

The average Secchi depth for **Barr Lake** in 2019 was 1.67 m and 1.42 m for **Milton Reservoir**. Both reservoirs experienced a spring clearing phase when the zooplankton were grazing on the diatom bloom. Then with the summer growth of algae, both reservoirs had less than 2.0 meters of clarity by August.

The growing season (July 1 – September 30) average for **Barr Lake** was 1.29 m and 1.71 m for **Milton Reservoir**. Typically, the growing season average is lower than the annual average because of increased algal growth during this period.

Figure 1 shows the annual cycle and 2019 results for water clarity. **Barr Lake's** clarity changed in response to algal activity. The diatom growth from January to early April and again in late May controlled the clarity. The cyanobacteria bloom in late July still allowed for over four feet of clarity. **Milton Reservoir** had deeper water clarity much later into the summer than average. Barr Lake also had a delayed clearing phase. July is a busier time for recreation so it is good to see that water clarity is getting deeper later into the summer. From August to December, the clarity stays close to 1.0 meter. This is very consistent for both reservoirs. During the late summer and fall, both reservoirs are typically shallow and exposed to resuspension as well as a steady growth of algae. Carp populations can also play a role in impacting water clarity.

Figure 1. 2019 water clarity data compared to WQ target and 2003-2019 annual average



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TSI Score – The Trophic Status Index (TSI) is a scoring system that measures the eutrophic level of a lake or reservoir by using water clarity, phosphorus, and Chl-a. The widely used Carlson TSI was developed by Bob Carlson in 1977. The Carlson TSI is a way to integrate complicated environmental measurements into a single score that is comparable between lakes. The TSI works well in north temperate lakes that are phosphorus limited. The TSI is not a perfect fit for Barr and Milton but you can learn from it. This is the reason why the average TSI is much different compared to the TSI score associated with just water clarity. The phosphorus TSI scores are in the hypereutrophic range (off the chart even) while the water clarity is more eutrophic (Figure 2). The TSI values within the eutrophic to mesotrophic range (45 – 60) seem to be a reasonable score for warm-water, shallow reservoirs such as Barr Lake and Milton Reservoir.

Figure 2. 2019 TSI scores for Barr and Milton, July - September