



Water Quality Summary: **Water Clarity**

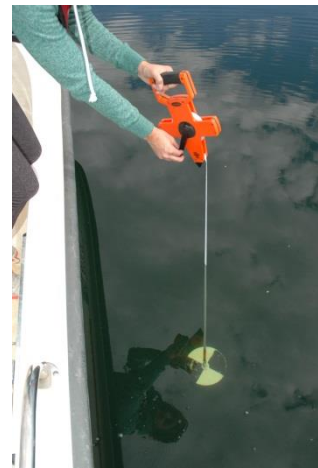
2023 Barr Lake & Milton Reservoir



Barr Lake and **Milton Reservoir**'s water quality has been sampled twenty times a year since 2003. These 420 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 2023 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 and sediments to water bodies resulting in algae and plant growth and sedimentation. This natural process occurs over a long geological period - 1,000's of years. Many lakes, reservoirs, ponds, and even estuaries throughout the world experience "*cultural eutrophication*". This term means that water bodies become more productive and shallower much quicker (months to years) due to increased inputs of nutrients and sediments from human activities. This unnaturally accelerated aging of lakes causes a biological response – algae growth that usually leads to blue-green algal scums. This biological response then triggers chemical and physical changes within the water – pH, oxygen, water clarity and color, fish, water safety, plants, and aesthetics.

Secchi Depth – This is the measurement of water clarity. There are many influences on water clarity - algae, zooplankton, silt/dirt, precipitants, color, time of day, and anything else that is suspended in the water. Water also has dissolved compounds (e.g., tannic acids from decomposing organic matter) that change the color of water and impact clarity. For Barr and Milton, water clarity is mostly influenced by planktonic algae. 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 (SD). 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 is a useful way to quickly measure the health of a lake and track water quality changes. Volunteers across the country use the SD 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 2.0 m (6.5 ft) or better is considered desirable. There is no state standard for water clarity, but clarity over 2.0 m is a good goal for **Barr** and **Milton**.



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2023 Water Clarity Data – SD is measured from the shady side of the boat during each visit. The weighted 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 few meters deeper and raised until the disk reappears, representing the raising depth. The average of the lowering and raising depths is recorded. For 2023, there were 20 depths recorded for each reservoir (Table 1).

Table 1. Barr Lake and Milton Reservoir 2023 clarity data (m and ft). Bold values are less than 2 meters.

Month	Secchi Depth (Barr)	Secchi Depth (Milton)
Jan	0.55 (1.8 ft)	0.45 (1.5 ft)
Feb	3.50 (11.5 ft)	0.60 (2.0 ft)
Mar	0.80 (2.6 ft)	0.65 (2.1 ft)
Mar	0.80 (2.6 ft)	0.40 (1.3 ft)
Apr	2.50 (8.2 ft)	0.50 (1.6 ft)
Apr	3.30 (10.8 ft)	0.55 (1.8 ft)
May	5.20 (17.1 ft)	2.05 (6.7 ft)
May	4.75 (15.6 ft)	2.70 (8.9 ft)
Jun	3.45 (11.3 ft)	1.05 (3.4 ft)
Jun	2.30 (7.5 ft)	2.05 (6.7 ft)
Jul	1.75 (5.7 ft)	1.60 (5.2 ft)
Jul	2.40 (7.9 ft)	0.60 (2.0 ft)
Aug	1.98 (6.5 ft)	0.90 (3.0 ft)
Aug	0.85 (2.8 ft)	0.40 (1.3 ft)
Sep	1.10 (3.6 ft)	0.50 (1.6 ft)
Sep	0.38 (1.2 ft)	0.52 (1.7 ft)
Oct	0.70 (2.3 ft)	0.31 (1.0 ft)
Oct	0.80 (2.6 ft)	0.34 (1.1 ft)
Nov	0.68 (2.2 ft)	0.56 (1.8 ft)
Dec	0.92 (3.0 ft)	0.60 (2.0 ft)

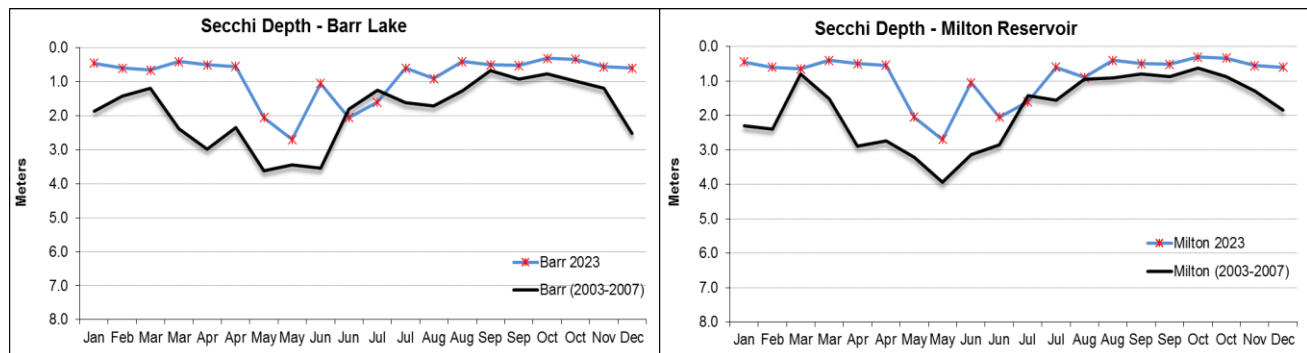
The average SD for **Barr Lake** in 2023 was 1.94 m and 0.87 m for **Milton Reservoir**. In recent years, Milton’s spring clearing phase has been truncated to only a month. Barr’s clearing phase seems to be extending into the early summer season.

The growing season (July 1 – September 30) average for **Barr Lake** was 1.41 m and 0.75 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 2023 results for water clarity. **Barr Lake’s** clarity changed in response to algal activity and water depth. Both systems are driven by algal growth when it comes to water clarity. **Milton Reservoir** clearing phase was shorter and shallower than Barr’s.

Barr Lake’s maximum SD was 5.20 meters (17 ft). For most of the year both reservoirs had less than average clarity. Zooplankton, especially the larger daphnia, are the natural grazers to keep the algae in check. Daphnia populations peak between April and July. Zooplankton do not do well during the warmer, summer months. They can also be stressed from over feeding from filter feeding fish like gizzard shad and other juvenal fish. Water clarity in both reservoirs is controlled by algal growth and will always reflect the productivity during the periods of peak algal growth which can occur during any time of the year.

Figure 1. 2023 water clarity data compared to WQ target and 2003-2007 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 northern 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. 2023 TSI scores for Barr and Milton, July - September

