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To Whom It May Concern:

Wolf Lake in Fond du Lac County is part of the DNR Directed Lakes Monitoring Program. The purpose of this monitoring is to assess overall lake health. 2017 was the first year of a three-year monitoring effort for this lake. During 2017, an aquatic invasive species survey was completed. During 2018 and 2019, water chemistry samples were collected three times each year. This report summarizes monitoring results. This report also summarizes water clarity (secchi) data from dedicated volunteers that collect readings on Wolf Lake and enter their data into the statewide database. Secchi data on Wolf Lake date back to 1987 and are essential to assessing the long-term condition of the lake.

A link to the DNR Directed Lake Monitoring protocols are available on our webpage at:
https://dnrx.wisconsin.gov/swims/downloadDocument.do?id=163086662

Water Chemistry

The following information is taken from the Wolf Lake webpage provided by the DNR.
https://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=60800&page=waterquality

Wolf Lake - Deep Hole 2019 Results

Wolf Lake - Deep Hole was sampled **18** different days during the 2019 season. Parameters sampled included:

- water clarity
- temperature
- dissolved oxygen
- total phosphorus
- chlorophyll

The average summer (July-Aug) secchi disk reading for Wolf Lake - Deep Hole (Fond du Lac County, WBIC: 60800) was 6.08 feet. The average for the Southeast Georegion was 7 feet. Typically, the summer (July-Aug) water was reported as CLEAR and BROWN. This suggests that the Secchi depth may have been mostly impacted by tannins, stain from decaying matter. Tannins are natural and not a result of pollution. Tannins can be distinguished from suspended sediment because the water, even though it's brown, it looks clear, like tea. Though tannins are not harmful per se, they are often not perceived as aesthetically pleasing as clear water. Tannins can also be important for decreasing light penetration into the water and decreasing algal growth.

Chemistry data was collected on Wolf Lake - Deep Hole. The average summer Chlorophyll was 10.3 µg/l (compared to a Southeast Georegion summer average of 32.8 µg/l). The summer Total Phosphorus average was 30.2 µg/l. Lakes that have more than 20 µg/l of total phosphorus may experience noticeable algae blooms.

Wolf Lake - Deep Hole 2018 Results

Wolf Lake - Deep Hole was sampled **17** different days during the 2018 season. Parameters sampled included:

- water clarity
- temperature
- dissolved oxygen
- total phosphorus
- chlorophyll

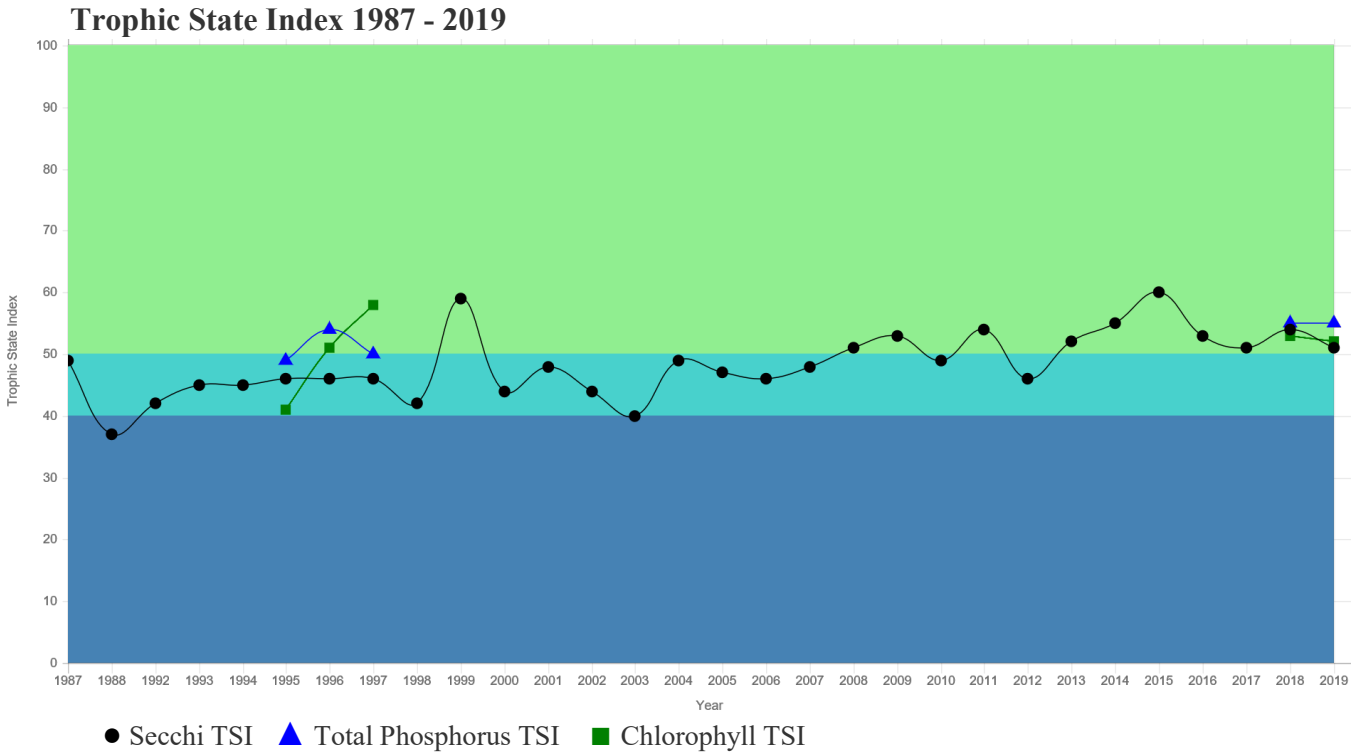
The average summer (July-Aug) secchi disk reading for Wolf Lake - Deep Hole (Fond du Lac County, WBIC: 60800) was 4.87 feet. The average for the Southeast Georegion was 7.4 feet. Typically, the summer (July-Aug) water was reported as MURKY and BROWN. This suggests that the secchi depth may have been mostly impacted by suspended sediments, tiny particles of soil or organic matter that are suspended in the water. Shallow lakes are often turbid because wind stirs up sediment from the bottom. High suspended sediments are often found in flowages and impoundments where precipitation runoff from the watershed transports solids via an incoming stream.

Chemistry data was collected on Wolf Lake - Deep Hole. The average summer Chlorophyll was 11.2 µg/l (compared to a Southeast Georegion summer average of 31.6 µg/l). The summer Total Phosphorus average was 32.9 µg/l. Lakes that have more than 20 µg/l of total phosphorus may experience noticeable algae blooms.

Trophic State Index (TSI)

The overall Trophic State Index (based on chlorophyll) for Wolf Lake - Deep Hole was 53. The TSI suggests that Wolf Lake - Deep Hole was **eutrophic**. This TSI usually suggests decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.

TSI is determined using a mathematical formula (Wisconsin has its own version). The TSI is a score from 0 to 110, with lakes that are less fertile having a low TSI. We base the overall TSI on the Chlorophyll TSI when we have Chlorophyll data. If we don't have chemistry data, we use TSI Secchi. We do this rather than averaging, because the TSI is used to predict biomass. This makes chlorophyll the best indicator.



TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
TSI > 80	Algal scums, summer fish kills, few plants, rough fish dominant. Very poor water quality.

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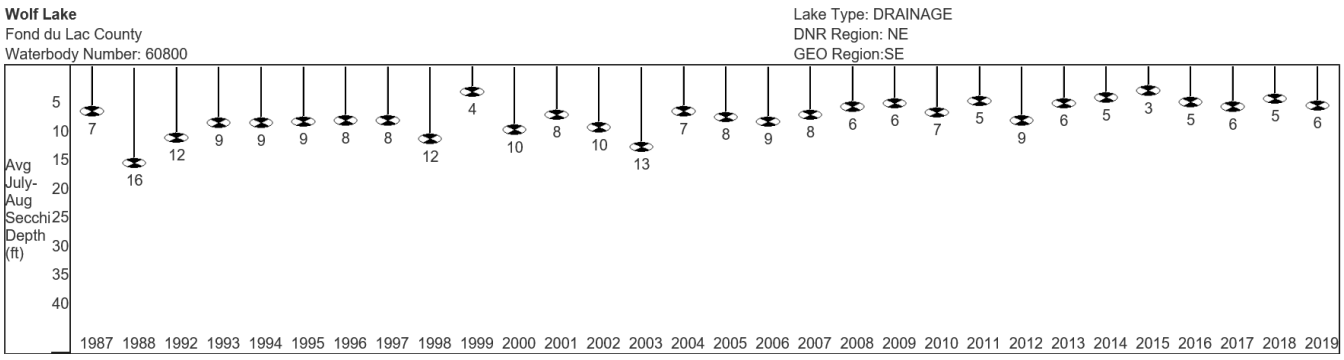
Water Clarity (secchi)

Water clarity data has been collected on Wolf Lake regularly since 1987. Average secchi depth ranged from 3 to 16 feet.



Past secchi averages in feet (July and August only)

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1987	7	7	7	1
1988	16	16	16	2
1992	11.5	11	12	2
1993	9	7.5	10.5	2
1994	9	8	10	2
1995	8.75	8	9.5	2
1996	8.5	8.5	8.5	1
1997	8.5	8	9	2
1998	11.75	11.5	12	2
1999	3.5	3	4	2
2000	10.25	9	11.25	5
2001	7.5	4.5	10.5	5
2002	9.75	9	10.5	2
2003	13.2	12	14	5
2004	7	5	9	5
2005	8	5	10	7
2006	8.79	5	13.5	7
2007	7.63	3.5	11.5	8
2008	6.25	4	8.5	6
2009	5.5	4	6.5	3
2010	7.1	6	8	5
2011	5.13	3.5	6	4
2012	8.63	7.5	10	4
2013	5.63	4	6.5	4
2014	4.63	4	6	4
2015	3.38	3	4	4
2016	5.3	3.5	9	5
2017	6.25	4	8	4
2018	4.87	4.5	5.5	6
2019	6.08	4.7	7.3	6

Aquatic Invasive Species (AIS) Survey

An Aquatic invasive Species survey was conducted in 2017. AIS that were found while monitoring consisted of hybrid Cattails (Typha sp.), Eurasian Watermilfoil (Myriophyllum *spicatum),* and Curly-leaf pondweed (Potamogeton *crispus).* Samples were also collected for Zebra Mussel veligers, Spiny Water Flea and Fishhook Water Flea but not found in Wolf Lake. To learn more about aquatic invasive species and become more familiar with each specific species, please visit the DNR aquatic invasive species webpage at: https://dnr.wi.gov/lakes/invasives/

Since Wolf Lake experiences significant blue-green algae blooms, I encourage the Wolf Lake District to continue to investigate opportunities to reduce nutrient runoff to the lake. The DNR Surface Water Grant program is available to help pay for a watershed assessment and the development of a comprehensive lake management plan. For more information on the grant program, please see our website at: https://dnr.wi.gov/Aid/SurfaceWater.html. For more information on blue-green algae see: https://dnr.wi.gov/lakes/bluegreenalgae/

This report summarizes the 2017, 2018 and 2019 monitoring results. This completes the three-year monitoring effort on Wolf Lake. If you have any questions regarding the survey results from Wolf Lake, please feel free to contact me at 920-662-5489 or at Mary.Gansberg@Wisconsin.gov

Sincerely,

Mary Gansberg

Mary Gansberg
Water Resources Management Specialist
Wisconsin Department of Natural Resources