

2022 Updated Green Lake 2022 TP+Chlorophyll + Secchi Disk Readings Combined Data from GLID's Dancik -Dahlins- and Mortensons Volunteers

From: Gordon Haubenschild (gordon_haubenschild@yahoo.com)

To: greenlakeisanti@yahoo.com

Date: Thursday, October 6, 2022 at 07:47 PM CDT

GLID BOARD and SWCD,

Info for your awareness, observations, opinions/comments, and recommended actions.

2022 Updated Green Lake 2022 TP+Chlorophyll + Secchi Disk Readings from GLID's volunteers

Dancik, Dahlins, and Mortensons.

Sooo GRATEFUL to our GLID's dedicated value-add volunteers and SWCD's involvement!

I combined the 2022 volunteer collected data to sanity check the 3 sources of measurements. Correlations looked good!

And then compared with 30 Year Historical Water Quality Yearly Averages. Key word is 'averages'.

(see composite chart and attached pdf below>>>)

Analysis Net net:

- Based on measurement data, Green Lake overall's long term water quality is mostly table, with occasional upturns/downturns. Some days/years, seems like more downturns,
- The lake is not degrading on an accelerated rate. ✓
- Our Green Lake has managed to offer enjoyment to many despite our human's impacts and changing climate.
- Many good days, our Green Lake is not too green. Water clear enough that I have been able to count the fish and pebbles on the bottom from the dock.
- Other bad days, the lake has a layer of thick green scum. Today, Brother Jim reported their dog looked like it was coated with a thick

coat of stinky green paint requiring two washings!

- In between those times, the lake water has some green visible characteristics, but can be enjoyed by many.

(180+ lake owners & families, thousands of visitor boat launches, hundreds of ice fisher-people, plus our nature's creatures)

- Several shorelines have accumulated some thick muck from years of decomposing weeds/algae/green scum.

While Owners that regularly remove muck deposits enjoy cleaner lake shoreline bottom.

- Our Green Lake has a huge nutrient budget load from the lake itself.

Okay, if interested/curious, read on, here's the data review:::

The Minnesota Clean Water Goals for our type of Lake during June-Sept is:

Phosphorus TP equal/less than 40ug/L

Chlorophyll less than 14mg/m³

Secchi clarity greater than 4.6 ft

for 2022: Green Lake measurement data averages were:

Phosphorus TP average was 86.6 ug/L = 2X worse than MN goal, hence on impaired list

Chlorophyll average was 23.86mg/m³ = 1.7X worse than MN goal

Secchi water clarity average was 4.8ft (with range of 3.6 to 5.6ft) = met MN goal

Using SWCD's Tiffany's and my earlier analysis of the 30 years of measurement averages:

- Over the long term, Phosphorus trend is slightly increasing, and above threshold.

- Over the long term, Chlorophyll trend is stable, but above threshold.

- Over the long term, water clarity trend is stable, meeting threshold.

GLID and SWCD's Green Lake Improvement Plan actions must be continued.

- + Need to continue to encourage Lake Owners to remove weeds/muck from lake and reduce runoff.**
- + Leverage our MPCA Section 319 Grant to reduce watershed nutrient inflow and address 'big impact changes' is important.**
- + Continue to measure/monitor/observe our lake. Need to reverse any negative trends.**
- + Guard against new AIS invasions and continue to address current AIS situations.**
- + Learn from other lake activities, like nearby Blue Lake's experiment with similar topography.**
- + And do a whole bunch more....**

Here's a view of combined 3 sets of collected 2022 measurements with a Green Lake 2022 Water Quality Summary chart that can be mapped against the 30 year summary charts.

Again, the key word is 'averages' with day to day/ year to year measurement fluctuations from many variables, including climate change.

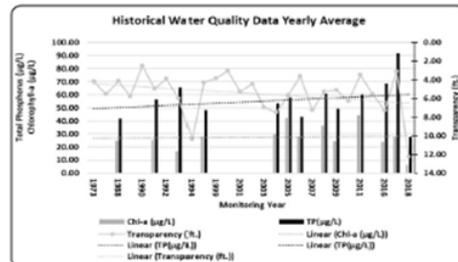
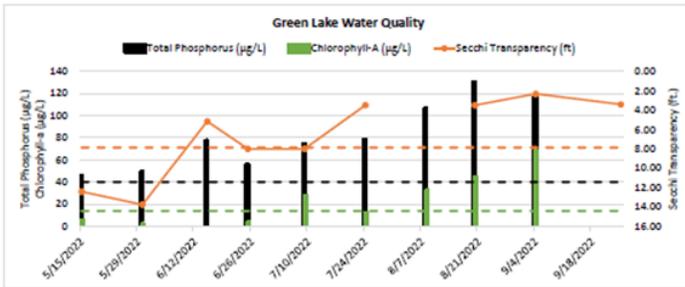
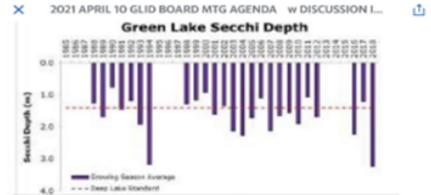
Green Lake Improvement District-Secchi Disc Reading 2022

Date	Time	Air Temp	Water Temp	Depth	Weather	Clarity Reading	
6/12/2022	8:30pm	73	70 25 ft		partly cloudy	48	4.0
6/19/2022	7:50pm	81	74 25 ft		sunny	63	5.3
6/26/2022	8:30pm	64	70 25 ft		sunny	82	6.8
7/4/2022	4:30pm	81	78 25 ft		partly cloudy	25	2.1
7/10/2022	8:30pm	81	78 25 ft		cloudy	33	2.8
7/17/2022	10:00am	80	78 25 ft		sunny/light wind	35	2.9
7/24/2022	4:00pm	77	78 25 ft		partly cloudy	50	4.2
7/30/2022	3:00pm	86	79 25 ft		sunny	47	3.9
8/14/2022	4:00pm	78	78 25 ft		sunny/calm	36	3.0
8/21/2022	11:30am	74	77 25 ft		sunny/calm	35	2.9
8/28/2022	4:00pm	77	75 25 ft		cloudy/windy	31	2.6
9/3/2022	2:00pm	71	72 25 ft		sunny	34	2.8
							3.6

Green Lake Improvement District-Secchi Disc Reading #2 for 2022

A	B	C	D	E
Date	Depth	Water Temp	Outdoor Temp	Notes on day
6/22/22	6ft 0	78.2		82 Sunny minimal traffic.
6/27/22	5ft 6	75.4		82 Sunny minimal traffic.
7/4/22	3ft 0	75.4		81 Partly cloudy. Heavy holiday traffic. Different graph for water temp.
7/5/22	2ft 10	76.8		78 Partly cloudy. Very green. Light traffic.
7/7/22	2ft 8	77.8		84 Sunny, read later in the evening. Very green. Light traffic.
7/18/22	2ft 7	81.4		86 Sunny. Very hot past few days.
7/28/22	3ft 11	74.8		74 Partly cloudy. Windy/kwavy. Water looks much better. Minimal traffic
8/2/22	4ft 0	77.3		93 Partly cloudy. Windy couple days.
				Sunny medium traffic. Shoreline algae is noticeably worse / cloudy than last reading.
8/5/22	3ft 8	77.7		91
8/9/22	3ft 8	77.6		80 Sunny. Light traffic. Calm / glass.
8/13/22	3ft 0	74		74 Cloudy. Quiet and rainy weekend
8/19/22	3ft 0	73.8		80 Close to 2" rain in past 48 Hrs. Light traffic with weather
8/21/22	2ft 10	76		81 Very busy day. Shorelines are quickly accumulating algae and suddenly smelly.
8/28/22	2ft 7	75		77 Quiet day. Shorelines cleared up quite a bit since the last reading.

Date Sam	Time	Year	Site ID	Location	Total Phosphorus	Chlorophyll-A	Secchi Tr	TSS (mg/L)	Water Te	Water Te	Depth at	Weather	Wind
5/15/2022	9:30	2022	0-0136-00-203	Green	45	5.3	12.42		48		30	Sunny	0-5
5/30/2022	9:30	2022	0-0136-00-203	Green	49	1.8	13.75		56.00		30	Light Rain	0-5
6/15/2022	10:45	2022	0-0136-00-203	Green	77	<1	5.17		60		30	Mostly Cl	0-5
6/25/2022	11:00	2022	0-0136-00-203	Green	55	3.6	8.00				30	Partly Cl	5-10
7/9/2022	10:15	2022	0-0136-00-203	Green	74	27.6	8.00				30	Partly Cl	5-10
7/24/2022	9:00	2022	0-0136-00-203	Green	78	12	3.50				30	Partly Cloudy	
8/8/2022	9:35	2022	0-0136-00-203	Green	106	32			69		30	Sunny	0-5
8/20/2022	17:30	2022	0-0136-00-203	Green	130	44.1	3.50				30	Partly Cloud	0-5
9/4/2022	13:00	2022	0-0136-00-203	Green	117	68.1	2.33				20	Sunny	
9/25/2022	9:30	2022	0-0136-00-203	Green			3.418				30	Sunny	5-10
Growing Season Averages:					86.6666667	23.86	5.6332 Annual Ave		58.25		#DIV/0!		



Hope,
Gordon Haubenschild
with GLID Board

Additional background data from recent years I found to compare with:

VZW Wi-Fi

8:45 AM

88%



Chlorophyll-a: N
Transparency: YE



Green Lake Monitoring Results 2016

Total Phosphorus (TP), Chlorophyll-a (Chl-a) and Secchi Transparency

MN Clean Water Goals for Deep Lakes:

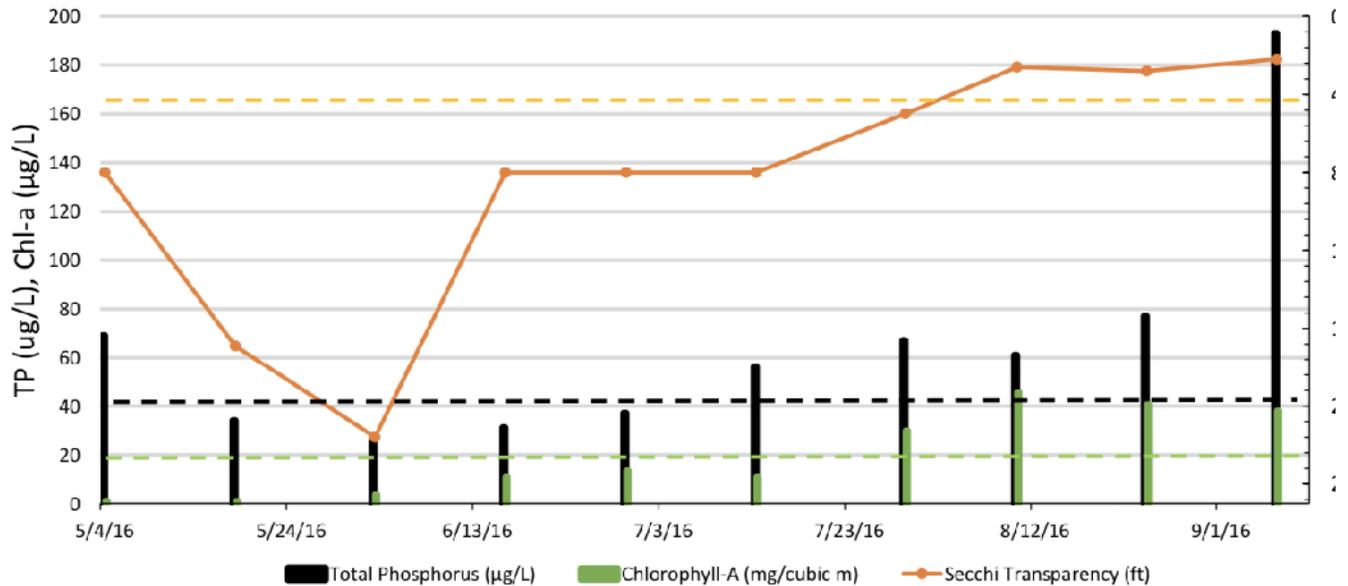
Total Phosphorus (TP): $\leq 40 \mu\text{g/L}$

Chlorophyll-a: $\leq 14\text{mg/m}^3$

Secchi Depth: $\geq 4.59 \text{ ft}$

Growing season average (June-September)	68.50 (TP)	24.08 (Chl-a)	7.28 (Secchi)
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Green Lake Surface Water Quality



Green Lake has a maximum depth of 28ft and the majority of the lake is greater than 15 feet deep which means this the lake st characteristics of a deep lake. Deep lakes tend to stratify or form layers, especially during summer, because the density of wat as its temperature changes. The layers mix in the spring and fall. When the layers mix, nutrients trapped on the bottom of th get released into the water column (termed internal loading). The phenomenon can be seen on the dissolved oxygen and ter graphs on page 3. The monitoring results for Green Lake are compared to the State goals for deep lakes in this area.

When compared to deep lake water quality goals, Green Lake meets the goals for transparency but not for Chl-a or TP. This ir is what was used to classify the lake as "impaired".

In 2016 TP was the highest early and late in the season. This result corresponds to the periods of time when the lake water c mixed, meaning nutrients sitting at the bottom of the lake could have been released into the water above. These nutrients cou

a combination of decaying vegetation and/or an accumulation of nutrients built up over time from land runoff. It is important to note that heavy rains, which began mid-July, would have also contributed to the climbing TP and Chl-a levels. Rain runoff would have carried nutrients from the lake tributaries, verified by monitoring data, and surrounding land. The aforementioned occurrence highlights the importance of implementing storm water practices to treat the runoff before it reaches the lake.

General Definitions

VZW Wi-Fi

8:50 AM

87%

Green Lake Monitoring Results 2017

Total Phosphorus (TP), Chlorophyll-a (Chl-a) and Secchi Transparency

MN Clean Water Goals for Deep Lakes:

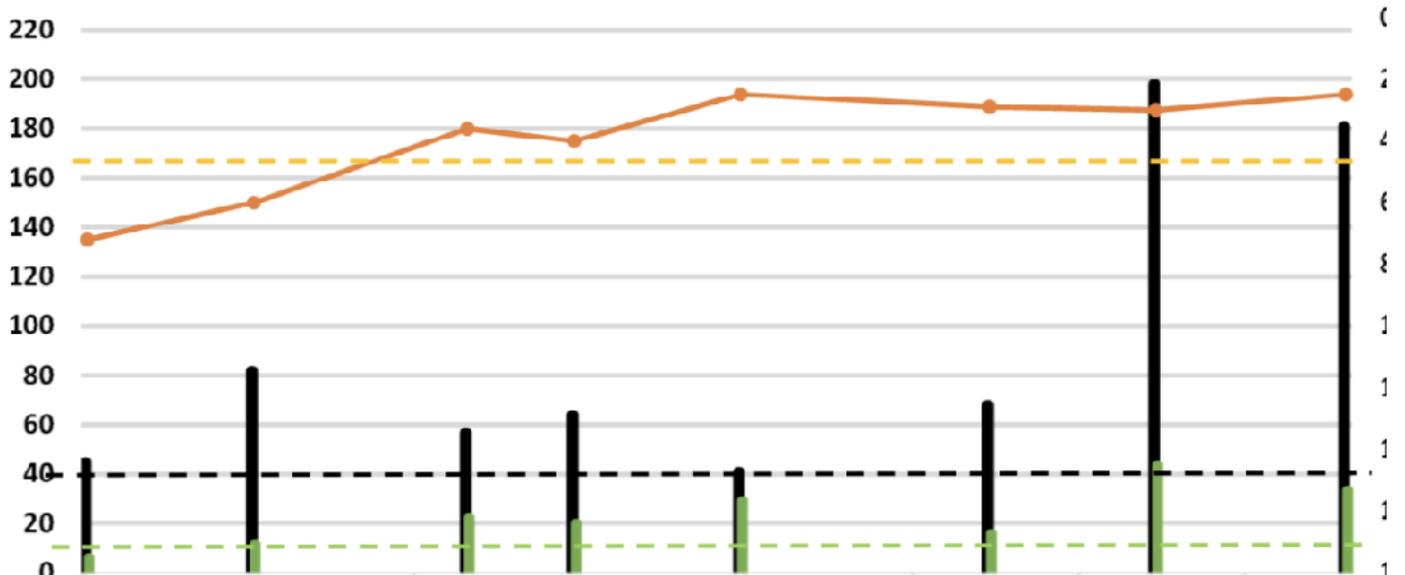
Total Phosphorus (TP): $\leq 40 \text{ ug/L}$

Chlorophyll-a: $\leq 14 \text{ mg/m}^3$

Secchi Depth: ≥ 4.59

Following season average	92.00 (TP)	27.47 (Chl-a)	3.08 (Secchi)
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Green Lake Water Quality



6/8/17 6/22/17 7/6/17 7/20/17 8/3/17 8/17/17 8/31/17 9/14/17

■ Total Phosphorus (ug/L) ■ Chlorophyll-A (ug/L) —●— Secchi Transparency (ft)

Green Lake has a maximum depth of 28ft and the majority of the lake is greater than 15 feet deep which means this the lake :
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page 3. The monitoring results for Green Lake are compared to the State goals for deep lakes in this area.

ompared to deep lake water quality goals, Green Lake exceeded thresholds for all three parameters, transparency, Tl
nation is what was used to classify the lake as "impaired".

he highest TP and Chl-a concentrations were observed late in the growing season. Because the monitoring agreemer
efore June samples were not collected in May. We suspect that TP and Chl-a would have been higher in May. These
d to the periods of time when the lake water column was mixed, meaning nutrients sitting at the bottom of the lake
sed into the water above. These nutrients could be from a combination of decaying vegetation and/or an accumula
uilt up over time from land runoff. Similar conditions were observed during the 2016 monitoring season. Addressi
o reduce nutrient runoff to the lake should be the first priority and investigating internal nutrient loading impacts/sc
he next step to improving lake water quality.

General Definitions

... (TP) ... essential plant nutrient in which ...



2022 Dancik and Dahlin and Mortenson GLID TP+Chlorophyll + Secchi Disk Readings Combined Data for Analysis.pdf
654.3kB