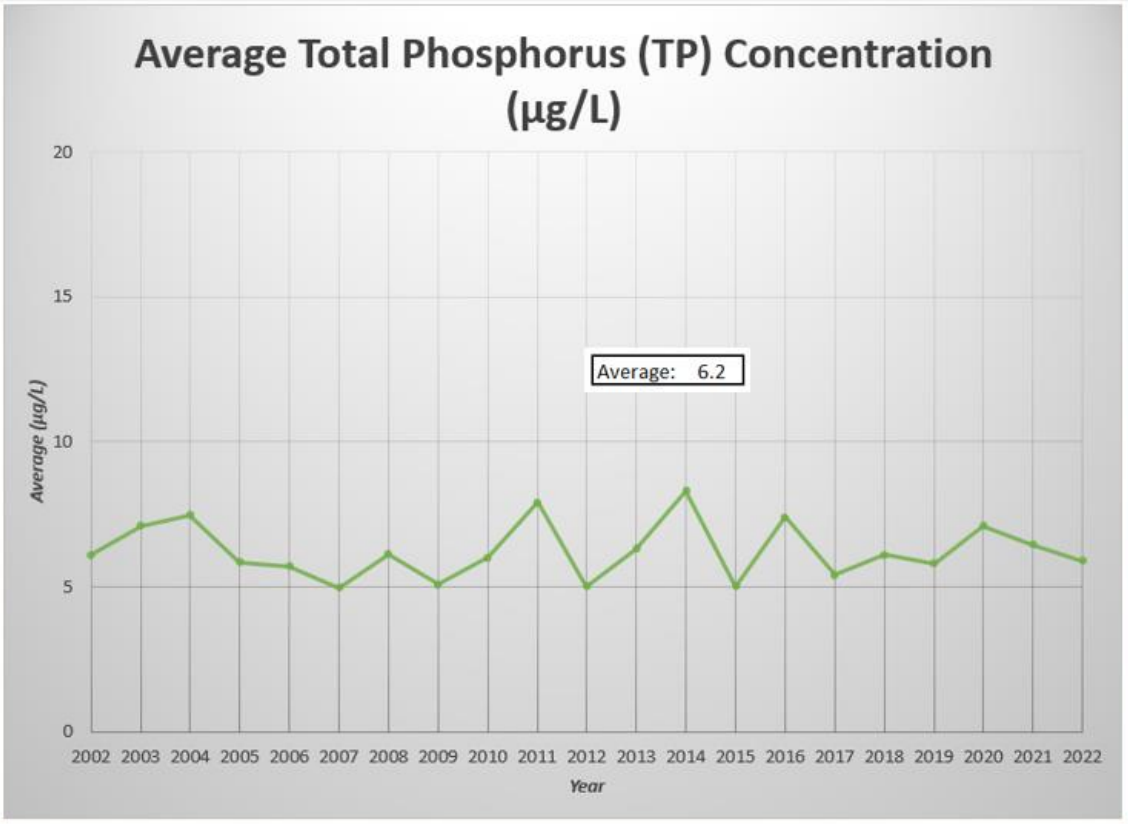
WATER TESTING RESULTS 2023

Big Cedar Lake

Total Phosphorus

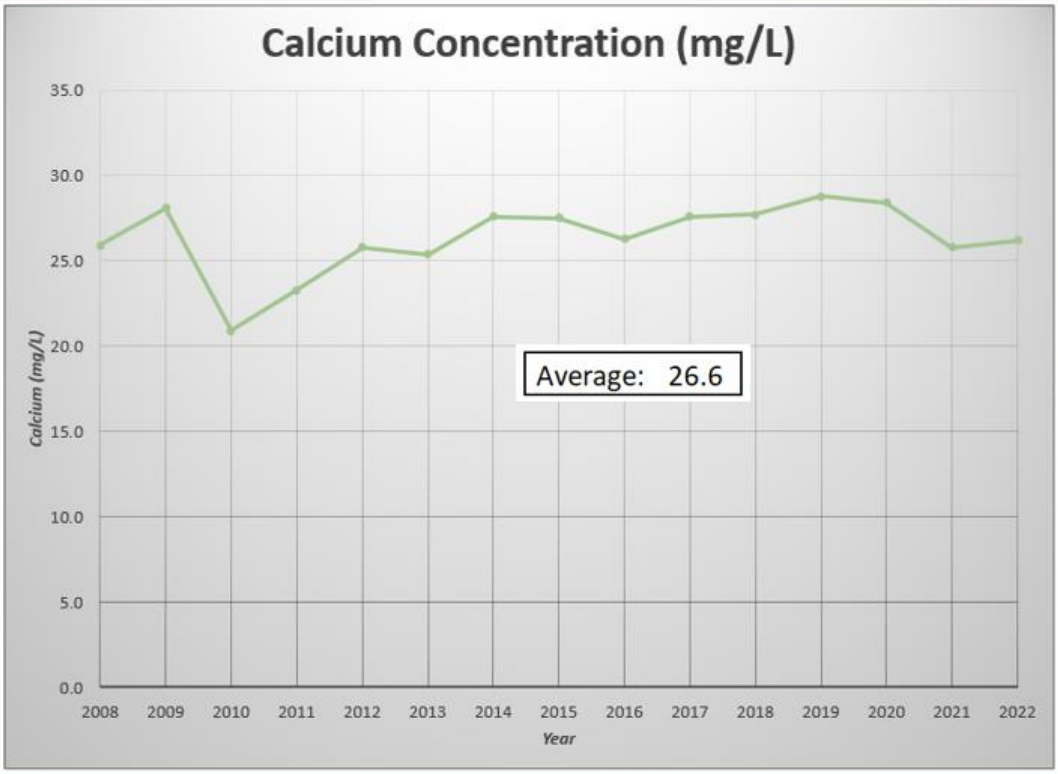
Year	Average (µg/L)
2002	6.1
2003	7.1
2004	7.47
2005	5.85
2006	5.7
2007	4.95
2008	6.13
2009	5.07
2010	6
2011	7.9
2012	5
2013	6.3
2014	8.3
2015	5
2016	7.4
2017	5.4
2018	6.1
2019	5.8
2020	7.1
2021	6.45
2022	5.88



- Total phosphorus concentration is used to interpret nutrient status in Ontario lakes because phosphorus is the element that controls the growth of algae in lakes. Increases in phosphorus will decrease water clarity by stimulating algae growth. In extreme cases algal blooms will affect the aesthetics of the lake and/or cause taste and odour problems with the water.
- Reminder that Phosphorus levels can be minimized by reducing or eliminating fertilizer use, pumping out your septic system on a regular basis, and being careful with soap (try to only use phosphate-fee soap). What goes on your property and into your drain eventually finds its way into the lake.

Calcuim Concentration

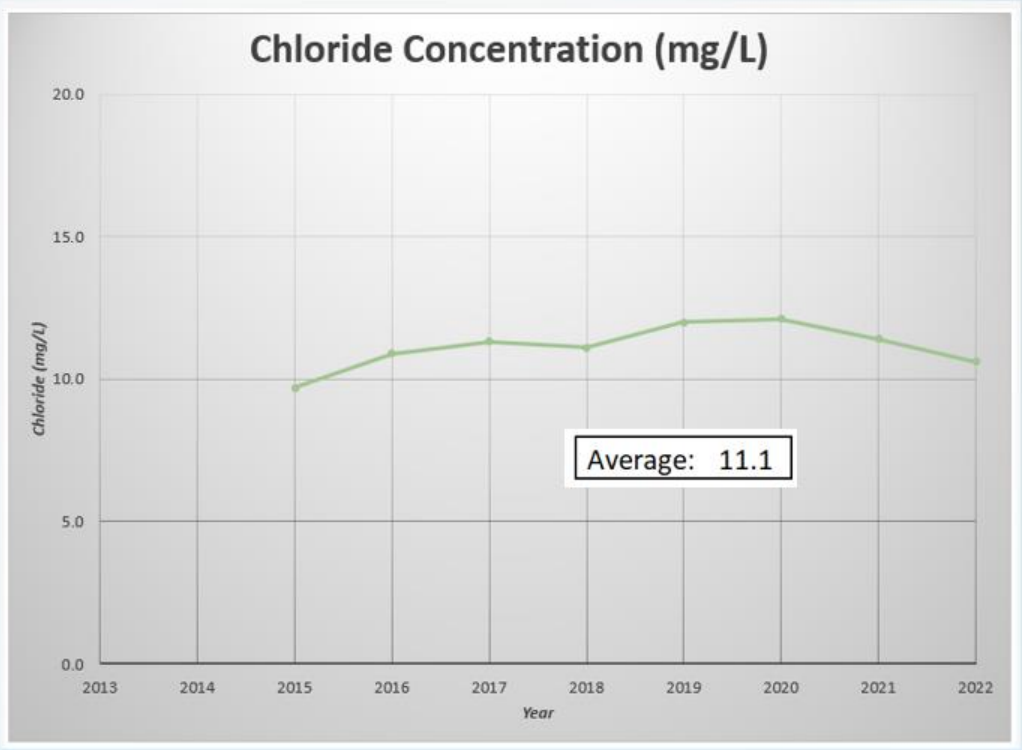
Year	Calcium (mg/L)
2008	25.9
2009	28.1
2010	20.9
2011	*23.3*
2012	25.8
2013	25.4
2014	27.6
2015	27.5
2016	26.3
2017	27.6
2018	27.7
2019	28.8
2020	28.4
2021	25.8
2022	26.2



- Calcium is a building block for bones and shells and is needed by all living organisms to grow. Levels of calcium below 2.5 mg/L can threaten the survival of many aquatic species. Calcium in lake water is derived from mineral weathering of rocks and calcium-rich dust. Many Ontario lakes on the Precambrian Shield have been found to have very low calcium levels believed to be due to the low rate of weathering of hard, low calcium content rocks. As shown by our numbers, our lake and other Kawartha Lakes do not have a calcium deficiency. The limestone bedrock and calcareous soils to the south of the lakes provide more than enough calcium to sustain the aquatic life in our lakes.

Chloride Concentration

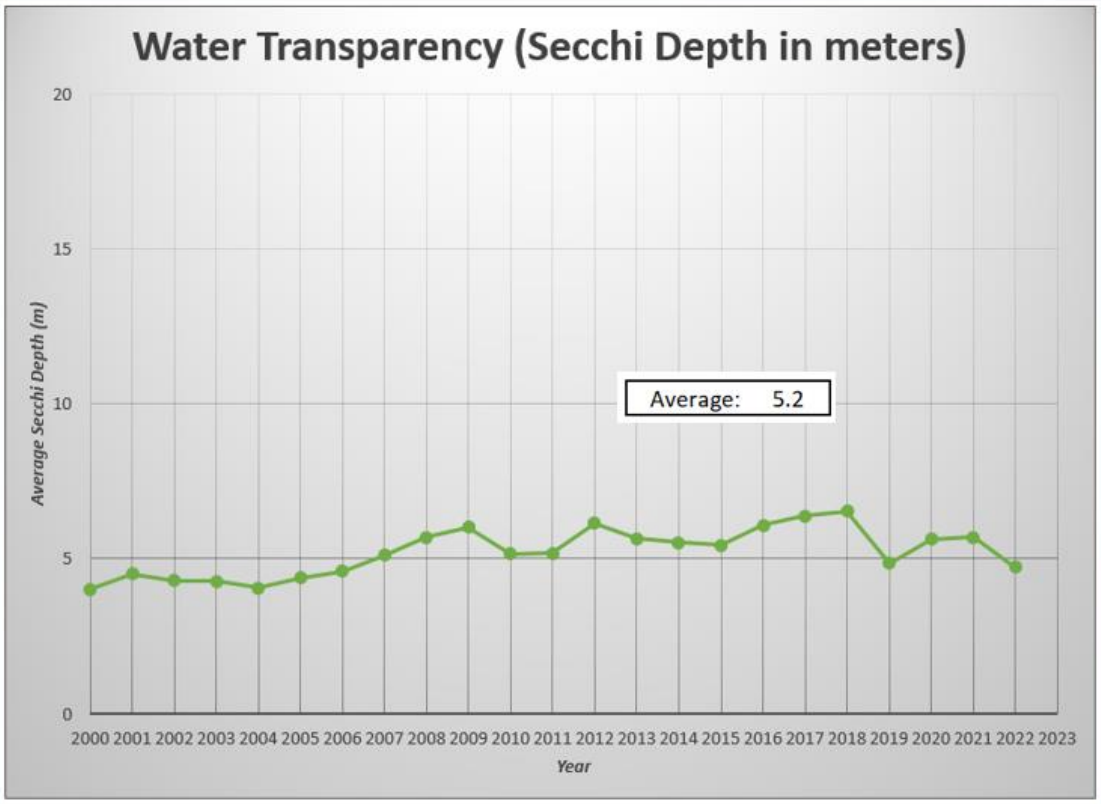
Year	Cl (mg/L)
2015	9.7
2016	10.9
2017	11.3
2018	11.1
2019	12.0
2020	12.1
2021	11.4
2022	10.6



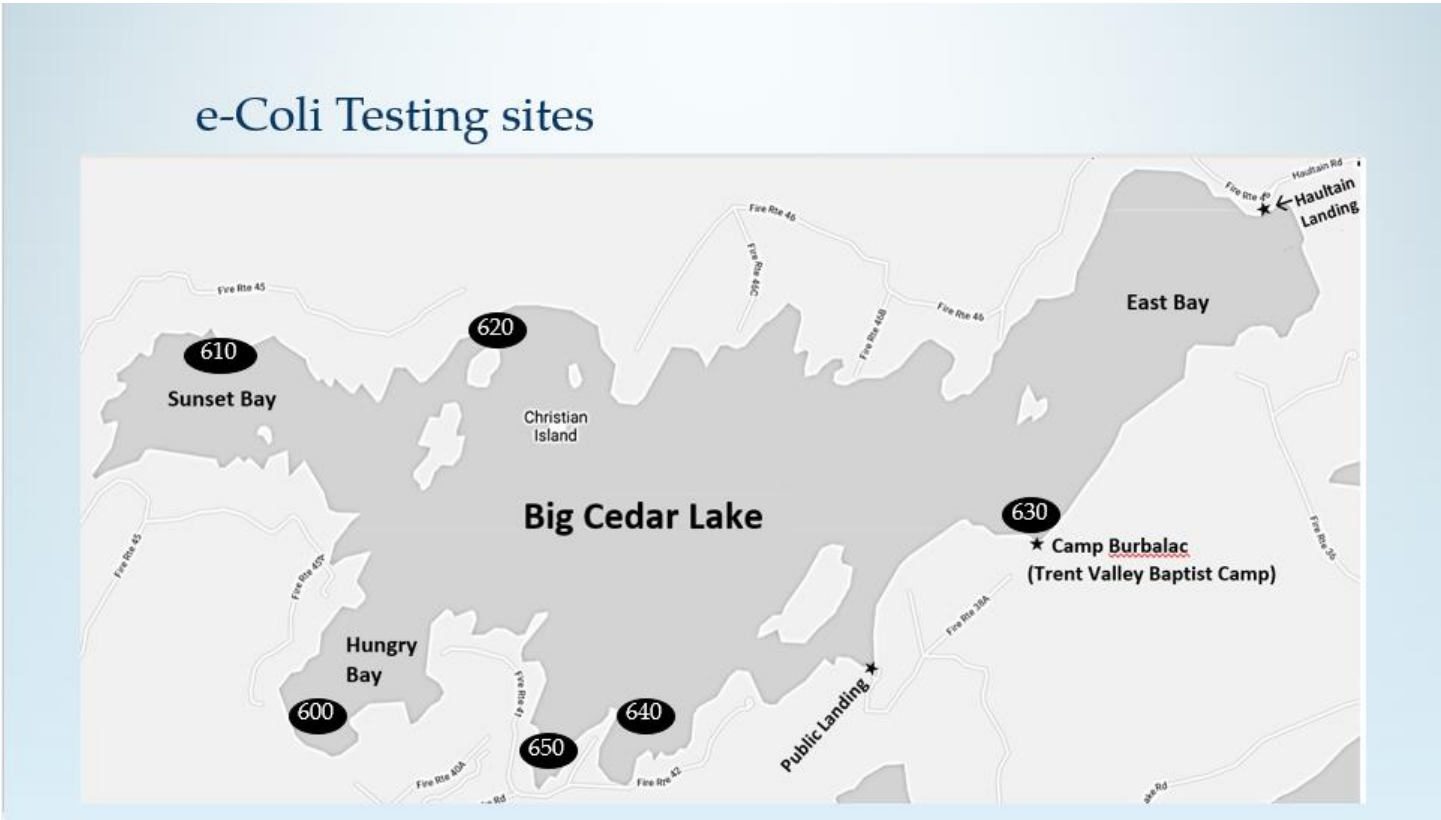
- Chloride levels can be affected by chlorine in laundry, road salt (sodium chloride or calcium chloride), fertilizers, or naturally through mineral deposits. In lakes, chloride is a relatively benign ion at low concentrations but begins to have ecological impacts as concentrations rise into the 100s and 1,000s of mg/L.

Water Transparency

Year	Average Depth (m)
2000	4.03
2001	4.51
2002	4.3
2003	4.28
2004	4.06
2005	4.38
2006	4.6
2007	5.11
2008	5.69
2009	6.02
2010	5.16
2011	5.19
2012	6.15
2013	5.65
2014	5.53
2015	5.45
2016	6.09
2017	6.38
2018	6.54
2019	4.85
2020	5.63
2021	5.70
2022	4.72



- Water clarity tests are done twice a month in the deepest part of the lake (28 m). Information from these tests will allow the early detection of changes in the nutrient status and/or the water clarity of the lake due to impacts of shoreline development, climate change and other stresses.
- Increases in phosphorus can decrease water clarity by stimulating algal growth. However, the amount of phosphorus is not the only factor controlling light penetration as the amount of dissolved organic carbon or non-biological turbidity also plays an important role. We have also seen changes in water clarity due to invading species such as zebra mussels. Thus, although it is possible to use total phosphorus to evaluate the nutrient status of the lake, water clarity readings are a useful supplement that can track changes in the lake that might be occurring that would not be noticed by monitoring phosphorus levels alone, such as a resurgence of zebra mussels. Declines in water clarity may be due to decreased populations of Zebra Mussels, or decomposition of organic material (more nutrients in the water).



- In 2017, the Big Cedar Stewardship Association approved covering the cost of some additional eColi testing. Prior to that date, Rudi Harner had done sampling of one site near his cottage for a number of years (labelled as site 620), and this has been published in the annual publication that is put out by the Kawartha Lake Stewards Association (KLSA) in their Annual Lake Water Quality Report. Big Cedar Lake has consistently reported low readings for this site, and this reflects positively to others looking at the health of our lake.
- When we chose the additional sites, we chose areas that were thought to be potential issues (such as bays where there are a high numbers of cottagers). We also chose both inlets of our lake to ensure eColi is not being introduced into our lake from upstream. In 2020, we started the reporting of all 6 sites to KLSA for inclusion in their publication (we realized a significant cost break by doing this) so we renumbered the sites to fit with the "640" that was already being reported.

eColi Testing – Results (cfu/100ml)

Sample Site	08-Aug-17	01-Jul-18	25-Jul-18	05-Aug-18	10-Aug-18	26-Aug-18	03-Jul-19	26-Jul-19	29-Jul-19	07-Aug-19	12-Aug-19	02-Sep-19	03-Jul-20	17-Jul-20	29-Jul-20	04-Aug-20	18-Aug-20	08-Sep-20	05-Jul-21	19-Jul-21	27-Jul-21	03-Aug-21	16-Aug-21	07-Sep-21	04-Jul-22	25-Jul-22	02-Aug-22	15-Aug-22	07-Sep-22	04-Jul-23	17-Jul-23	08-Aug-23	21-Aug-23	06-Sep-23
#600 – Base of Hungry Bay (near shore)	2	0	2	0	1		2			1		0	12	6	0	3	7	5	4	4	7	4	7	2	4	60	301	1		0				
#600a - Base of Hungry Bay (near 600)																												1						
#600b - Base of Hungry Bay (near 600 in bay)																												3						
#600c - Base of Hungry Bay (near 600)																												12	2		26	13	5	5
#610 – Inlet in Sunset Bay	0	0	0	0	0		0			0		0	1	0	0	1	1	1	4	4	0	0	0	0	0	4	0	4	1	0	2	2	0	1
#620 – Inlet behind McGill Island	1	0	7	0	3		1			1		6	0	4	3	1	8	1	0	3	9	1	1	1	3	13	4	3	10	1	6	5	1	30
#630 – In front of camp, east end of lake	0	0	2	0	0		0			1		1	0	1	1	0	0	0	3	2	0	2	1	0	21	2	5	2	2	2	0	1	8	0
#640 – Cole's Bay (prev reported by KLSA)	0	0	0	0	1	1	11	0	2	2	1	1	3	4	4	3	1	0	1	0	2	8	0	0	0	39	5	3	4	3	1	1	2	0
#650 – Base of Bolton's Bay (near shore)	1	1	2	0	0		0			2		1	0	0	8	7	2	2	7	1	2	4	#	4	4	173	5	7	1	0	1	4	2	0

Testing on 17-Jul-23 and 08-Aug-23 was after a heavy rain which occurred the previous day, so high counts are likely to be from run-off
06-Sep-23 was after a period of no rain in the past 48 hours, so high count could be water fowl

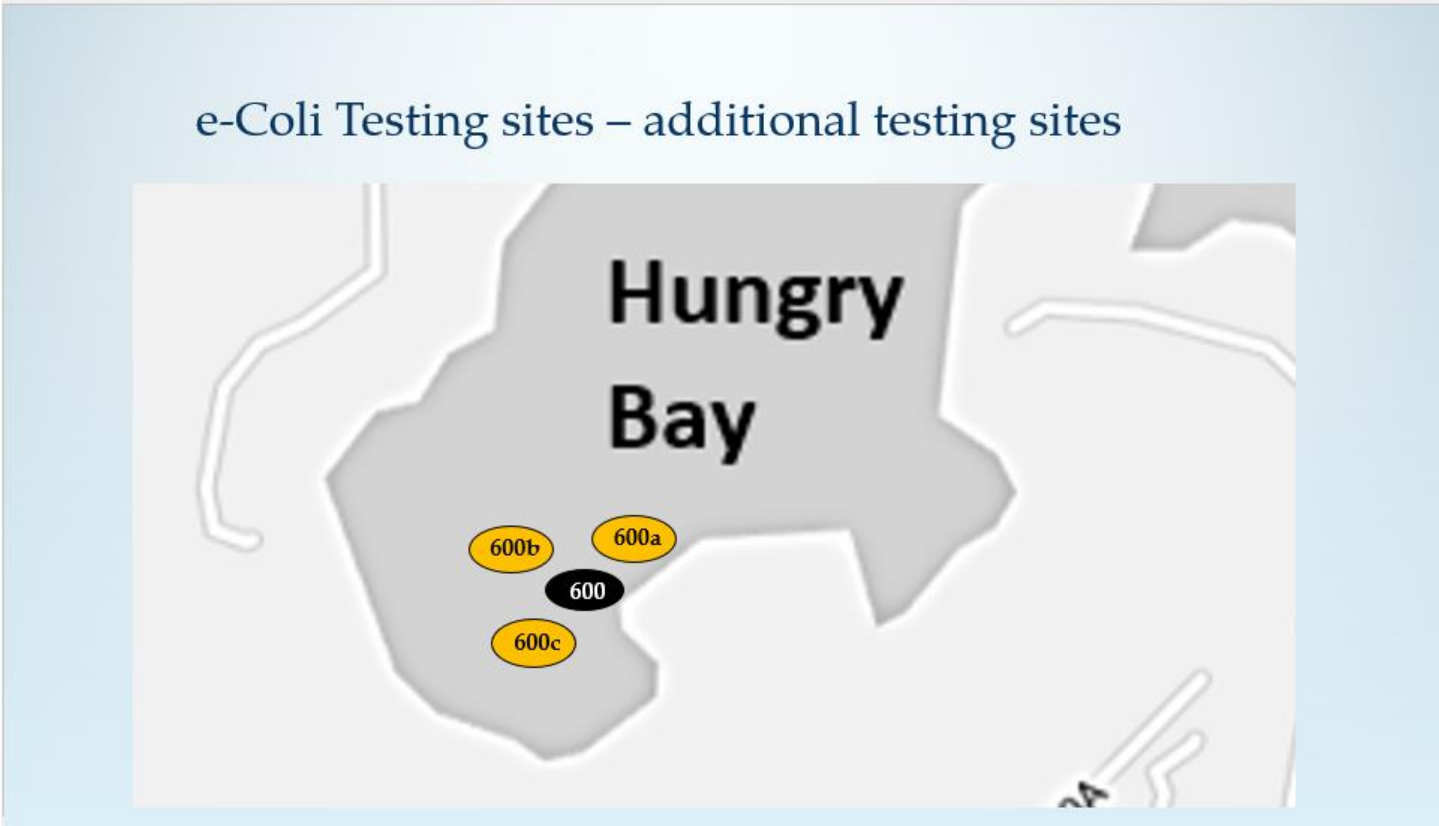
* KLSA considers counts over 50 cfu/100mL as "high" for Kawartha Lakes and triggers retesting. Counts 20 and below (with occasional between 20-50) are normal for Kawartha Lakes. The safe swimming level (at which public beaches are posted) is 100 cfu/100mL. Count of zero for drinking water.

- The chart above shows the results reported based on the samples done at various points on the lake each year from 2017 through 2023. Most of the low / non-zero readings can easily be accounted for by non-human sources (such as bird droppings, run-off, etc.)

- In 2022, one of the eColi tests was done after a heavy rainfall in late July, which resulted in much higher values being reported. In subsequent tests, all but one of the sites had returned to lower near-normal levels. The site in Hungry Bay that remained high (and was in fact even higher in the second test) was tested with 3 additional eColi tests taken in the vicinity of the site, to understand the high values better.

- In 2023, it was decided (after the first test) to continue with the site that had reported high values. This site continued with the high eColi levels each time there was a significant rainfall prior to testing.

- These high values after heavy rainfall emphasize the importance of keeping a natural shoreline; not only to keep the waterfowl from coming up onto your property, but also to act as a filter for run-off into the lake. Note that a number higher than 50 cfu/100 mL is considered "high" for Kawartha Lakes, and the safe swimming level (at which public beaches are "posted") is 100 cfu/100mL.



- This map shows the approximate location of the testing sites in Hungry Bay.

Trent Advanced Water Nutrient Analysis

	Sp Con						pH						Secchi					
	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022
Big Cedar Lake	188	189	199	199	189	194	8.23	8.19	8.42	7.47	7.47	8.23	4.64	5.5	3.88	6	5.5	5.5
Surrounding Lakes (NORKLA)																		
Min	34.9	34.2	34.2	32.3	12.8	13.6	7.07	7.07	6.35	6.25	6.81	6.37	2.71	1.5	2.13	4.5	2.5	2.5
Max	188	222	205	199	223	206	8.23	8.42	8.42	7.77	8.48	8.28	4.64	5.63	5.4	6.5	6.75	9.5

	CHL						PP						TP					
	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022	2017	2018	2019	2020	2021	2022
Big Cedar Lake	2.98	3.75	3.13	1.34	2.65	6.03	1.76	4.55	5.48	3.24	2.69	3.97	6.33	3.21	5.81	11.16	5.64	4.29
Surrounding Lakes (NORKLA)																		
Min	2.8	1.34	1.07	0.88	1.56	2.01	0.99	2.30	1.11	2.15	0.77	1.69	5.15	2.4	1.38	4.6	2.05	2.51
Max	5.19	10.3	6.1	5.06	9.11	12.3	2.75	12.3	10	5.44	5.75	5.46	9.26	9.78	5.81	15.07	15.1	11.4

- In 2017, the North Kawartha Lake Association (NORKLA) set up some more in-depth water testing, in association with Dr. Frost from Trent University, Big Cedar Lake participated in these tests, in order to supplement the water testing currently being done. Our Big Cedar Lake Association has funded this additional testing for Big Cedar Lake each year since.
- The chart above summarizes the results of this additional water testing, and shows the results of Big Cedar for 2017 through 2022, as well as providing a comparison to the other NORKLA lakes that participated in this testing. The following reviews summarizes each of the findings.
- The first data item is **Conductivity** – which is somewhat self-explanatory, it is the opposite of resistance. This is created by dissolved solids and is an indication of the ability of the lake to sustain/create aquatic life, especially crustaceans. Our lake is on the high end of this scale, but these high numbers are not high enough to be a concern (a salt-water lake would not be desirable).
- Next is Acidity/Alkalinity which is measured in a base-10 logarithmic scale from 0 to 14 (where for instance 7 is 10 times more than 6). Seven is neutral, below 7 is acidic. It is better to be higher than 7, up to 9 which is slightly Alkaline. This is affected by Acid rain vs a limestone run-off which is a Base. Big Cedar is at the higher end of the lakes in our area as a Base, which is good.
- The Secchi measurement is the same clarity measurement done twice a month that was presented above, but this chart shows that our lake is on the high end of clarity of lakes in the area. A Secchi depth of less than 2 m would be of concern.
- CHL or Chlorophyll is a measurement of algae, the “green stuff” and other plant particulates. Big Cedar is on the low side of this one as well, which may be attributed to zebra mussels. Values close to or below 5 mg/L are generally considered good and a sign of low algal bio-mass.
- The last two measurements have to do with Phosphorus. Particulate Phosphorus is that which is suspended in water, and the last is the total Phosphorus. Phosphorus is from soaps and fertilizers (Reminder: it is important to always use phosphate free soaps etc.) so low levels of phosphorus are optimal. Plant life (eg. algae) need phosphorus thus high levels may cause algae to be worse.

Trent Advanced Water Nutrient Analysis

Legend of Measures:	Units:	Better high (⇧) or low (⇩)?
Sp Con - Specific Conductivity	uS/m	
DO - Dissolved Oxygen	mg/L	⇧
Temp -Temperature	Celsius	
pH - Acidity/Alkalinity	pH scale	⇧ to 9
TSS - Total Suspended solids	mg/L	
CHL - Chlorophyll	ug/L	
Secchi - Clarity	m	
SRP - Soluble Reactive Phosphorus	ug/L	⇩
PP - Particulate Phosphorus	ug/L	⇩
TP - Total Phosphorus	ug/L	⇩

NORKLA Lakes:
Anstruther
Big Cedar
Chandos
Coon
Eel
Jacks
Long
Looncall
Loucks
Upper Stoney
Wolf

- This chart gives the units for each of the measures in the previous chart, indicates whether it's better for that measure to be on the high side or low side, and also lists the NORKLA lakes that are included in these data.