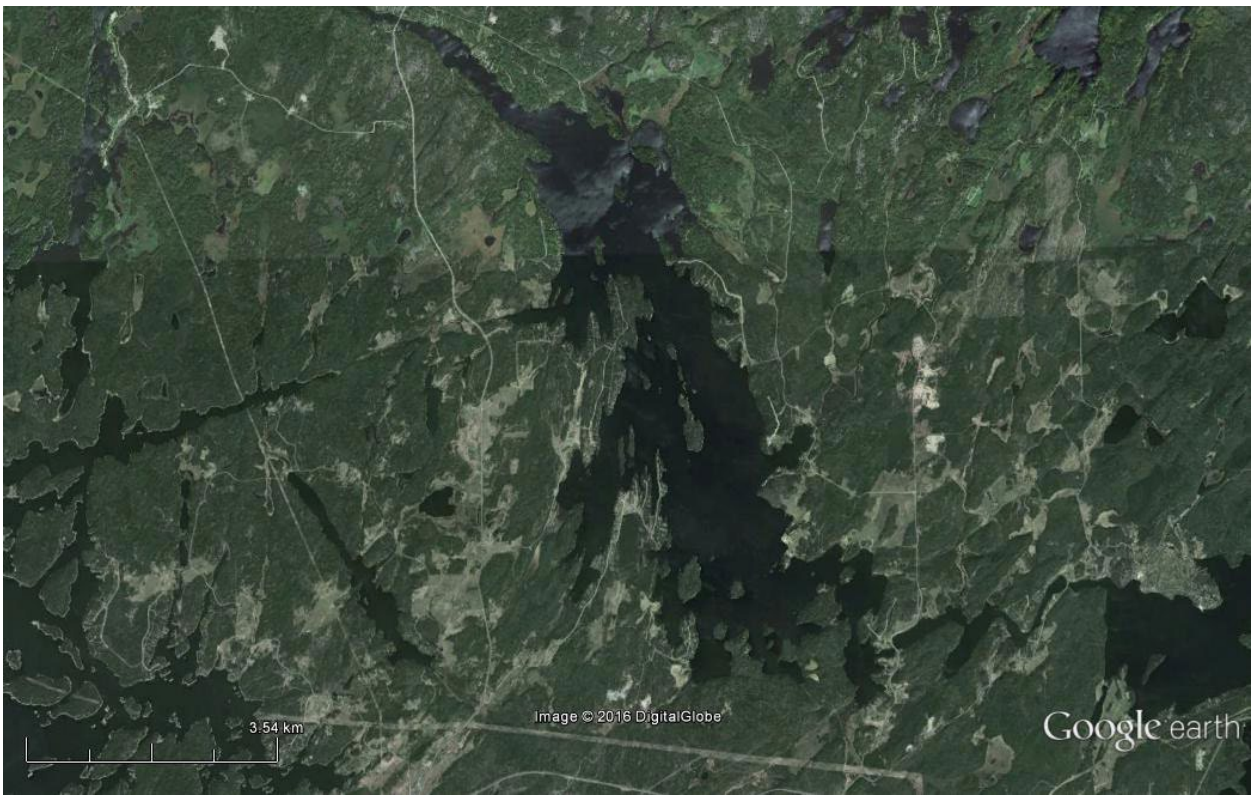

BLACK STURGEON LAKES WATER QUALITY MONITORING

2024 REPORT

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Planner

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1.0 BACKGROUND

In the fall of 2007, the City of Kenora was presented with the results of the *Lake Capacity and Management Study for Black Sturgeon Lake*. One of the recommendations of this study was to conduct ongoing water quality assessments on Lower Black Sturgeon Lake to monitor changes to the water quality in the lake.

In 2009 and 2010, the City of Kenora awarded the contract to conduct the baseline data work for the first two years of water quality monitoring on Black Sturgeon Lakes to Ryan Haines Consulting. From 2015 to 2022, the water quality assessment contract was awarded annually to Kenora Resource Consultants Inc. (note – Ryan Haines Consulting was incorporated into Kenora Resource Consultants Inc. in 2012). In June of 2024, Ryan Haines was hired by the City of Kenora as a Planner and, subsequently, the 2024 Black Sturgeon Water Quality Assessment was conducted in-house with technical support from the Grand Council Treaty #3 Territorial Planning Unit.

2.0 METHODOLOGY

Two sampling sessions were conducted during the 2024 season, a spring session on June 7th and a late summer session on August 22nd. Water samples were taken at two locations on Lower Black Sturgeon Lake and one location at Upper Black Sturgeon during each sampling session. Sample locations on Lower Black Sturgeon correspond to sites identified in the *Lake Capacity and Management Study for Black Sturgeon Lake*. A site on the western end of Upper Black Sturgeon Lake was added during the 2010 sampling season to help to better understand potential sources of the higher nutrient levels found at the upstream site on Lower Black Sturgeon.

The selection of the site locations has been designed to determine the impacts of development on the water quality of Black Sturgeon Lakes. Site 2 is located at the outlet of Black Sturgeon Lakes into the Winnipeg River, Site 3 is located at the inlet of Black Sturgeon Creek into Lower Black Sturgeon Lake, and Site 4 is located at the outlet of Upper Black Sturgeon Lake (Figure 2) into Black Sturgeon Creek. Site 2 is the main sampling location used to assess the impacts of development on water quality because the new and proposed developments on Lower Black Sturgeon Lake are occurring upstream of this site.

All fieldwork was conducted from a small motorboat with a sonar unit mounted to the stern. At each sampling site, an anchor was used to keep the boat in one location.

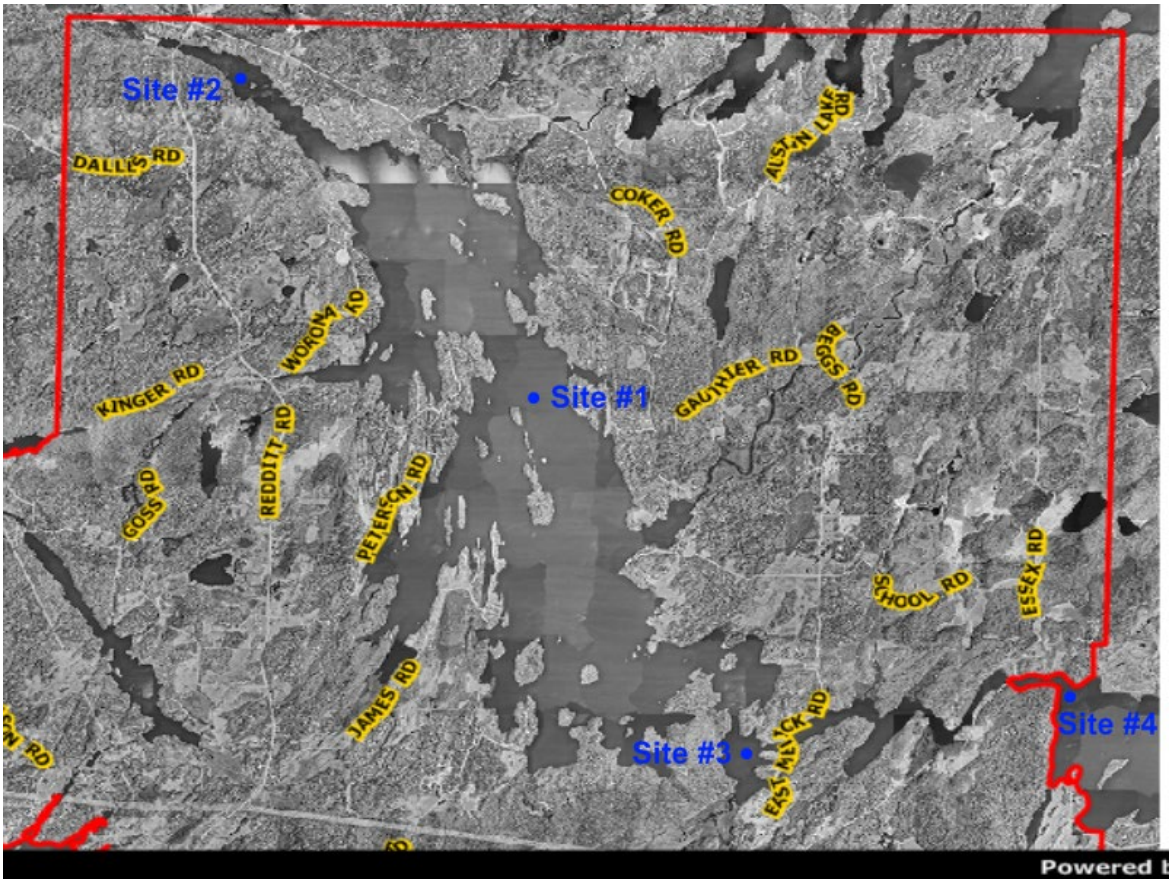

Figure 2 – Sampling Sites for Water Quality Monitoring on Black Sturgeon Lakes

2.1 Spring Sampling

During the spring sampling session, the focus was on the euphotic zone (surface water) sampling to capture spring turnover or mixing of the lake. The spring fieldwork consisted of recording Secchi depths and collecting euphotic zone composites at sites #2, #3, and #4.

Secchi depth was determined at each site by lowering a Secchi disk (20-cm disk with alternating black and white quadrants) over the shaded side of the boat (Figure 3). The disk was lowered until the observer could no longer distinguish between the white and black quadrants and then raised until the disk came back into view. This was repeated three times and then the depths at which the disk disappeared and then reappeared were averaged to give the Secchi depth.

The euphotic zone is the section of the water column where enough light penetrates to facilitate algae growth (measured as 2X the Secchi depth). In order to obtain a water sample containing water from the euphotic zone, a weighted, 500 mL, small neck bottle was lowered with a rope in the water column to a depth of 2X Secchi depth then quickly brought to the surface. The euphotic composite water was then transferred to the sample bottle

provided by the laboratory for shipping (Figure 4). For the two Lake Partner Program sampling sites, the water was filtered with an 80-micron filter as it was poured into the sampling bottles.

Figure 4 – Transferring water sample from euphotic zone composite into lab sample bottle

2.2 Late Summer Sampling

Late summer sampling included all of the fieldwork conducted during the spring (Secchi depths and euphotic zone composite water sampling), but with the addition of temperature/oxygen profiles and bottom water column samples to measure the impacts of the summer thermal stratification and oxygen depletion on water quality.

Temperature/oxygen profiles were obtained at Sites #2, #3, and #4 during the late summer sampling session using a YSI 55 Dissolved Oxygen Meter.

During the later summer sampling session, an additional water sample was taken at sites #2, #3, and #4 approximately one meter from the bottom of the lake using a Beta horizontal water sampler (Figure 5). Both ends of the water sampler were opened prior to lowering it

(using a rope) to the desired water depth. At the desired depth, a small weight (messenger) was sent down through the water column along the length of the rope triggering a release mechanism on the sampler and causing the sampler caps to close.

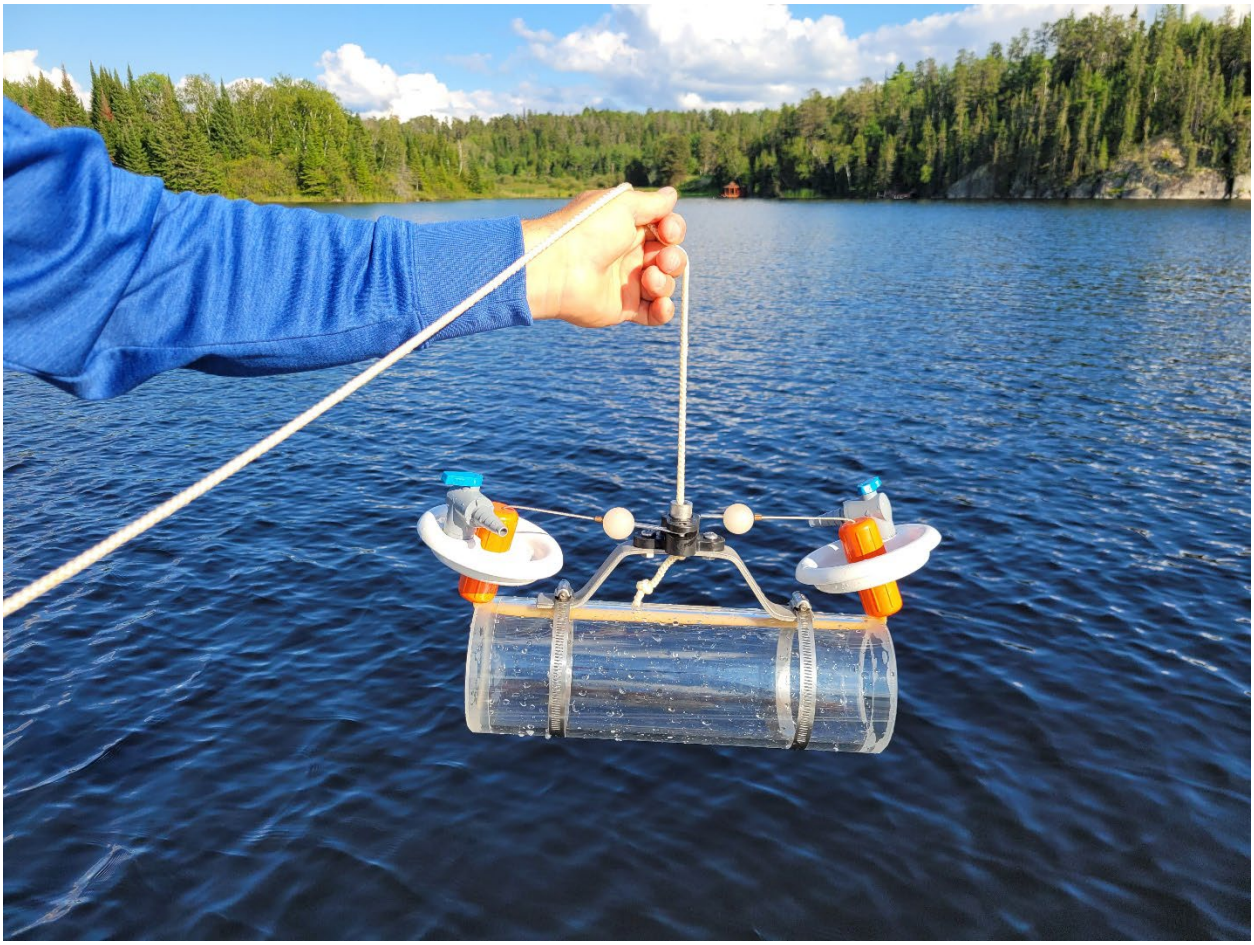

Figure 5 – Horizontal Beta Sampler prior to deployment

All water samples collected were transferred immediately upon collection to sample bottles for analysis at a laboratory. Samples were delivered by vehicle to the ALS Laboratory Group in Winnipeg, MB, for analyses.

3.0 RESULTS

3.1 Sampling Session Dates and Locations

The 2024 sampling sessions were conducted on June 7th and August 22nd. 2024.

3.2 Total Phosphorous

During 2024, the spring turnover euphotic zone phosphorous concentrations taken at Site 2 (0.0123 mg/L), Site 3 (0.0138 mg/L), and Site 4 (0.0112 mg/L) were all below the provincial water quality objective (PWQO) of 0.0200 mg/L (Figure 6).

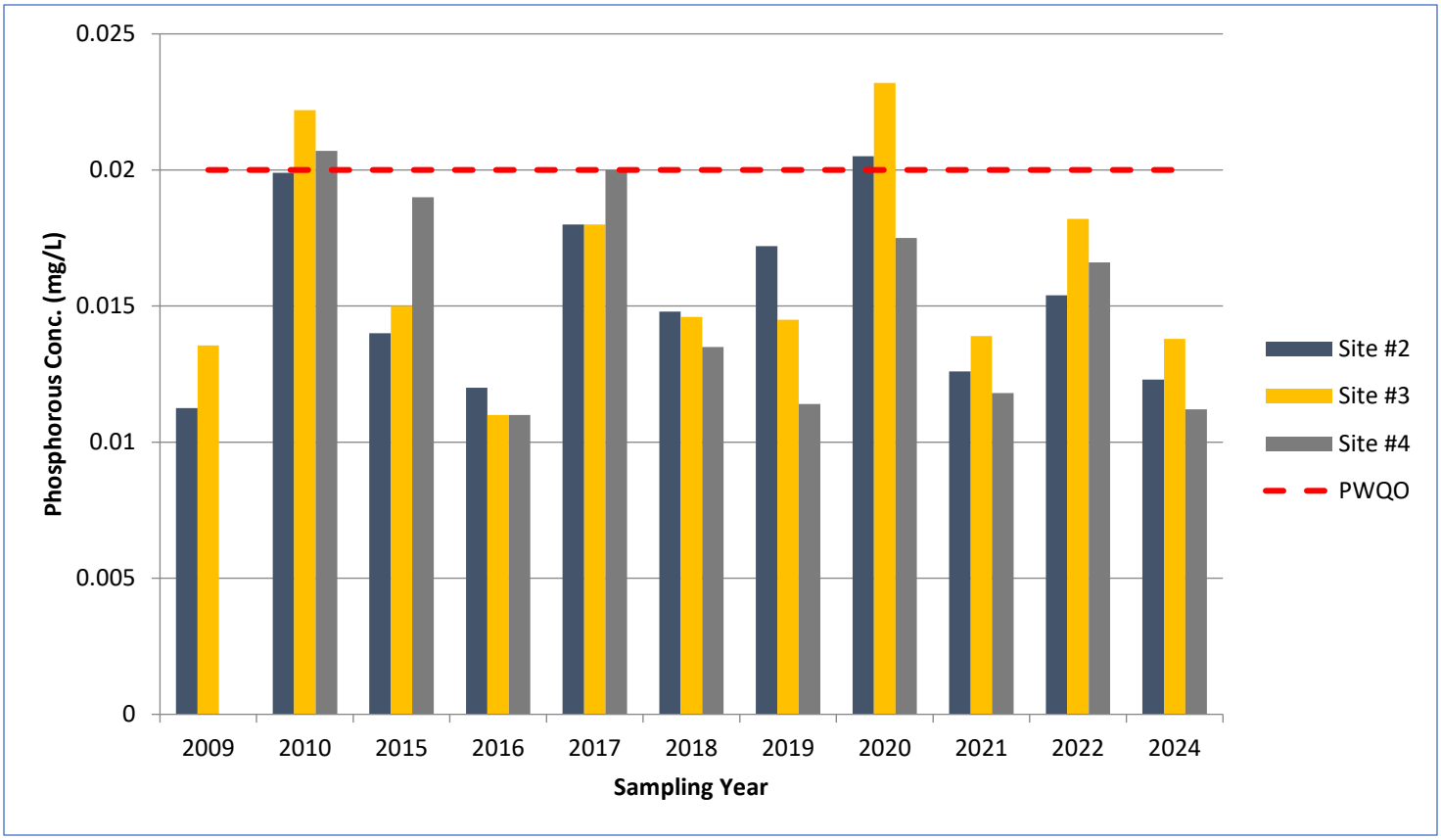

Figure 6 – Spring Turnover Total Phosphorous Concentrations for Three Sampling Sites on Black Sturgeon Lakes from 2009 to 2024.

3.3 Chemical Analyses - Water Quality Characteristics

The spring turnover water samples were analyzed for 54 parameters encompassing dissolved organic carbon, colour, pH, alkalinity, turbidity, and scans for cations/anions and trace metals. The 2024 results for Site 2 (outlet of Black Sturgeon Lakes and downstream of new development activities) were comparable to the results for the other 10 sampling seasons and were all within the provincial water quality objectives (PWQO) for the parameters where an objective is provided. The full results can be found in Appendix 1.

The results at Site #2 in 2024 were the lowest to date for five parameters; aluminum (0.0384 mg/L), barium (0.00742 mg/L), iron (0.056 mg/L), selenium (0.000074 mg/L) and total dissolved solids (22.6 mg/L) as well as highest for four parameters; chloride (4.41 mg/L), dissolved organic carbon (9.16 mg/L), total organic carbon (8.82 mg/L), and UV transmittance (62.4 %T).

4.0 DISCUSSION

4.1 Total Phosphorous

The total phosphorous readings that are of the most interest for water quality analyses are the ones taken during spring turnover. The reason for this is that turnover is when the phosphorous is mixed throughout the water column and provides an indication of overall phosphorous concentrations in the waterbody. Spring turnover is also when past phosphorous concentrations (i.e. Lake Partner Program) have been measured, which enables analysis of trends over time using a larger database over a longer time period.

The Ontario provincial water quality objective for total phosphorous concentrations is less than 20 µg/L (0.02 mg/L) "to avoid nuisance concentrations of algae in lakes" (MOE 1994). The 2024 spring sampling results for phosphorous concentrations were all below the provincial water quality objective (PWQO) of 0.0200 mg/L: Site 2 (0.0123 mg/L), Site 3 (0.0138 mg/L), and Site 4 (0.0112 mg/L). The phosphorous concentration at the outlet of Black Sturgeon Lakes (Site 2) was the second lowest recorded since sampling began in 2010.

The third sampling site on Upper Black Sturgeon Lake (site #4) was added for the 2010 and subsequent sampling seasons to help determine the potential source of higher levels of phosphorous found at the inlet of Black Sturgeon Lake (site #3) when compared to the outlet (site #2). Consistent with previous years, during the 2024 sampling season it was found that Lower Black Sturgeon had greater concentrations of phosphorous entering the water body at site #3 than leaving it at site #2. This indicates that there was a source of phosphorous in the wetland area and/or development area between Upper and Lower Black Sturgeon Lakes.

4.2 Chemical Analyses - Water Quality Characteristics

The spring turnover water samples were analyzed for 54 parameters and these were all within the provincial water quality objectives (PWQO) for the parameters where an objective is provided.

The results at Site #2 in 2024 were the lowest to date for five parameters; aluminum (0.0384 mg/L), barium (0.00742 mg/L), iron (0.056 mg/L), selenium (0.000074 mg/L) and total dissolved solids (22.6 mg/L) as well as highest for four parameters; chloride (4.41 mg/L), dissolved organic carbon (9.16 mg/L), total organic carbon (8.82 mg/L), and UV transmittance (62.4 %T).

5.0 SUMMARY

The phosphorous levels at Site #2, Site #3, and Site #4 are below the 0.02 mg/L provincial water quality objective (PWQO). This is the eleventh year of water sampling on Black Sturgeon Lakes and the phosphorous results have been below the PWQO for nine of these years, including the past three sampling seasons.

The 2024 sampling results for sites #2, #3, and #4 for the full suite of water quality parameters were all within the PWQO for the parameters where an objective is provided.

The results collected and analyzed as part of the Black Sturgeon Lakes water sampling program from 2009 to 2024 do not provide any indicators of negative impacts of development activities on water quality within Lower Black Sturgeon Lake.

6.0 REFERENCES

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Riemersma, S., Little, J., Ontkean, G., and Moskal-Hébert, T. 2006. Phosphorus sources and sinks in watersheds: A review. 82 pp. In Alberta Soil Phosphorus Limits Project. Volume 5: Background information and reviews. Alberta Agriculture, Food and Rural Development, Lethbridge, Alberta, Canada

APPENDIX 1 – 2010 TO 2024 LABORATORY RESULTS FOR WATER QUALITY CHARACTERISTICS

2010 TO 2024 Laboratory Results for Water Quality Characteristics – SITE #2 (OUTLET OF LOWER BLACK STURGEON LAKE)

Parameter	2010	2015	2016	2017	2018	2019	2020	2021	2022	2024	Unit	PWQO
Alkalinity, Bicarbonate (HCO3)	21.3	16.8	26.5	21.2	20.5	24.4	24	20.5	19.4	19.6	mg/L	
Alkalinity, Carbonate (CO3)	<	<	<	<	<	<		<0.60	<0.60		mg/L	
Alkalinity, Hydroxide (OH)	<	<	<	<	<	<		<0.34	<0.34	<1.0	mg/L	
Total Alkalinity (CaCO3)	17.5	16.8	21.7	17.4	16.8	20	19.7	16.8	15.9		mg/L	
Chloride (Cl)	<	3.76	4.16	3.86	3.83	4.35	4.09	4.37	4.24	4.41	mg/L	
Flouride (F)	0.15	0.037	0.044	0.045	0.042	0.043	0.040	0.04	0.047	0.042	mg/L	
Sulphate (SO4)	<	1.93	1.97	1.81	1.58	2.34	1.61	1.72	1.73	1.69	mg/L	
Colour, True	20	18	24.2	30.1	29	19.7	26.5	19.9	27.0	18.7	CU	
Dissolved Organic Carbon	8.7	7.5	7.78	8.14	8.84	7.73	8.17	8.2200	8.66	9.16	mg/L	
Turbidity	1.2	1.1	1.31	1.34	1.28	1.81	1.35	1.07	1.28	1.24	NTU	
pH	7.3	7.44	6.78	7.11	7.44	7.3	7.58	7.41	7.14	7.22	pH units	6.5 - 8.5
Aluminum (Al)-Total	0.044	0.0513	0.0655	0.0641	0.0452	0.0489	0.0591	0.0564	0.0736	0.0384	mg/L	0.075
Antimony (Sb)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.02
Arsenic (As)-Total	<	0.00032	0.003	0.00037	0.00036	0.00042	0.00038	0.00030	0.00032	0.00038	mg/L	0.005
Barium (Ba)-Total	0.00832	0.00845	0.00822	0.00808	0.00764	0.00821	0.00780	0.00796	0.00808	0.00742	mg/L	n/a
Beryllium (Be)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.011
Bismuth (Bi)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	n/a
Boron (B)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.2

Parameter	2010	2015	2016	2017	2018	2019	2020	2021	2022	2024	Unit	PWQO
Cadmium (Cd)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.0001
Calcium (Ca)-Total	5.05	5.77	5.25	5	4.85	5.01	5.12	5.18	5.25	4.90	mg/L	n/a
Cesium (Cs)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	n/a
Chromium (Cr)-Total	<	<	<	<	0.00023	0.00018	0.00021	0.00021	0.00021	<	mg/L	0.001
Cobalt (Co)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.0009
Copper (Cu)-Total	0.00073	0.00087	0.00062	0.00116	0.00088	0.00078	0.00081	0.00089	0.00087	0.00076	mg/L	0.001
Iron (Fe)-Total	0.065	<	0.111	0.119	0.097	0.097	0.104	0.084	0.126	0.056	mg/L	0.3
Lead (Pb)-Total	<	0.0001	<	<	<	0.000050	0.000626	<	<	<	mg/L	0.001
Lithium (Li)-Total	n/a	<	<	<	0.0013	0.0012	0.0013	0.0013	<0.0010	0.0012	mg/L	n/a
Magnesium (Mg)-Total	1.5	1.79	1.61	1.62	1.63	1.82	1.82	1.65	1.54	1.60	mg/L	n/a
Manganese (Mn)-Total	0.00496	0.00529	0.0151	0.0127	0.00929	0.0113	0.00859	0.00695	0.0113	0.00376	mg/L	n/a
Molybdenum (Mo)-Total	<	<	<	<	0.000066	<	0.000079	<	0.000053	<	mg/L	0.04
Nickel (Ni)-Total	0.00048	<	<	<	0.00065	0.00057	0.00061	0.00056	0.00060	<	mg/L	0.025
Phosphorus (P)-Total	0.0157	0.014	0.012	0.018	0.0148	0.0172	0.0205	<0.050	<0.050	<	mg/L	0.02
Potassium (K)-Total	0.954	1.08	0.995	1.02	0.968	0.980	1.02	0.913	0.885	0.986	mg/L	n/a
Rubidium (Rb)-Total	0.00161	0.00202	0.00193	0.00198	0.00194	0.00189	0.00194	0.00200	0.00188	0.00190	mg/L	n/a
Selenium (Se)-Total	<	<	<	<	0.000131	0.000116	0.000090	0.000098	0.000133	0.000074	mg/L	0.1
Silicon (Si)-Total	1.16	0.88	1.07	1.43	0.7	0.80	1.31	1.10	1.25	0.91	mg/L	n/a
Silver (Ag)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.0001
Sodium (Na)-Total	2.53	3.25	3.07	3.04	3.1	3.27	3.48	3.50	3.12	3.33	mg/L	n/a

Parameter	2010	2015	2016	2017	2018	2019	2020	2021	2022	2024	Unit	PWQO
Strontium (Sr)-Total	0.0219	0.0239	0.023	0.0244	0.0234	0.0231	0.0240	0.0225	0.0209	0.0222	mg/L	n/a
Tellurium (Te)-Total	<	<	<	<	<	<	<	<	0.00024	<	mg/L	n/a
Thallium (Tl)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.0003
Thorium (Th)-Total	n/a	<	<	<	<	<	<	<	<	<	mg/L	n/a
Tin (Sn)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	n/a
Titanium (Ti)-Total	0.00094	0.00124	0.00162	0.00136	0.00099	0.00091	0.00110	0.00106	0.00202	0.00105	mg/L	n/a
Tungsten (W)-Total	<	<	<	<	<	<	<	<	<	<	mg/L	0.03
Uranium (U)-Total	<	<	<	<	0.000089	0.000072	0.000087	0.000070	0.000072	0.000061	mg/L	0.005
Vanadium (V)-Total	<	0.0002	0.00022	0.00023	<	<	0.00059	<	<	<	mg/L	0.006
Zinc (Zn)-Total	<	<	<	<	<	<	0.0065	<	<	<	mg/L	0.03
Zirconium (Zr)-Total	<	<	<	<	0.000122	0.000060	<	<	<	<	mg/L	0.004
Nitrate	n/a	<	0.049	0.0623	<	0.0276	<	0.0074	0.043	<	mg/L	
Nitrate + Nitrite	0.057	<	n/a	<	<	<				<	mg/L	
Nitrite	n/a	<	<	<	<	<	<	<	<	<	mg/L	
Total Kjeldahl Nitrogen	n/a	0.37	0.35	0.38	0.29	0.58	0.42	0.33	0.41	0.387	mg/L	
Total Nitrogen Calculated	n/a	0.37	n/a	0.38	0.29	0.58	0.42	0.33	0.41	0.387	mg/L	
Total Organic Carbon			8.14	7.84	8.11	7.57	8.41	8.18	8.47	8.82	mg/L	
Phosphorus (P)-Total	0.0157	0.014	0.012	0.018	0.0148	0.0172	0.0205	0.0126	0.0154	0.0123	mg/L	0.02
UV Transmittance			58.6	55.1	54.7	60.3	56.0	60.3	57.4	62.4	% T	

Parameter	2010	2015	2016	2017	2018	2019	2020	2021	2022	2024	Unit	PWQO
Total Dissolved Solids			52	42.6	45.3	39	40.9	27.6	32.0	22.6	mg/L	
Langelier Index 4C			-2.7	-2.5	-2.2	-2.2	-2	-2.2	-2.5	-2.42		
Langelier Index 60C			-1.9	-1.7	-1.4	-1.5	-1.2	-1.4	-1.7	-1.64		
Hardness Calculated	18.8		19.7	19.2	18.9	20	20.3	19.7	19.4	18.8	mg/L	
Conductivity	52.6		57.3	56.4	53.2	54.6	53.9	56.3	54.7	55.6	umhos /cm	
Ammonia (total)				<	<	<	<	<	<	0.0053		
Bromide in Water by IC			<		<	<	<	<	<	<	mg/L	

< - concentrations are below the laboratory detection limit

PWQO – Provincial Water Quality Objective