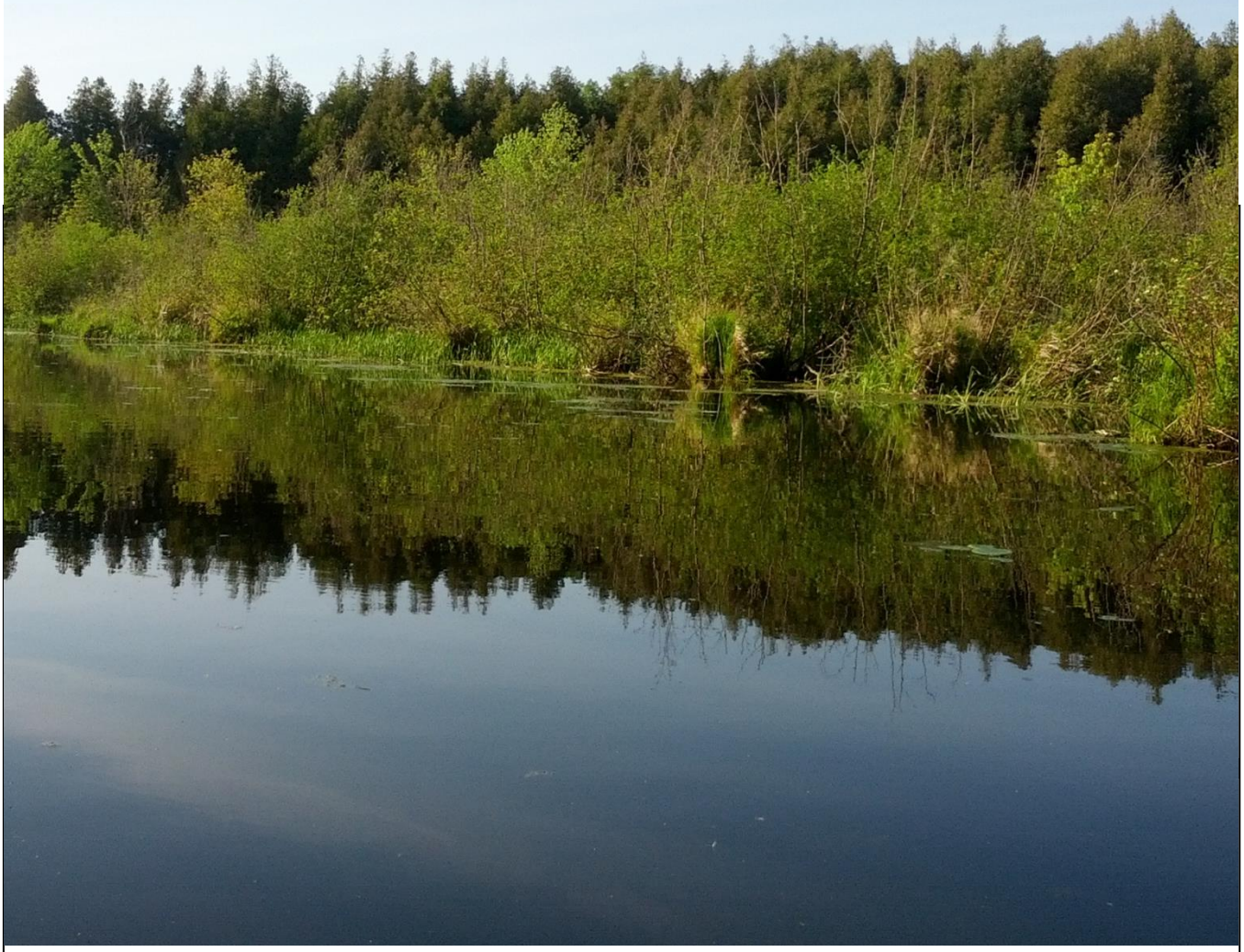
Kawartha Water Watch – Crego Lake

Annual Report

For sampling undertaken in 2019



KAWARTHA CONSERVATION

Discover · Protect · Restore

About Kawartha Conservation

Who we are?

We are a watershed-based organization that uses planning, stewardship, science, and conservation lands management to protect and sustain outstanding water quality and quantity supported by healthy landscapes.

Why is watershed management important?

Abundant, clean water is the lifeblood of the Kawarthas. It is essential for our quality of life, health, and continued prosperity. It supplies our drinking water, maintains property values, sustains an agricultural industry, and contributes to a tourism-based economy that relies on recreational boating, fishing, and swimming. Our programs and services promote an integrated watershed approach that balance human, environmental, and economic needs.

The community we support

We focus our programs and services within the natural boundaries of the Kawartha watershed, which extend from Lake Scugog in the southwest and Pigeon Lake in the east, to Balsam Lake in the northwest and Crystal Lake in the northeast – a total of 2,563 square kilometers.

Our history and governance

In 1979, we were established by our municipal partners under the *Ontario Conservation Authorities Act*.

The natural boundaries of our watershed overlap the six municipalities that govern Kawartha Conservation through representation on our Board of Directors. Our municipal partners include the City of Kawartha Lakes, Region of Durham, Township of Scugog, Township of Brock, Municipality of Clarington, Municipality of Trent Lakes, and Township of Cavan Monaghan.

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Acknowledgements

The Kawartha Water Watch program would not be possible without the hard work, enthusiasm and diligence of its volunteers. Kawartha Conservation would like to thank the volunteers for their hours of time and effort, as well as resources invested into the sampling program.

Funding for this program was provided by the Kinmount Park Estates Association.

WATER QUALITY

Crego Lake Results 2019

			1998-2019			
Parameter	**Provincial Guideline**	**2019 (Avg)**	**Max**	**Min**	**Avg**	**75th ***
pH	6.5-8.5	7.87	8.00	6.50	7.69	8.00
Turbidity	(drinking water) 5 NTU's (JTU's)	1.71	20.00	0	1.48	2.00
Secchi (m)	N/A see glossary	3.16	5.50	1.20	3.02	3.40
Alkalinity (ppm)	Decrease <25% of natural concentration	59.0	180.00	44.00	82.96	90.00
E.coli (CFU's)	100 CFU/100ml	10.7↓	86.00↓	0↓	3.25↓	3.00↓
Total coliform (CFU's)	1000 CFU/100ml	159.3↓	840.0↓	0↓	80.15↓	38.00↓
Total Phos. (mg/l)	0.02 mg/l (lakes)	0.008↓	0.04↑	0.002↓	0.008↓	0.01↓

↑↓ *indicates above or below provincial/federal objective*
**75th percentile - 75% of the sorted values are less than or equal to the value shown*
(Average TP results from the LPP from 2002-2016 = 0.008 mg/l, Secchi 1996-2016=3.64)

2019 Crego Lake Results by site

CRL-1

Sample Date	pH	Turbidity (JTU)	Secchi (m)	Alkalinity (mg/l $CaCO_3$)	E. Coli	Total Coliform	Total Phosphorus (mg/l)
May 18	7.4	5.0	2.0	44.0	NA	NA	NA
June 9	7.7	2.5	3.5	60.0	0↓	108↓	NA
July 14	8.0	1.0	4.1	64.0	4↓	8↓	NA
Aug. 11	8.0	2.0	3.5	60.0	3↓	12↓	NA
Sept. 15	8.0	2.0	4.7**	68.0	4↓	460↓	NA

*(B) Indicates Secchi disk hit the bottom of lake before reading could be taken
***The maximum Secchi value ever recorded at CRL-1 was 4.7*

CRL-2

Sample Date	pH	Turbidity (JTU)	Secchi (m)	Alkalinity (mg/l $CaCO_3$)	E. Coli	Total Coliform	Total Phosphorus (mg/l)
May 18	7.7	2.0	2.0	44.0	NA	NA	NA
June 9	7.7	1.0	3.2	60.0	NA	NA	0.010↓
July 14	8.0	1.0	4.5	60.0	NA	NA	0.008↓
Aug. 11	8.0	2.0	3.5	60.0	NA	NA	0.103↓
Sept. 15	8.0	1.75	4.4	64.0	NA	NA	0.007↓

**The maximum Secchi value ever recorded at CRL-2 was 5.5*

CRL-3

Sample Date	pH	Turbidity (JTU)	Secchi (m)	Alkalinity (mg/l $CaCO_3$)	E. Coli	Total Coliform	Total Phosphorus (mg/l)
May 18	7.6	2.0	2.0	56.0	NA	NA	NA
June 9	7.7	1.0	3.1	64.0	NA	NA	NA
July 14	8.0	1.75	3.3	60.0	NA	NA	NA
Aug. 11	8.0	1.0	3.3	60.0	NA	NA	NA
Sept. 15	8.0	1.75	B*	64.0	NA	NA	NA

The maximum Secchi value ever recorded at CRL-3 was 3.7

CRL-4

Sample Date	pH	Turbidity (JTU)	Secchi (m)	Alkalinity (mg/l $CaCO_3$)	E. Coli	Total Coliform	Total Phosphorus (mg/l)
May 18	7.7	2.50	2.0	44.0	NA	NA	NA
June 9	7.7	1.75	2.8	60.0	1↓	102↓	NA
July 14	8.0	2.50	B*	56.0	2↓	8↓	NA
Aug. 11	8.0	0	B*	60.0	1↓	4↓	NA
Sept. 15	8.0	0	B*	68.0	4↓	440↓	NA

The maximum Secchi value ever recorded at CRL-4 was 3.0

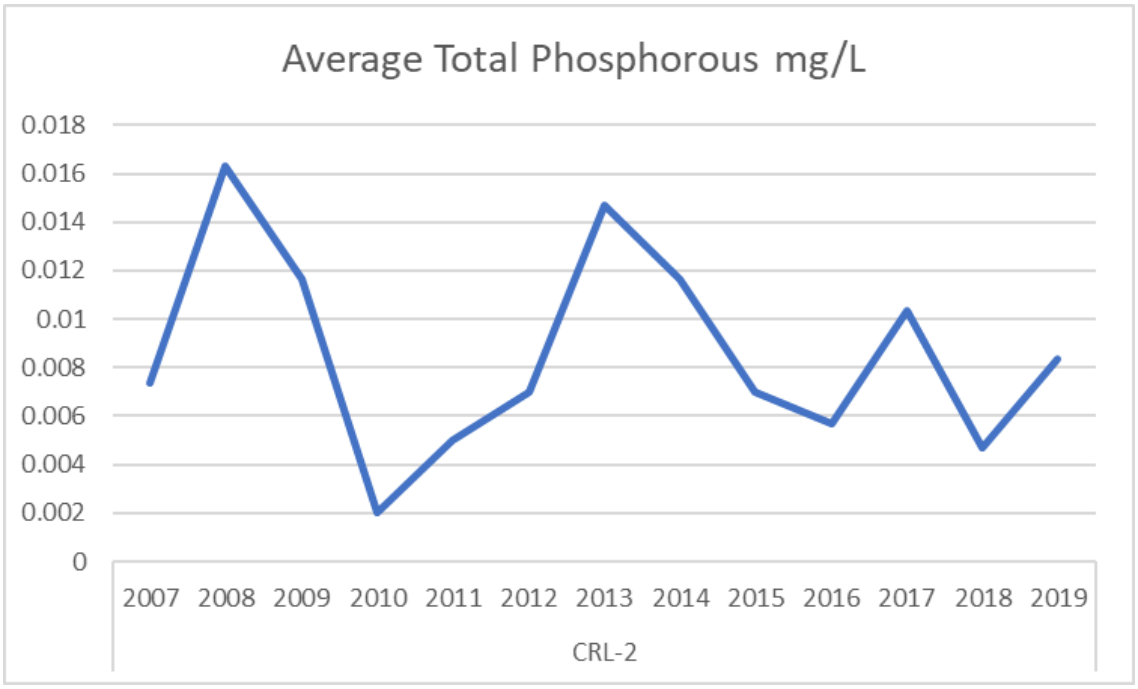
CRL-5

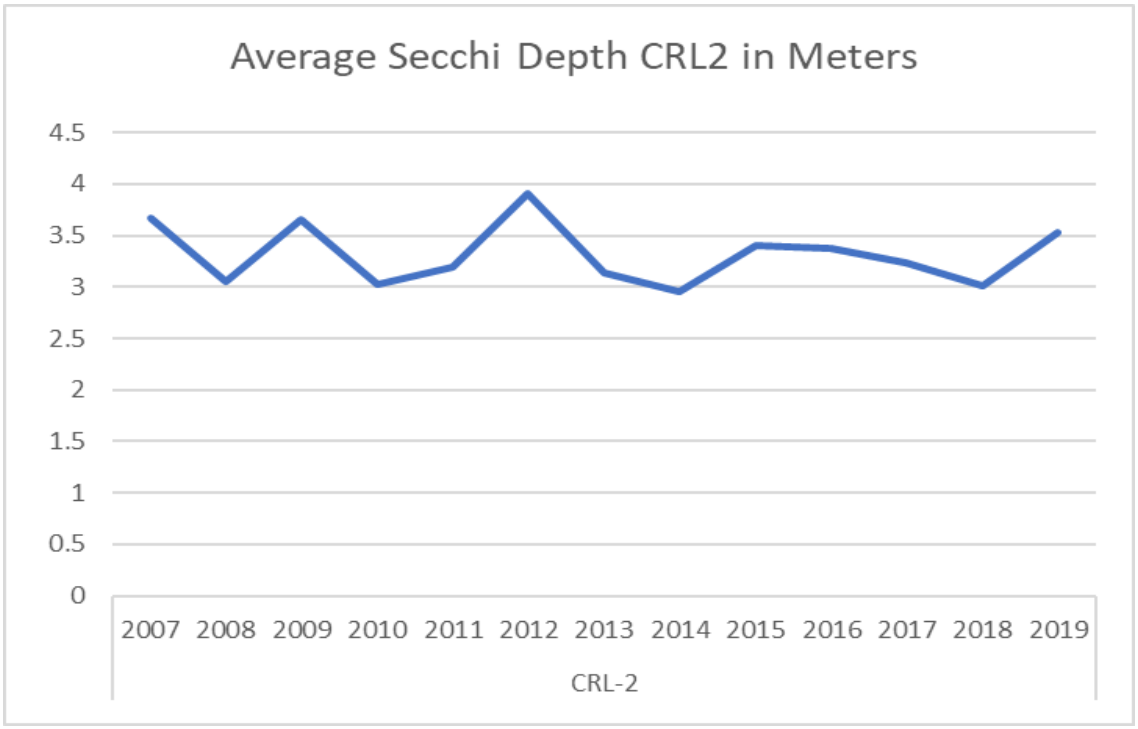
Sample Date	pH	Turbidity (JTU)	Secchi (m)	Alkalinity (mg/l $CaCO_3$)	E. Coli	Total Coliform	Total Phosphorus (mg/l)
May 18	7.8	2.0	1.95	52.0	NA	NA	NA
June 9	7.7	1.75	3.1	56.0	86↓	420↓	NA
July 14	8.0	1.5	B*	60.0	16↓	32↓	NA
Aug. 11	8.0	0	B*	60.0	5↓	18↓	NA
Sept. 15	8.0	1.25	B*	64.0	2↓	300↓	NA

The maximum Secchi value ever recorded at CRL-5 was 3.7

Observations:

- Samples in 2019 indicated that Crego Lake remains consistent and that water quality is very good at all sample locations. Escherichia Coliform and Total Coliform samples were below the provincial guidelines for recreational water and Total Phosphorous remained consistently very low.
- Since 1998 only three samples have exceeded the provincial or federal guidelines in any category, all were Total Phosphorous (TP) samples and the exceedances were 0.012mg/L, 0.016mg/L and 0.003mg/L above the TP guideline of 0.02 mg/L (12, 16 and 3 parts per billion respectively).
- Nutrient levels and Secchi depths indicate that Crego Lakes is a Mesotrophic Lake, which means that it has a medium amount of nutrients, usually has clear water and supports recreational activities such as swimming and fishing.


Average Total Phosphorous mg/L
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
CRL-2


Average Secchi Depth CRL2 in Meters
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019
CRL-2

Benthic Macroinvertebrate Collection 2018

Samples were collected on May 8, 2019 using Ontario Benthos Biomonitoring Network (OBBN) Protocols. The next round of Benthic Sampling is scheduled for the spring of 2020, however the Covid-19 pandemic requires that sampling be rescheduled to May, 2021.

The mean value of the three replicates at each site has been used to calculate the value for each index. Results with an * indicate that not all three replicates contained the standard 100 benthos (bugs).

Crego Lake: CrL-1

Index	2008 Results	2010 Results	2012 Results	2014 Results	2016 Results	2019 Results	Average
Biotic Index (Hilsenhoff)	6.26	6.12*	6.59*	4.67*	5.55	5.48*	5.78
Simpson's Diversity Index	0.73	0.80*	0.68*	0.89*	0.81	0.70*	0.77
% EPT Index	4.64	11.51*	5.66*	20.31*	9.87	50.9*	17.15

Crego Creek (outlet): CC-1

Index	2010 Results	2012 Results	2014 Results	2016 Results	2019 Results	Average
Biotic Index (Hilsenhoff)	5.13	3.58	5.93*	6.01	3.44*	5.16
Simpson's Diversity Index	0.70	0.59	0.57*	0.31	0.58*	0.54
% EPT Index	24.07	53.93	26.24*	10.22	60.32*	28.62

Benthic Macroinvertebrates (Aquatic Insects)

Aquatic insects are good indicators of the health of the aquatic ecosystems. The Hilsenhoff index is not the best indicator for lake samples because it was designed for streams, and therefore habitat can influence the presence or absence of species. The best application of the data is to look for consistency from year to year. The MOECP is developing an index based on Dragonflies and Damselflies, which is more suited to Lake benthic analysis. In 2019, the Lake data shows some variation from the past samples, with a significant increase in Mayflies, which indicates good water quality as Mayflies are somewhat intolerant to pollution relative to many other aquatic insects.

Crego Creek shows a significant improvement for 2019, likely due to seasonal variation with this sample being collected in early May. The average value for Crego Creek indicates excellent conditions based on the Hilsenhoff index.

- Results indicate the Lake is fair and the Creek excellent, with high diversity in the Lake and very high EPT percentages in both the Lake and Creek

- Abundant lake species included Mayflies, Bloodworms and Scuds, with very high numbers of Mayflies.
- At the lake site there was a higher level of species diversity (15 out of 29) than the outlet creek.
- In Crego Creek (lake outlet) there was a low/medium level of species diversity (12 out of 29), however a slightly higher percentage of EPT (not tolerant of pollution) than the lake
- The most abundant species in Crego Creek were Stoneflies (intolerant of pollution) and Blackflies (somewhat tolerant of pollution). Crego Creek flows are quite variable throughout the season and the "excellent" score is a result of the high percentage of Stoneflies, a species that cannot survive oxygen deprivation and would be absent when flows are low or even non-existent.
- Spring temperatures can alter the species composition due to the fact that when the water warms, many aquatic insects "hatch out" and begin the adult phase of their lives at which time they leave the water
- Water chemistry samples indicate that Crego Lake is a healthy body of water
- Comparisons of the Lake samples over time show consistency (species associated with shredding/consuming detritus), however 2019 showed a significant increase in Mayflies, which are slightly intolerant of pollution.
- The Hilsenhoff Index was designed to measure water quality in flowing water which should be taken into consideration when comparing results from Crego Lake and Crego Creek.

Summary: The 2019 benthic sampling indicates a healthy and diverse aquatic insect community and that the water exiting Crego Lake is excellent for supporting aquatic ecosystems.

***Crego Lake and Crego Creek were sampled for Benthics in 2010, 2012, 2014, 2016, 2018 the next round of sampling is scheduled for May, 2020.*

Benthic Figures

Family Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.75	Excellent	Organic Pollution Unlikely
3.76-4.25	Very Good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly Poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.00	Very Poor	Severe organic pollution likely

Simpson's Diversity Index (D)
Diversity within the benthic macroinvertebrate community was described using the Simpson's diversity index ("D"). Its values range from 0, indicating low diversity, to a maximum of 1.

Ephemeroptera, Plecoptera, Trichoptera Richness Index (%EPT)
Ephemeroptera (Mayflies), *Plecoptera* (Stoneflies), and *Trichoptera* (Caddisflies) are all species that are considered to be very sensitive to poor water quality conditions, therefore the presence of these organisms are indicator of good water quality sites. Higher populations of these organisms are an indicator of good water quality sites. Higher populations of these organisms in a sample typically indicate increased stability for the site.

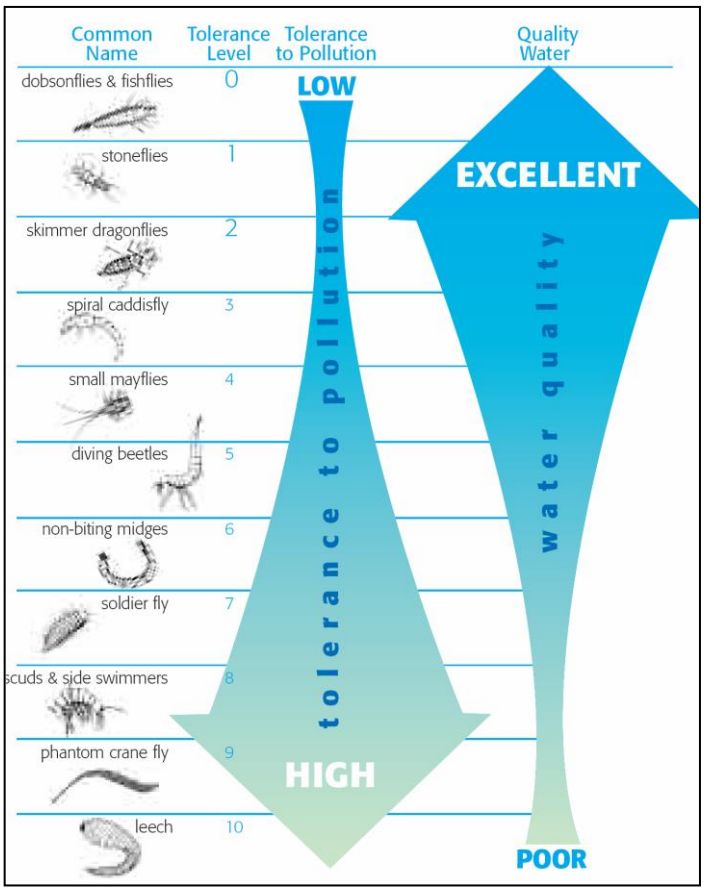
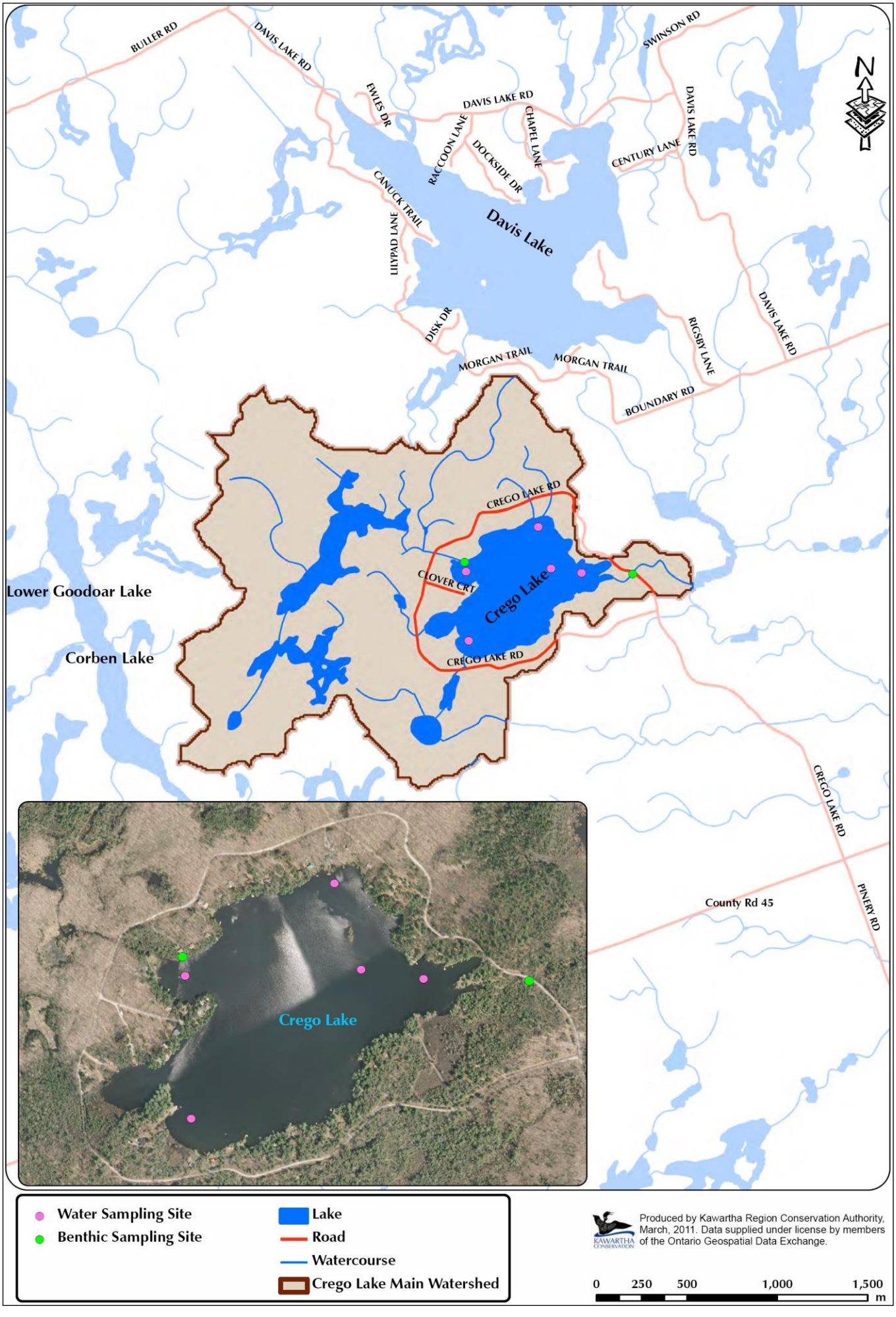


Figure 1.0 – Map of Crego Lake Sample Area



GLOSSARY OF TERMS

pH -pH is a measure of the acidity of a solution. Natural pH values in lakes are typically between 6 and 9, with provincial water quality objectives set at 6.5 to 8.5.

Turbidity – Turbidity is a measure of the amount of particles suspended in water. Sources of natural turbidity include algae blooms, erosion and run-off. Increased turbidity in water decreases the amount of light transmission which can impact the entire aquatic community. There is no provincial objective for recreational surface water, however there are objectives for drinking water using the Nephelometric Turbidity Units (NTU's) method, which is virtually the same as the Jackson Turbidity Units (JTU's) method applied by KWW. The objective is 5 NTU's for water appearance.

Secchi (Clarity) - A Secchi disc is used to measure the depth light travels through the water. Provincial guidelines for Secchi depths are that "Suspended matter should not be added to surface water in concentrations that will change the natural Secchi disc reading by more than 10 percent." Secchi measurements are the inverse of Turbidity, measuring clarity rather than cloudiness.

SD (m)	Attributes	Fisheries & Recreation	
>8	**Oligotrophy:** Clear water, oxygen throughout the year in the hypolimnion	Water may be suitable for an unfiltered water supply.	Salmonid fisheries dominate
8-4	Hypolimnia of shallower lakes may become anoxic		Salmonid fisheries in deep lakes only
4-2	**Mesotrophy:** Water moderately clear; increasing probability of hypolimnetic anoxia during summer	Iron, manganese, taste, and odor problems worsen. Raw water turbidity requires filtration.	Hypolimnetic anoxia results in loss of salmonids. Walleye may predominate
2-1	**Eutrophy:** Anoxic hypolimnia, macrophyte problems possible		Warm-water fisheries only. Bass may dominate.
0.5-1	Blue-green algae dominate, algal scums and macrophyte problems	Episodes of severe taste and odor possible.	Nuisance macrophytes, algal scums, and low transparency may discourage swimming and boating.
0.25-0.5	**Hypereutrophy:** (light limited productivity). Dense algae and macrophytes		
<0.25	Algal scums, few macrophytes		Rough fish dominate; summer fish kills possible

Carlson, R.E. and J. Simpson. 1996.

Alkalinity - Alkalinity is a measure of compounds present in the water that are capable of neutralizing acids, including carbonates, bicarbonates and hydroxides. Natural surface waters will usually range between 30 mg/l (ppm $CaCO_3$) to 500 mg/l (ppm $CaCO_3$), with the provincial objective for alkalinity stating that decreases should not exceed 25% of the natural concentration.

Bacteria - Measurements of bacteria in water focus on both *Escherichia coliform (E. coli)* and Total *coliform.* The limit for *E. coli* in recreational waters is 100 colony forming units (CFUs) per 100 ml sample and for Total *coliform*, 1000 CFUs/100 ml sample. Regardless of what bacteria results indicate, lake users should NEVER drink UNTREATED lake water due to the presence of other pathogens, such as *Giardia* and *Cryptosporidium*, which are common in surface water and can cause severe gastrointestinal illness.

Phosphorus - Phosphorus is the limiting nutrient for aquatic plant growth. Therefore, limiting phosphorus is the most effective way to reduce algae and aquatic plant growth. Provincial guidelines for phosphorus are established at 0.02 mg/l for lakes and 0.03 mg/l in rivers.

Benthic macroinvertebrates (aquatic insects) are excellent bioindicators and are often used to assess the health of aquatic ecosystems. The Hilsenhoff index is one method of analyzing benthic samples and is generally applied to streams due to the higher level of dissolved oxygen and specific habitat requirements of many invertebrate species. In some cases samples that indicate excellent water quality using chemical parameters can be used as reference conditions to which benthic samples can be compared using the Hilsenhoff index. In larger lakes with heavily developed shorelines, it is very important to compare values over time to judge changes, in water chemistry and ecology.

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