



VILLE DE / TOWN OF

B A R K M E R E

Consultative Committee on the Environment (CCE)

Report on Water Quality Testing – 2020

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EXECUTIVE SUMMARY

Over the past decade and a half, with the overview of the Consultative Committee for the Environment (CCE), the town of Barkmere has been conducting its own water quality analyses of Bark Lake as well as participating in the Réseau de surveillance volontaire des lacs RSVL's yearly analyses to evaluate the overall health and trophic stage of the Lake. These tests include pH, Dissolved oxygen (DO) and temperature profiling, as well as the physio-chemical tests of Total Phosphorous, Chlorophyll a, and Dissolved Organic Carbon (DOC). In recent years, the committee has also been conducting fecal coliforms tests, as many of the lake's residents rely on the lake water for drinking and cooking. These tests are conducted annually, between the months of May and November. The three main study sites for all tests are in Wentworth Bay, Silver Bay, and at Priest's Point, as well as other locations on the lake and its main tributaries, located in Whittal Bay, Cope Bay, and the inlet. A map of the lake and the study sites has been included in figure 1 below.

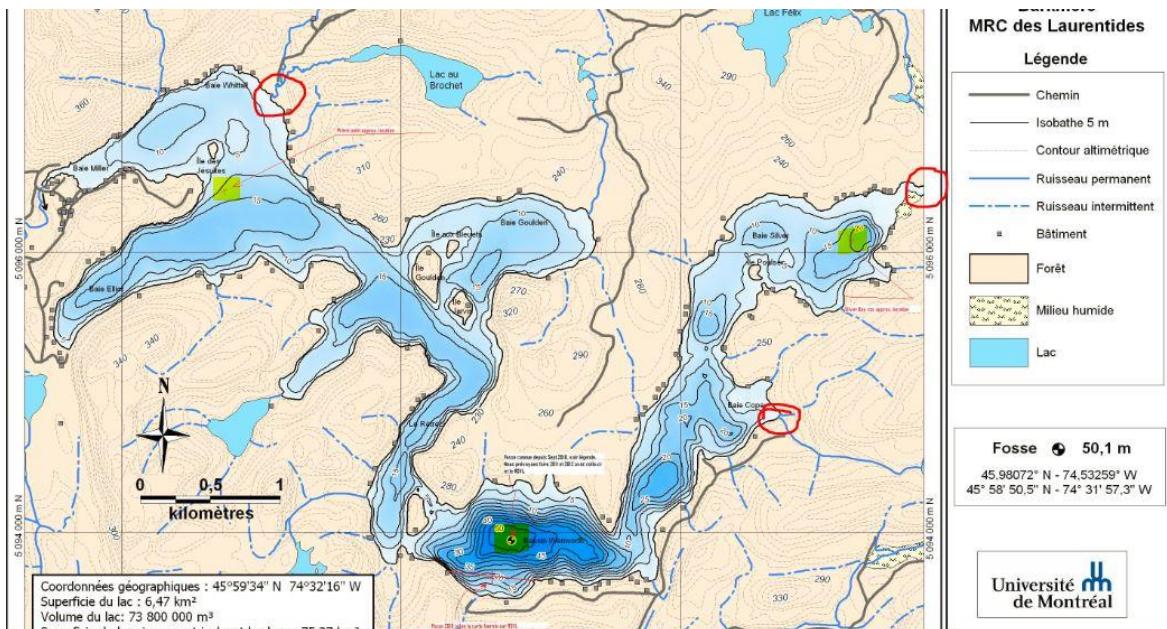


Figure 1: Bathymetric Map of Bark Lake. The depths of each part of the lake can be determined by looking at the lines and numbers on the map. The depth increases with darkening color. Wentworth Bay contains the deepest part of the Lake; the deepest point is marked with a black and white circle. The yellow/green highlighted areas correspond to the sample sites, from left to right: Priest's Point, Wentworth Bay, and Silver Bay. The red circles indicate the three main tributaries feeding into Bark Lake, where Phosphorus tests are conducted, clockwise starting from the far left: Whittal Bay, Inlet (Silver Bay), and Cope Bay.

The physico-chemical tests of Total Phosphorous, Chlorophyll a, as well as transparency allowed us to determine the trophic stage of the lake. With those results, it was determined that the lake continues to be in the oligotrophic life stage. It has not changed in the 20 or so years since the CCE has been conducting its studies, see figures 2-4 of results from the years 2010, 2015, and 2020 for comparison. These results are more than satisfactory, as this life stage is described as young and healthy. Oligotrophic means low nutrient levels (e.g. Phosphorous and Nitrogen); when there are less nutrients in the water, the lake is home to less organisms, like algae and fish. With less organisms dying and decomposing, as well as less algal blooms taking up oxygen, high levels of oxygen can be found throughout the water column, which leads to the lake being able to sustain more life for a longer period.

Figure 2. a. Results 2010

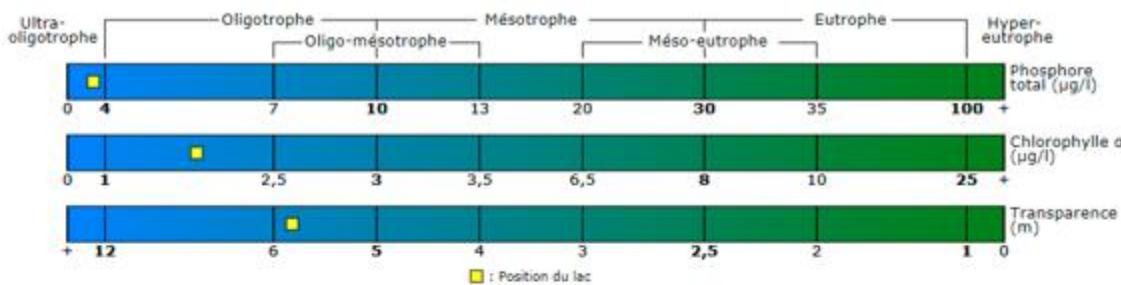


Figure 2. b. Results 2015

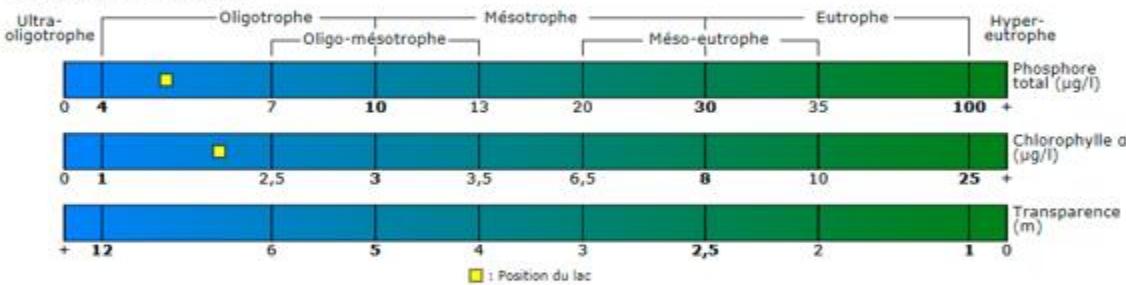


Figure 2. c. Results 2020

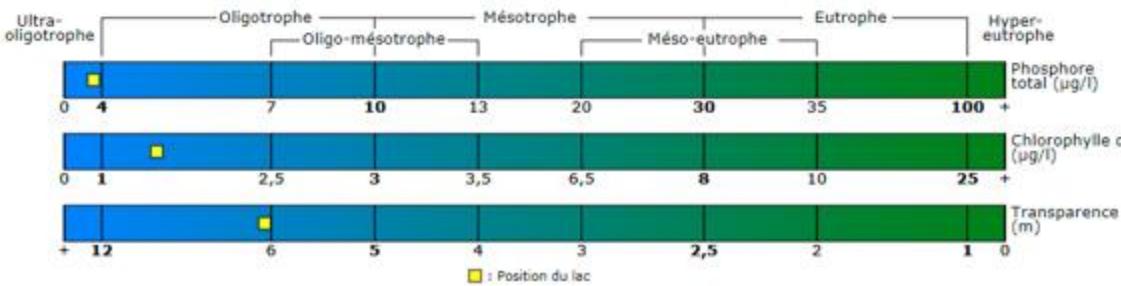


Figure 2: Trophic stages of Bark Lake in 2010, 2015, and 2020. The results for total Phosphorus and Chlorophyll a place Bark Lake within an oligotrophic trophic state for the past 15 years. Transparency had not been calculated in 2015. The yellow squares represent the results on the trophic scale.

This year's dissolved oxygen (DO) and temperature profiling confirms lake stratification with the presence of the three layers found in a stratified lake. i.e., epilimnion, metalimnion, and hypolimnion (as can be seen in the results section below). The epilimnion is described by the warmer top layer of the water column; metalimnion is the middle layer that changes depth throughout the day and mixes the cold water of the hypolimnion with the warmer water of the epilimnion. The hypolimnion, which extends to the lake floor, is the coldest layer, with the lowest DO values, often reaching zero, i.e., anoxic levels. The average depth of the layers in bark lake for 2020 were as follows: epilimnion (0-6M), metalimnion (6-10M), hypolimnion (>10M).

The phosphorus levels of the lake have increased steadily in the last 5 years, however, it should be noted that the methodology for phosphorus testing changed in 2018, and the historical data will be changed this year to match that protocol, thus the increase in Phosphorus levels in the 5-year comparison should not cause alarm.

The Lake's 4 main tributaries were tested for total phosphorous, and the results were significantly higher than those for the rest of the lake: Cope bay especially, with an average of 36.63 µg/l. This is most likely due to the fact that a road was recently built behind cope bay, allowing access to the lake and causing erosion of the soil. The construction of this road also destroyed a beaver dam, thus causing even larger amounts of runoff to now flow into the lake.

With concern growing in regard to the spreading of invasive zebra mussels throughout North America, it should be noted that optimal adult growth occurs at pH levels between 7.4 and 8.4, but populations have been found in the hypolimnetic zone of lakes with a pH between 6.6 and 8. So, although the likelihood of colonization of Bark Lake by zebra mussels is low since pH levels are below 7.4, the possibility still exists. The same safety measures that are taken in regard to Eurasian water milfoil should also be taken with zebra mussels to ensure the safety of the lake and its inhabitants, i.e. boat, kayak, etc.

washing when leaving and entering Bark Lake. The inhabitants of the lake should also stay on the lookout and inform the council or CCE should they find presence of these aquatic pests in Bark Lake.

The fecal coliform levels in most areas of Bark Lake are slightly above the government's safe drinking recommendation, so it is recommended to boil lake water should anyone need to use it for drinking or cooking purposes. People in Whittal Bay and Miller Bay should refrain from drinking lake water, wherever possible, as the levels in those areas this year are very high. In the coming years, we will be testing fecal coliforms more frequently and in a wider range of bays so that every cottager will know the safety level associated with their drinking water.

There has been a slight infrequency of tests from year to year, so going forward, all tests should be conducted at the same time, once per month, from May to November. This should provide us with a standardized testing schedule which will ensure more accurate data. For detailed lab reports from the Centre d'Expertise en Analyse Environnemental du Québec (CEAEQ) and the Réseau de Surveillance Trophique des Lacs (RSVL), please refer to Anexes II and III.

In conclusion, cottagers can rest easy knowing that the overall health of Bark Lake continues to be of high quality, in an oligotrophic life stage.

INTRODUCTION

Water quality is not only an important indicator of environmental health, but also important for the enjoyment of many recreational cottager practices like fishing, swimming and boating. The council of Barkmere has been doing a great job of managing the environmental health of Bark Lake with the implementation of the Consultative Committee on the Environment (CCE) in the 1980s, and the monitoring of the Lake's water quality with standardized water quality tests and detailed reports since 2008. In this report, we will look at the water quality test results from the 2020 season, as well as integrating the cumulative results from the past 10 years of water testing. The tests conducted this year as well as previously include temperature and dissolved oxygen profiles, transparency, total phosphorous, chlorophyll a, and dissolved organic carbon (DOC), pH, as well as bacterial testing for total fecal coliforms at key points in the Lake. These tests are conducted every year because they each are important measures of water quality and environmental health.

Two of the main factors affecting water quality are temperature and oxygen, as they can have serious effects on the biological and chemical processes of a lake (Antonopoulos & Giannou, 2002). Dissolved oxygen refers to the amount of oxygen found in the layers of a lake, the more oxygen available in the lake layers, the more life can be sustained. Stratified lakes contain 3 layers, known as the epilimnion, metalimnion or thermocline, and hypolimnion. The epilimnion is the topmost and warmest layer that gets directly penetrated by the sun's rays, the metalimnion/thermocline is the barrier between the top and bottom layers, that transfers oxygen and heat throughout the day, and the hypolimnion is the bottom and coldest layer.

Suspended solids in a lake are common sources of water impairment, as they can affect the physical, chemical, and biological properties of aquatic ecosystems (Dahlgren, Nieuwenhuyse, & Litton, 2001). Though they occur naturally in streams and lakes, it is human activity that can greatly increase their

concentrations, like urban runoff, waste discharge, soil erosion from construction, forestry or agricultural sites, to name a few (Dahlgren, Nieuwenhuyse, & Litton, 2001). These particles are measured via total suspended solids (TSS), turbidity, or, like in our case, transparency (Dahlgren, Nieuwenhuyse, & Litton, 2001).

The Total Phosphorus test is important because it measures organic and inorganic phosphorous found in a lake, which directly correlate to the water quality of that lake (USGS, 2020). Some contributing factors to high levels of phosphorus in lakes include soil and bank erosion, heavy rains leading to runoff from agricultural fertilizers and manure, and organic waste effluent from sewage (USGS, 2020) or in the more likely case of Bark Lake, septic tanks. Phosphorus is an essential element to plant life, but too much in water can speed up eutrophication (USGS, 2020). Eutrophication refers to the symptoms a body of water acquires when it is exposed to a large amount of nutrients, namely Phosphorus and Nitrogen (Schindler, et al., 2008). The negative effects caused by the high levels of nutrients include dense algal blooms of nitrogen fixing cyanobacteria, otherwise known as blue-green algae (Schindler, et al., 2008). These blooms cause high turbidity and increase anoxia (lack of oxygen), which can lead to the death of fish and other aquatic organisms (Schindler, et al., 2008). Phosphorus levels are measured every year so that, should they ever become too high, the proper measures can be put in place to try and slow down the eutrophication process.

Chlorophyll is a driving factor for photosynthesis, which allows plants and algae (and other unicellular organisms) to create their own energy from light. **Chlorophyll “a”** is the photosynthetic pigment that creates the green color we see in algae and plants (Oram, Ecosystem and Lake Productivity Chlorophyll Analysis, 2020). To determine where to take a sample in the water column, the Secchi disk measurements can be used as an estimate, because the sample must be taken in the photic zone, i.e., where enough sunlight penetrates the water to permit photosynthesis (Oram, Ecosystem and Lake Productivity Chlorophyll Analysis, 2020). It is important in water testing, because it is directly linked to

the number of algae in the water; the darker green the water, the more algae there is, and high levels of algae in water can lead to a faster eutrophication process.

Dissolved Organic Carbon (DOC) is the result of decomposition of plant and animal (i.e., organic) material in water (Bruckner, 2020). It is important in the carbon cycle and serves as a primary food source for many aquatic food webs (Bruckner, 2020). DOC is an important constituent of water quality, as it can affect light penetration, which is important for the autotrophs that need light to survive, as mentioned above. DOC is not toxic in itself, but it can transport contaminants and toxic compounds (Ledesma, Köhler, & Futter, 2012), which is why it is important to test for it in lakes, especially when most of its inhabitants use the lake water for drinking and cooking.

pH is the measured amount of hydrogen ions present in a substance, in our case, a lake. pH is measured on a scale from 0 to 14 and allows us to measure the alkalinity of a lake, from the most acidic (0), neutral (7), to the most basic (14). pH is affected by the amount of plant growth and organic material in water, as the decomposition of these constituents in water forms carbonic acid, too much of which will lower pH (Lead in Water, 2021). It can be considered an important component to water quality, because it can have an effect on the trophic stage of a lake, as minor changes in pH can increase the solubility of phosphorus and other nutrients in a lake, which could increase plant and algae growth and lead to eutrophication (Fondriest, 2020). Another reason for its importance is that many aquatic organisms require a certain range of pH to be able to survive and they are very sensitive to change, so if the pH of a lake is too high or too low, the aquatic organisms living within it will die (Fondriest, 2020). The vast majority of aquatic organisms require a pH range of 6.5-9.0, but some can withstand a wider range, as shown in figure 3, below.

With concern growing in regard to the spreading of invasive zebra mussels throughout North America, it should be noted that larval development is entirely inhibited at pH levels below 7.4 and optimal

adult growth occurs at pH levels between 7.4 and 8.4 (Benson et. al, 2021). Although, populations have been found in the hypolimnetic zone of lakes with a pH between 6.6 and 8 (Benson et. al, 2021).

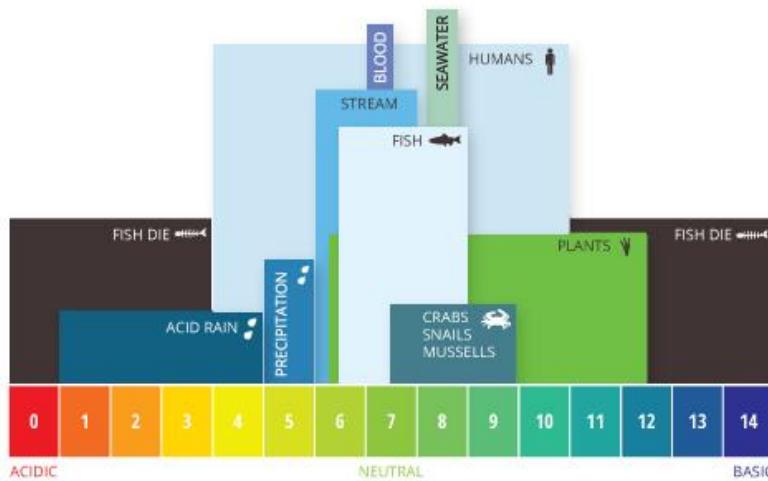


Figure 3: “Aquatic pH levels. The optimum levels for fish and other aquatic organisms are between 6.5 and 9.0. Outside of that range, organisms can become stressed or die.” (Fondriest, 2020). A substance is considered acidic if the pH is below 6, neutral between 6 and 8, and basic above 8.

Total coliforms are a type of bacteria that are relatively harmless and live in the intestines of animals (including humans), and aid in the digestion of food. They themselves are not dangerous, instead, they are used as indicator organisms to measure the amount of actual dangerous pathogens in a water sample (Thelin & Gifford, 1983). The specific subgroup most commonly used for these tests is called fecal coliforms because, as stated by Gifford and Thelin (1983); “fecal contamination in water can most accurately be detected and measured by a fecal coliform test [...] this indicator system has an excellent positive correlation with warm-blooded animal fecal contamination”. The organism that is being measured by a fecal coliform test is the one most well-known to humans: *Escherichia coli* (*E. coli*) (Thelin & Gifford, 1983). The presence of these bacteria in aquatic environments, like Bark Lake, indicate that the water has been contaminated with fecal matter, most likely of the human variety, from sewage systems or in our case, septic tanks. It is very important to test for fecal coliforms because many pathogenic diseases can be spread through water, like typhoid fever, gastroenteritis and hepatitis A (Oram, Fecal Coliform Bacteria in Water,

2021). According to the government of Canada, for water to be considered drinkable, there must be no detectable fecal coliforms for every 100 mL of water (<1 CFU/100 mL), Bark Lake accepts <2 CFU/100 mL as safe to consume, but recommends boiling water as an extra precaution.

The water testing schedule used for the 2020 season is included in Annex I, the complete RSVL Water Quality Report is included in Annex II, and the physicochemical lab results conducted by the Centre d'expertise en analyse environnementale du Québec (CEAEQ) are included in annex III.

The following is a summary of the tests mentioned above, analysis of the results, and general conclusions.

METHODOLOGY

Due to the situation of the world with the COVID-19 pandemic during the summer of 2020, all tests were only conducted once or twice last year, between the months of June and October. In an attempt for the water testing to be standardized, the sampling was done at the same three points as have been used for the past few years. Those being Priest's Point, Wentworth Bay (La fosse, i.e., the deepest point in the lake), and Silver Bay. Water testing samples were taken by Kirstin Laviolette Lachance and Jake Michael Chadwick.

Dissolved Oxygen (DO) and Temperature Profiling

The materials used to do the temperature and DO profiling included: the town of Barkmere's dissolved oxygen/Temperature instrument and probe (YSI Pro ODO). The instrument refers to the main body which displays the measurements, and the probe refers to the sensor which measures the temp and DO. The materials also included a measuring tape and a small weight attached to the probe to ensure it went straight down the water column, an anchor and chain, and a boat to access the testing sites.

At each testing site, we released the anchor, attached the probe to the instrument, wrote down the Barometer and Air temperature, then released the probe into the water and took the measurements of DO and temperature at each meter in the water column, until the DO reached 0, which was an indication that we had reached the sediment.



Photo 1: Environmental technologist taking the dissolved oxygen and temperature profile of Bark Lake, using a DO and temp probe.

Transparency

Transparency is an important indicator of water quality as it can indicate excess algal growth and sediment concentration, which is a sign of eutrophication. Transparency was measured via Secchi disk twelve times in 2020, between June and November, by Lindsay Ackroyd. The measurements were taken in Wentworth Bay, Patry Bay, and Silver Bay. The Secchi disk is a circular flat disk with alternating black and white triangular grids on the top. Transparency is measured by the sun penetrating the water column and reflecting off of the Secchi disk (see figure 4), the Secchi disk is attached to a rope and tape measure and lowered into the water. The Secchi disk is lowered into the lake for as long as it is visible, and the depth is noted once it is completely obscured by the sediments in the water.

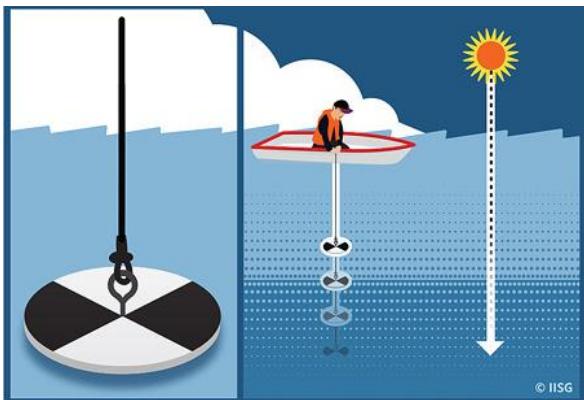


Figure 4: Secchi disk usage. The diagram on the left shows a standard Secchi disk, the diagram on the right shows how the Secchi disk works.

Physicochemical tests

The physicochemical tests conducted on Bark Lake this year, included **Total Phosphorous (Ptra)**, **Chlorophyll a (Chlor a)**, and **Dissolved Organic Carbon (DOC)**. These tests provide us with a clear picture of what trophic state a body of water is in, those being oligotrophic, mesotrophic, and eutrophic. These tests were conducted 5 times per year from 2017-2020, twice by the CCE, normally during the months of May and September, and 3 times by the RSVL in June, July, and August.

Due to the COVID-19 pandemic in 2020, **Ptra** sampling was conducted later than usual to conform to the restrictions in place at the time. Sampling was done in Silver Bay, Wentworth Bay, and Priest's Point June 21st and October 25th. Tributary sampling was conducted on July 26th. Total Phosphorus analysis was done using method *MA. 303 – P 5.2* (CEAEQ, 2019).

Chlor a sampling was conducted on October 25th, 2020 in the same three main sample sites of the lake. The Chlorophyll a analysis was done in the lab by the CEAEQ using the method *MA. 800- Chlor. 1.0* (CEAEQ, 2012).

To measure **DOC**, a sample of water was taken from the lake and then the very small particles found in the water (between 0.7-0.22 um) are measured by using high temperature combustion or persulfate oxidation (Bruckner, 2020). Sampling was conducted on October 25th, and the analysis was done in the lab on October 29th using method *MA. 300 – C 1.0* (CEAEQ, 2016).

The same sampling protocol was followed for each of the physicochemical tests mentioned above: Samples were taken at each sample site with a small plastic bottle labeled with the site name. The bottle was placed into the water and opened and filled ¾ of the way, then recapped out of the water, the bottles were then placed in a cooler with ice packs for the samples to stay cold until they were brought to the lab to be analyzed.

pH

Measuring pH can be done using litmus paper, or for a more accurate reading, an electronic pH meter. When using litmus paper for a rough estimate of the pH level, the paper is dipped into the water sample and compared to the subsequent pH color chart. Samples were taken at each sample site with a small plastic bottle labeled with the site name. The bottle is placed into the water and opened and recapped under water, the bottles are then placed in a cooler with ice packs for the samples to stay cold until they are brought to the lab to be analyzed. Sampling was done on August 26th and analyzed in the lab on August 28th, 2020, using method **MA. 303 – Titre Auto 2.1** (CEAEQ, 2012).

Fecal Coliforms

Testing was done in Bark Lake on August 19th and in the Ruisseau Longue on August 27th, 2020. Fecal coliforms are measured by taking a sample of water at each sample site. A small plastic bottle labeled with the site name is placed into the water and opened and recapped under water, the bottles are then placed in a cooler with ice packs for the samples to stay cold until they are brought to the lab within

48h for the test to be conducted. The tests then conducted in the lab include either the membrane filter method or the most probable number (MPN) method (Thelin & Gifford, 1983). The method used by the CEA EQ was **MA. 700- Fec.Ec. 1.0** (CEAEQ, 2016).

The lab analyses for physicochemical, pH and Coliform tests were conducted by the **Centre d'expertise en analyse environnementale du Québec (CEAEQ)** and the exact protocols have been included in the bibliography should they be required. The complete lab results have been included in Annex III.

RESULTS

Dissolved Oxygen (DO) and Temperature Profiling

Table I, below shows that Wentworth Bay has the highest and longest rise in dissolved oxygen in the metalimnion, the DO rises from 9.94 mg hg to 14.70 mg hg between 5 and 8 meters below the surface, followed by a steady decline to the hypolimnion. Priest's Point shows a steep and quick incline in DO from 9.94 mg hg to 13.70 mg hg between the depths of 5 and 6 meters, followed by a steep decline all the way to the hypolimnion and sediment bottom. Silver Bay shows an increase in DO from 9.42 mg hg to 12.75 mg hg between the depths of 5 and 7 meters, after which it declines in the form of a staircase into the hypolimnion.

Figure 5 represents the temperature and dissolved oxygen content of the three sampling sites in Bark Lake in August of 2020. The first few meters have a stable temperature, which represents the warm epilimnion. Then, we see a rapid decline of the temperature paired with a bump in the dissolved oxygen levels in the Metalimnion/thermocline located between the depths of 6-11 meters. Finally, the temperature levels out in the hypolimnion and the DO continues to decline until it reaches zero, which indicates the probe has touched the sediment bottom.

Table I: Dissolved Oxygen and Temperature Profiling in the three main bays on August 26th, 2020.

DEPTH (M)	WENTWORTH BAY		PRIEST'S POINT		SILVER BAY	
	T (°C)	DO (mghg)	T (°C)	DO (mghg)	T (°C)	DO (mghg)
0	21.2	10.05	20.3	10.15	21.9	9.65
1	21.3	10.01	21.0	10.09	22.1	9.52
2	21.4	9.96	21.0	10.05	22.2	9.48
3	21.4	9.94	21.1	10.01	22.2	9.46
4	21.4	9.96	21.2	9.97	22.2	9.43
5	21.4	9.94	21.2	9.94	22.2	9.42
6	19.1	13.10	14.4	13.70	18.1	12.01
7	13.1	14.53	10.7	12.60	15.0	12.75
8	10.3	14.70	9.4	10.88	11.1	11.85
9	8.8	14.03	8.2	8.53	9.2	9.62
10	8.0	11.30	7.7	7.47	9.1	9.62
11	7.4	10.42	7.3	6.52	7.3	8.61
12	6.8	9.20	7.0	5.18	6.4	5.99
13	6.4	8.77	6.7	2.95	6.1	5.46
14	6.1	8.65	6.4	0.00	6.1	5.28
15	5.7	8.53			5.4	2.50
16	5.6	8.76			5.4	0.00
17	5.3	8.84				
18	5.1	6.66				
19	5.0	8.31				
20	4.9	8.35				
21	4.7	8.29				
22	4.6	8.28				
23	4.6	8.09				
24	4.5	7.95				
25	4.4	7.86				
26	4.4	7.82				
27	4.4	7.80				
28	4.3	7.76				
29	4.3	7.70				
30	4.3	7.76				
31	4.3	7.60				

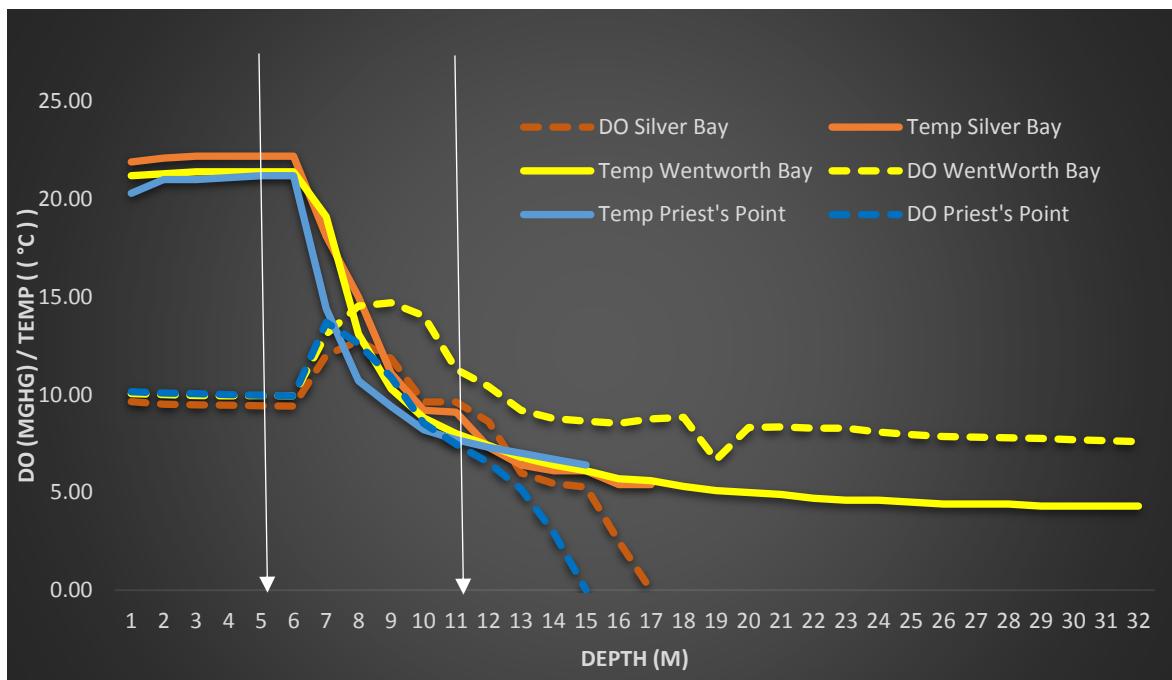


Figure 5: Graphic interpretation of the Temperature and profile of Bark Lake in August 2020. This graph shows the relationship between the Temperature and Dissolved Oxygen at the three sample sites. The orange solid line represents the temperature of the water in Silver Bay at depth (x); the orange dotted line represents the dissolved oxygen (DO) at the same sample site and depth; the blue solid line represents the temperature at Priest's Point; the blue dotted line represents the DO at that sample site; the solid yellow line represents the temperature in Wentworth Bay; and the dotted yellow line represents the DO at that sample site. The vertical lines going through the graph represent the separations between the different stratification zones of the lake, from left to right Epilimnion (top/warm layer), Metalimnion (middle/mixing layer), and Hypolimnion (bottom/cold layer).

Transparency

Table II shows the transparency values of the 2020 season. The depths at which the secchi disk is visible are low in the beginning of summer and steadily increase as the season goes on, with the deepest visibilities being at the end of September. Silver bay has the lowest average visibility, and Patry bay has the highest, with Wentworth following closely. These values make sense because Silver bay is much shallower than the other two bays, with much more suspended sediment.

Table II: Transparency data for Bark Lake, 2020.

Date	Silver Bay (m)	Wentworth Bay (m)	Patry Bay (m)
6/7/2020	4.43	4	3.89
6/20/2020	5.59	5.29	4.89
7/4/2020	6.33	6	6.31
7/20/2020	4.87	5.85	5.74
7/24/2020	6.02	6.17	6.27
8/6/2020	5.71	4.98	5.61
8/14/2020	5.62	6.63	7.18
8/24/2020	5.59	6.69	7.03
8/27/2020	5.44	6.39	7.45
9/5/2020	6.11	7.87	7.09
9/19/2020	7.67	7.29	8.18
10/3/2020	7.01	7.65	7.1
Average	5.87	6.23	6.40

Physicochemical tests (Phosphorus, Chlorophyll a, DOC)

The physicochemical tests conducted in 2020 included Total Phosphorus (Ptra), Chlorophyll a (Chlor a) and Dissolved Organic Carbon (DOC). See Table III below for the results, which indicate that Bark Lake continues to be in an oligotrophic state (see table V for comparison). Phosphorus levels vary from one area of the lake to another, with the lowest levels being found in Wentworth Bay at 2.9 µg/l and 3.0 µg/l at the beginning of the summer and end, respectfully. Priest's Point has a higher content of 5.4 and 5.3 µg/l, and Silver Bay has the most variation from one time period to the next of 3.6 to 6.8 µg/l (refer to annex III for the complete results of the lab analyses of the CEAEQ). At an average of 1.92 µg/l,

Chlorophyll a results show a decrease compared to last year, but an overall increase compared to the previous 5 years, and DOC has remained stable between 3.2 and 3.3 mg/l C in the past three years.

Table III: RSVL Physicochemical Water Sampling Results for the 2020 Season.

<i>Bay</i>	<i>Phosphorus (µg/l)</i>	<i>Chlorophyll a (µg/l)</i>	<i>DOC (mg/l C)</i>
<i>Average Silver Bay</i>	5.2	2.07	3.7
<i>Average Wentworth Bay</i>	2.95	2.08	3.1
<i>Average Priest's Point</i>	5.35	2.99	2.9
<i>Average RSVL data</i>	3.1	1.5	3.2
<i>Global Average 2020</i>	4.04	1.92	3.23

Table IV has been included as a reference point with previous years' data. The Ptra, DOC, and Chlor a levels have all increased during the 5 year period but are still well within the range of an oligotrophic lake (Table V). The average Phosphorus levels increased steadily from 2016 to 2019, going from 1.99 to 4.27 µg/l (which represents a 53.4% increase in only 3 years time), followed immediately by a 5.4% decrease in 2020. Chlorophyll a levels tend to fluctuate yearly, decreasing some years and increasing in others, but with an overall trend upwards. And, Dissolved Organic Carbon saw a jump in 2018 where it increased by 0.20 mg/l C from the year before, representing a 6.1% increase. This was a large increase compared to the previous 5 years where DOC only fluctuated by less than 0.05 mg/l C per year.

Table IV: Summary of CCE Average Physico-chemical Results for the Years 2016-2020.

<i>Test</i>	<i>2020</i>	<i>2019</i>	<i>2018</i>	<i>2017</i>	<i>2016</i>
Ptra (µg/l)	4.04	4.27	2.13	2.23	1.99
COD (mg/l C)	3.23	3.27	3.28	3.08	3.04
Chlor a (µg/l)	1.92	2.72	1.25	0.83	1.43

Table V: Trophic state categories based on summer water quality (Nürnberg, 1996).

BARK LAKE 2020	OLIGOTROPHIC	MESOTROPHIC	EUTROPHIC
Secchi Disk Transparency (m)	6.17	>4	2 - 4
Chlorophyll a ($\mu\text{g/l}$)	2.38	< 3.5	3.5 - 9
Total Phosphorus ($\mu\text{g/l}$)	4.5	< 10	10 - 30
			31 - 100

The table above describes the measurements of each water quality constituent that help to determine the trophic state of a lake. Oligotrophic lakes have high visibility and low nutrient count (phosphorus and chlorophyll a). Mesotrophic lakes have as their name suggests, moderate visibility and a moderate amount of nutrients. Eutrophic lakes have very low visibility and high nutrient count. Bark Lake falls in the oligotrophic state for each of the components.

Tributary Testing

The phosphorus levels in most of the tributaries have increased compared to last year's levels, with the exception of Whittal bay near the lake, which shows the opposite with a decrease of $25.9 \mu\text{g/l}$. Over the course of the last 5 years, we have seen large decreases in 2 of Cope bay's sample sites and one of Whittal bay's sample sites, whereas the rest of the tributary sample sites show very slight increases. Overall, the lake's tributaries have seen a relatively steady decrease in phosphorus levels, with an average of $21.14 \mu\text{g/l}$ in 2015 versus $17.69 \mu\text{g/l}$ in 2020, as seen in table VI, below. Sample sites are pictured in figure 6.

Figure 6 a. Inlet (Silver bay) Tributaries Figure 6 b. Whittal bay Tributaries Figure 6 c. Cope bay Tributaries



Figure 6: Bark Lake tributaries for Ptra testing. These aerial photos depict each of the tributaries where testing for Ptra is conducted in Bark Lake. Each tributary has 3 testing sites, those being near the lake/bottom (B), middle (M), and the highest point/top (T).

Table VI: Ptra levels ($\mu\text{g/l}$) in Bark Lake's tributaries, 2015 to 2020, inclusively.

<i>Sample Site</i>	<i>2020</i>	<i>2019</i>	<i>2018</i>	<i>2017</i>	<i>2016</i>	<i>2015</i>
Cope Bay (Highest Point/top)	47.6	14	30.2	38.2	27.45	70.2
Cope Bay (Culvert/middle)	35.8	34.9	25.8	25.6	23.25	25.8
Cope Bay (Near Lake/bottom)	26.5	16.9	26.1	19.5	24.85	38.9
Inlet (Above dam/Top)	10.2	10.4	6.9	5.3	7.8	9.6
Inlet (at Bridge/middle)	10.3	9.7	5.9	6.3	8.25	8.7
Inlet (Near Lake/bottom)	13.1	8.9	5.6	5.5	8.55	9.3
Whittal Bay (Bridge/Top)	6.6	4.3	4.7	n/a	n/a	6.1
Whittal Bay (After dam/middle)	3.6	4.1	6	n/a	n/a	16.8
Whittal Bay (Near lake/bottom)	5.5	31.4	10.6	4.2	n/a	4.9
Average	17.69	14.96	13.53	14.94	16.69	21.14

pH Testing

pH was tested in three sites last year, those being Silver Bay, Wentworth Bay, and Priest's Point. The average pH of Bark Lake remains neutral at 7.06. pH results from the last three years have been included in Table VII and we see that the levels have not changed substantially over that time.

Table VII: pH levels in the three Bark Lake Sample Sites for years 2018, 2019 and 2020.

<i>Sample Site</i>	<i>2020</i>	<i>2019</i>	<i>2018</i>
Siler Bay	7	7.4	7
Wentworth Bay	7.1	7.4	6.9
Priest's Point	7.1	7.3	6.8
Average	7.06	7.37	6.9

Fecal Coliforms

The number of fecal coliforms found in Bark Lake do not meet the Maximum Acceptable Concentration for Drinking Water. Table VIII shows that the minimum amount was found in Dugan Bay and Cope Bay, at <2 CFU/100 mL, but even those are slightly above safe drinking levels. Silver Bay, Patry Bay and Green Bay had normal levels at 2, 2 and 3 CFU/100 mL, respectively. The Outlet and Whittal Bay had high levels, of 11 and 23 CFU/100 mL. Fecal coliform levels from 2019 have been included as a reference for normal levels.

Table VIII: Fecal Coliforms (CFU/100ml) found in each Bay in Bark Lake 2020, 2019 for comparison.

<i>Sample Site</i>	<i>2020</i>	<i>2019</i>
Outlet	11	3
Whittal Bay	23	2
Patry Bay	2	<2
Green Bay	3	<2
Dugan Bay	<2	n/a
Cope Bay	<2	<2
Silver Bay	2	2

Table IX below shows the fecal coliform counts for the Ruisseau Longue, with even higher results. The property behind chemin de Barkmere had 3 CFU/100 mL. The Village Bridge had 25 CFU/100 mL, which is a normal amount for that site, as the same levels have been found in previous years. The site at Chemin de la Montagne had a staggering 82 CFU/100 mL. See figure 7 for sample site locations.

Table IX: Fecal Coliforms in the Ruisseau Longue, August 27th, 2020.

<i>Sample Site</i>	<i>2020</i>
Ch. Barkmere	3
Village Bridge	25
Ch. De la Montagne	82

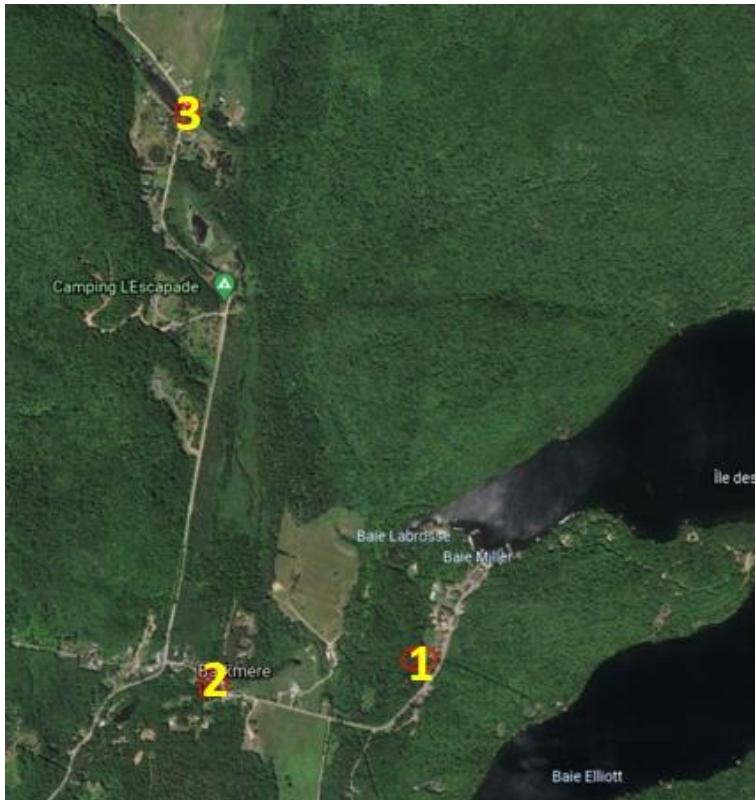


Figure 7: Ruisseau longue Tributaries for fecal coliform testing. This aerial photo depicts the 3 sample sites for fecal coliform testing in the tributaries located west of Bark Lake's outlet stream. #1 represents Chemin Barkmere, #2 represents the Village Bridge, and #3 represents Chemin de la Montagne.

DISCUSSION

The increase of the physicochemical properties of the lake over the years indicates a normal aging of Bark Lake, the levels are not changing so drastically to cause worry of eutrophication.

The bump in dissolved oxygen seen in the metalimnion is explained by the mixing of the epilimnion and hypolimnion. The water cycling causes gas exchange between layers to occur, resulting in a spike in DO in the metalimnion. This is a normal occurrence that we expect to see every year. It should be noted that due to thundershowers having begun when the DO and Temp of Wentworth Bay was being done, the probe was taken out of the water before it had reached the bottom of the lake, and we moved onto the next sample site before the storm got worse. This doesn't cause any worry though, as the temperature and oxygen levels stabilize in the hypolimnion, until they reach the bottom, where the DO plummets to zero, indicating that the sediment has been reached, as we saw in the results for Silver Bay and Priest's Point.

The Phosphorus results of the 2020 season conform to the data expected from each spot of the lake. Wentworth Bay is the deepest bay, so the lower levels of Phosphorus in that bay correspond to the expected results from a deeper water column, and vice versa for the shallower bays (Priest's Point and Silver Bay). The only outlier is that of Silver Bay in the fall where the Phosphorus content increased considerably whereas if there were to be any change, it should have been a decrease with the colder fall temperatures, because temperature impacts phosphorus release rates (Kim, Choi, & Stenstrom, 2003). It should also be noted, however, that the methodology for phosphorus testing changed in 2018, and the historical data will be changed this year to match that protocol, thus the increase in Phosphorus levels in the 5-year comparison should not cause alarm.

The Lake's 4 main tributaries were tested for total phosphorous, and the results were significantly higher than those for the rest of the lake: Cope bay especially, with an average of 36.63 µg/l. This is most

likely due to the fact that a road was recently built behind Cope bay, allowing access to the lake and causing erosion of the soil. The construction of this road also destroyed a beaver dam, thus causing even larger amounts of runoff to now flow into the lake.

As mentioned earlier, there is growing concern for the safety of Bark Lake in regard to the spreading of invasive zebra mussels throughout North America. Though the likelihood of zebra mussels surviving in Bark Lake is low because of its pH levels being below 7.4, the possibility still exists. So the same safety measures that are taken in regard to Eurasian water milfoil should also be taken with zebra mussels to ensure the safety of the lake and its inhabitants, i.e. boat, kayak, etc. washing when leaving and entering Bark Lake, and the inhabitants of the lake should be aware of the possibility and inform the committee should they ever find the presence of these mussels in the lake.

The fecal coliform levels in most areas of Bark Lake are slightly above the government's safe drinking recommendation, so it is recommended to boil lake water should anyone need to use it for drinking or cooking purposes. People in Whittal Bay and Miller Bay should refrain from drinking lake water, whenever possible, as the levels in those areas this year are very high.

I would recommend continuing, in following years, the fecal coliform testing in a wider range of bays. Those being: Green Bay, Miller Bay, Wentworth Bay, Cope Bay, Silver Bay, as well as the addition of Reeve's Bay. We could alternatively create a rotation of bays to test on separate years, as the coliform results don't tend to fluctuate considerably every year. It is also to be noted that the coliform sample bottles didn't conform to the standard for the CEAEQ; they were too full so they couldn't be properly mixed. In future they will be filled to the $\frac{3}{4}$ mark.

In conclusion, the overall health of Bark Lake continues to be of high quality, in an oligotrophic life stage.

REFERENCES

- Antonopoulos, V. Z., & Giannou, S. K. (2002). *Simulation of Water Temperature and Dissolved Oxygen Distributon in Lake Vegoritis, Greece*. Thessaloniki: Elsevier.
- Benson, A.J., Raikow, D., Larson, J., Fusaro, A., Bogdanoff, A.K., and Elgin, A., 2021, *Dreissena polymorpha* (Pallas, 1771): U.S. Geological Survey, Nonindigenous Aquatic Species Database, Gainesville, FL, <https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=5>, Revision Date: 3/8/2021, Access Date: 3/24/2021
- Bruckner, M. Z. (2020, September 28). *Measuring Dissolved and Particulate Oranic Carbon (DOC and POC)*. Retrieved from Microbial Life: Educational Resources: https://serc.carleton.edu/microbelife/research_methods/biogeochemical/organic_carbon.html
- Centre d'expertise en analyse environnementale du Québec. (2012). *Méthode d'analyse MA. 303 - Titr Auto 2.1*. Québec: Gouvernement du Québec.
- Centre d'expertise en analyse environnementale du Québec. (2012). *Méthode d'analyse MA. 800 - Chlor. 1.0*. Québec: Gouvernement du Québec.
- Centre d'expertise en analyse environnementale du Québec. (2016). *Méthode d'analyse MA. 300 - C 1.0*. Québec: Gouvernement du Québec.
- Centre d'expertise en analyse environnementale du Québec. (2016). *Méthode d'analyse MA. 700 - Ec.BCIG 1.0*. Québec: Gouvernement du Québec.
- Centre d'expertise en analyse environnementale du Québec. (2019). *Méthode d'analyse MA. 303 - P 5.2*. Québec: Gouvernement du Québec.
- Dahlgren, R. A., Nieuwenhuyse, E. V., & Litton, G. (2001). Transparency Tube Provides Reliable Water-Quality Measurements. *Caifornia Agriculture*, vol: 58 (3): 149-153.
- Fondriest. (2020, December 31). *pH of Water*. Retrieved from Fondriest: Environmental Learning Center: <https://www.fondriest.com/environmental-measurements/parameters/water-quality/pH/>
- Kim, L.-H., Choi, E., & Stenstrom, M. K. (2003). Sediment characteristics, phosphorus types and phosphorus release rates between river and lake sediments. *Chemosphere: Volume 50*, 53-61.
- Lead in Water. (2021, February 17). *Factors affecting ph of Water*. Retrieved from Lead in Water: <https://leadinwater.weebly.com/factors-affecting-ph-of-water.html>
- Ledesma, J. L., Köhler, S. J., & Futter, M. N. (2012). *Long-Term Dynamics of Dissolved Organic Carbon: Implications for Drinking Water Supply*. Uppsala: Elsevier.
- Oram, B. (2020, October 17). *Ecosystem and Lake Productivity Chlorophyll Analysis*. Retrieved from Water Research Center: <https://water-research.net/index.php/ecosystem-and-lake-productivity-chlorophyll-analysis>
- Oram, B. (2021, January 5). *Fecal Coliform Bacteria in Water*. Retrieved from Water Research Center: <https://www.water-research.net/index.php/fecal-coliform-bacteria-in-water>
- Schindler, D. W., Hecky, R. E., Findlay, D. L., Stainton, M. P., Parker, B. R., Paterson, M. J., . . . and Kasian, S. E. (2008). Eutrophication of Lakes Cannot be Controlled by Reducing Nitrogen Input:

Results of a 37-Year Whole-Ecosystem Experiment. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*, Volume 105 (32): 11254-11258.

Spears, B. M., Carvalho, L., Perkins, R., Kirika, A., & Paterson, D. M. (2007). Sediment phosphorus cycling in a large shallow lake: spatio-temporal variation in phosphorus pools and release. *Hydrobiologia* 584, 37-48.

Thelin, R., & Gifford, G. F. (1983). Fecal Coliform Release Patterns from Fecal Material of Cattle. *Environmental Quality: Volume 12*, 57-63.

USGS. (2020, December 31). *pH and Water*. Retrieved from USGS: Science for a Changing World: https://www.usgs.gov/special-topic/water-science-school/science/ph-and-water?qt-science_center_objects=0#qt-science_center_objects

USGS. (2020, October 17). *Phosphorus and Water*. Retrieved from USGS: Science for a changing world: https://www.usgs.gov/special-topic/water-science-school/science/phosphorus-and-water?qt-science_center_objects=0#qt-science_center_objects

ANNEX I: Water Testing Schedule, 2020

Date	RSVL	CCE
June 1-14th		· O2 & Temp.
June 15-30th		· Total Ptra · Chlorophyll a · DOC (3 std locations) · Transparency
July 1-14th	· Transparency	
July 15-31st	· Total Ptra · Chlorophyll a · DOC · Transparency	· O2 & Temp. · Total Ptra tributaries · Coliformes ruisseau longue
Aug 1-14th	· Transparency	
Aug 15-31st	· Total Ptra · Chlorophyll a · DOC · Transparency	· O2 & Temp. · Coliformes lake · pH
Sept 1-14th	· Transparency	
Sept 15-30th	· Total Ptra · Chlorophyll a · DOC · Transparency	
Oct 1-14th		· Total Ptra · Chlorophyll a · DOC (3 std locations) · Transparency
Oct 15-31st	· Transparency	

ANNEX II: RSVL Water Quality Report

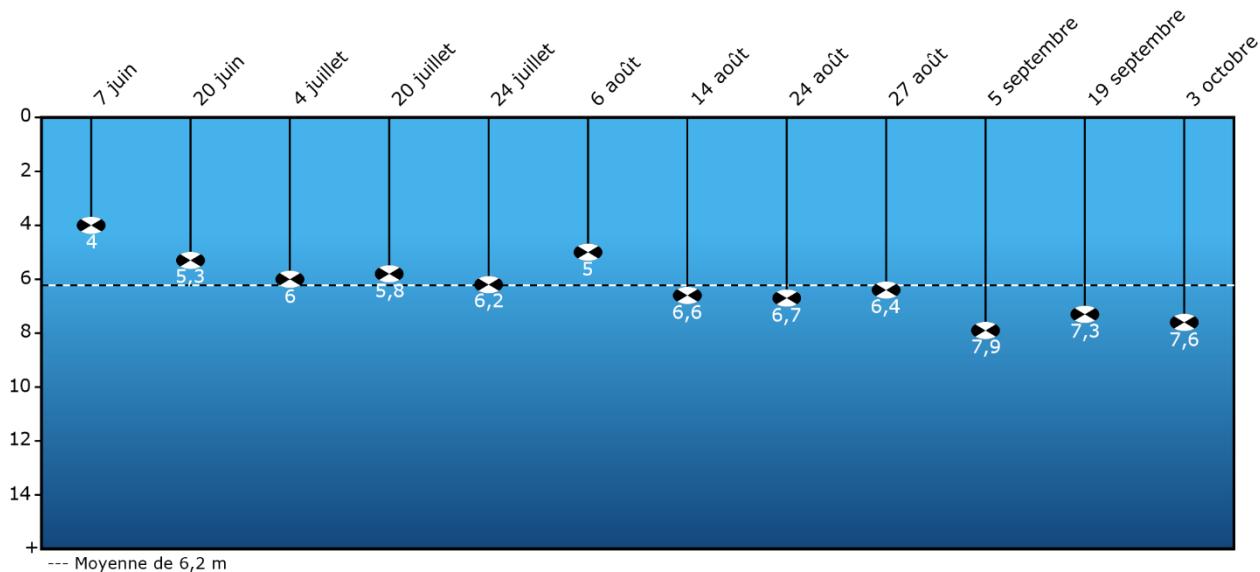


Ministère de l'Environnement
et de la Lutte contre les changements climatiques

Accueil
Nous joindre
English

Réseau de surveillance volontaire des lacs Lac des Écorces (0596A) - Suivi de la qualité de l'eau 2020

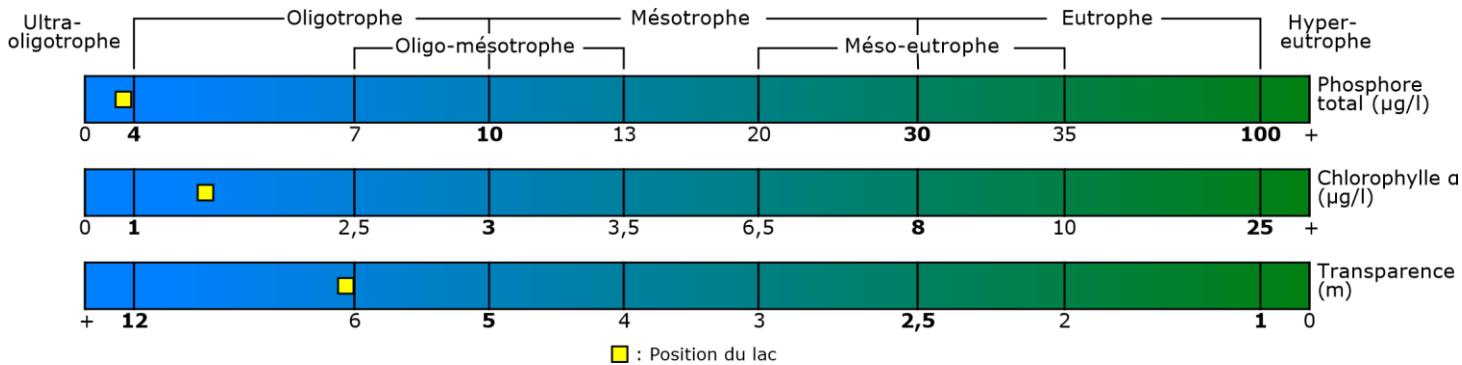
Transparence de l'eau - Été 2020
(profondeur du disque de Secchi en mètres)



Données physicochimiques - Été 2020

Date	Phosphore total (µg/l)	Chlorophylle a (µg/l)	Carbone organique dissous (mg/l)
2020-08-03	3,7	2,2	3,5
2020-08-16	2,8	1,1	3,5
2020-09-27	2,9	1,1	2,7
Moyenne estivale	3,1	1,5	3,2

Classement du niveau trophique - Été 2020



Physicochimie

- Le Lac des Écorces compte 3 stations de surveillance. Cette fiche présente les résultats de la station 0596A. Une excellente estimation de la transparence moyenne estivale de l'eau a été obtenue par 12 mesures de la profondeur du disque de Secchi. Cette transparence de 6,2 m caractérise une eau très claire. Cette variable situe l'état trophique du lac à cette station dans la classe oligotrophe.
- La concentration moyenne de phosphore total trace mesurée est de 3,1 µg/l, ce qui indique que l'eau est très peu enrichie par cet élément nutritif. Cette variable situe l'état trophique du lac à cette station dans la classe ultra-oligotrophe.
- La concentration moyenne de chlorophylle a est de 1,5 µg/l, ce qui révèle un milieu dont la biomasse d'algues microscopiques en suspension est faible. Cette variable situe l'état trophique du lac à cette station dans la classe oligotrophe.
- La concentration moyenne de carbone organique dissous est de 3,2 mg/l, ce qui indique que l'eau est légèrement colorée. La couleur a donc probablement une faible incidence sur la transparence de l'eau.

État trophique et recommandations

- L'ensemble des variables physicochimiques mesurées à la station 0596A situe l'état trophique du lac dans la classe oligotrophe. Le sommaire des résultats des années de suivi pour cette station est illustré dans la fiche pluriannuelle.
- L'intégration des données recueillies à chacune des stations de surveillance permet de situer l'état trophique du Lac des Écorces dans la classe oligotrophe. Ce lac présente peu ou pas de signes d'eutrophisation. Ce plan d'eau est à protéger. Afin de conserver son état et ses usages, le MELCC recommande l'adoption de mesures préventives pour limiter les apports de matières nutritives issues des activités humaines.

Note : Une évaluation complète de l'état trophique du lac devrait notamment tenir compte de certaines composantes du littoral telles que les plantes aquatiques, le périphyton et les sédiments.

Date de production: 2021-03-25

ANNEX III: CEAEQ Physicochemical Lab Reports

Certificat d'analyse

Direction des expertises et des études
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Québec (Québec) G1P 3W8
Tél.: 418 643-1301
Téléc.: 418 528-1091

Client: Ville de Barkmere
182, chemin Barkmere
Barkmere (Québec) J0T 1A0

Nom de projet: Lac des Écories

Responsable: Jake Chadwick

Téléphone: 514-928-6778

Code projet client:

Date de réception: 28 octobre 2020

Numéro de dossier: Q123617

Bon de commande:

Code projet CEAEQ: 3175

Numéro de l'échantillon : Q123617-01

Préleveur: Jake Chadwick

Date de prélèvement: 25 octobre 2020

Description de l'échantillon: S1

Description de prélèvement: Silver Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Chlorophylle a

Méthode: MA. 800 - Chlor. 1.0

Résultat

LDM

Date d'analyse: 28 octobre 2020

2,07 µg/l

0,09

Remarque(s)

Niveau: Paramètre

No Éch.:Q123617-01 **Paramètre:** Chlorophylle a

Remarque

Ce paramètre ne fait pas partie de la portée d'accréditation du Conseil canadien des normes.

L'analyse a été réalisée avec la méthode MA. 800 - Chlor.2.0.

Certificat d'analyse (suite de l'échantillon numéro : Q123617-04)

Numéro de l'échantillon : Q123617-04

Préleur: Jake Chadwick

Description de l'échantillon: P1

Description de prélèvement: Priest's Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 25 octobre 2020

Chlorophylle a

Méthode: MA. 800 - Chlor. 1.0

Date d'analyse: 28 octobre 2020

Chlorophylle a

Résultat

Unité

LDM

2,99 µg/l

0,09

Remarque(s)

Niveau: Paramètre

No Éch.:Q123617-04 Paramètre: Chlorophylle a

Remarque

Ce paramètre ne fait pas partie de la portée d'accréditation du Conseil canadien des normes.

L'analyse a été réalisée avec la méthode MA. 800 - Chlor.2.0.

Numéro de l'échantillon : Q123617-07

Préleur: Jake Chadwick

Date de prélèvement: 25 octobre 2020

Description de l'échantillon: W1

Description de prélèvement: Wentworth Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Chlorophylle a

Méthode: MA. 800 - Chlor. 1.0

Date d'analyse: 28 octobre 2020

Chlorophylle a

Résultat

Unité

LDM

2,08 µg/l

0,09

Remarque(s)

Niveau: Paramètre

No Éch.:Q123617-07 Paramètre: Chlorophylle a

Remarque

Ce paramètre ne fait pas partie de la portée d'accréditation du Conseil canadien des normes.

L'analyse a été réalisée avec la méthode MA. 800 - Chlor.2.0.

Les résultats ne se rapportent qu'à l'échantillon soumis à l'analyse.

J'atteste avoir formellement constaté ces faits

Certificat approuvé le 13 novembre 2020

Angela Paquet-Walsh, M.Env., biologiste
Division biologie et microbiologie

Légende:

ABS: Absence

DNQ: Résultat entre la LDM et la LQM

INT: Interférences - Analyse impossible

ND: Non détecté

ST: Sous-traitance

PR: Présence

RNF: Résultat non disponible

NDR: DéTECTé - Mais ne satisfait pas le rapport isotopique

TNI: Colonies trop nombreuses pour être identifiées

VR: Voir remarque

Ce certificat ne doit pas être reproduit, sinon en entier, sans le consentement écrit du CEAEQ

Version 1 (1284048)

Certificat d'analyse

Direction de l'analyse chimique
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Tél.: 418 643-1301
Téléc.: 418 528-1091

Client: Ville de Barkmere
182, chemin Barkmere
Barkmere (Québec) J0T 1A0

Nom de projet: Lac des Écorces

Responsable: Jake Chadwick

Téléphone: 514-928-6778

Code projet client:

Date de réception: 28 octobre 2020

Numéro de dossier: Q123617

Bon de commande:

Code projet CEAEQ: 3175

Numéro de l'échantillon : Q123617-02

Préleveur: Jake Chadwick

Date de prélèvement: 25 octobre 2020

Description de l'échantillon: S2

Description de prélèvement: Silver Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Carbone organique dissous

Méthode: MA. 300 - C 1.0

Résultat **Unité** **LDM**

Date d'analyse: 29 octobre 2020

carbone organique dissous

3,7 mg/l C 0,2

Remarque(s)

Niveau: Paramètre

No Éch.:Q123617-02 **Paramètre:** Carbone organique dissous

Non-Conformité: hors délai de conservation

Délai de 2 jours dépassé lors de la réception de l'échantillon.

Numéro de l'échantillon : Q123617-03

Préleveur: Jake Chadwick

Date de prélèvement: 25 octobre 2020

Description de l'échantillon: S3

Description de prélèvement: Silver Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Résultat **Unité** **LDM**

Date d'analyse: 13 novembre 2020

Phosphore total

6,8 µg/l 0,6

Certificat d'analyse (suite de l'échantillon numéro : Q123617-05)

Numéro de l'échantillon : Q123617-05

Préleur: Jake Chadwick

Date de prélèvement: 25 octobre 2020

Description de l'échantillon: P2

Description de prélèvement: Priest's Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Carbone organique dissous

Méthode: MA. 300 - C 1.0

Résultat Unité LDM

Date d'analyse: 29 octobre 2020

carbone organique dissous

2,9 mg/l C 0,2

Remarque(s)

Niveau: Paramètre

No Éch.:Q123617-05 Paramètre: Carbone organique dissous

Non-Conformité: hors délai de conservation

Délai de 2 jours dépassé lors de la réception de l'échantillon.

Numéro de l'échantillon : Q123617-06

Préleur: Jake Chadwick

Date de prélèvement: 25 octobre 2020

Description de l'échantillon: P3

Description de prélèvement: Priest's Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Résultat Unité LDM

Date d'analyse: 13 novembre 2020

Phosphore total

5,3 µg/l 0,6

Certificat d'analyse (suite de l'échantillon numéro : Q123617-08)

Numéro de l'échantillon : Q123617-08

Préleur: Jake Chadwick

Description de l'échantillon: W2

Description de prélèvement: Wentworth Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 25 octobre 2020

Carbone organique dissous

Méthode: MA. 300 - C 1.0

Résultat Unité LDM

Date d'analyse: 29 octobre 2020

carbone organique dissous

3,1 mg/l C 0,2

Remarque(s)

Niveau: Paramètre

No Éch.:Q123617-08 Paramètre: Carbone organique dissous

Non-Conformité: hors délai de conservation

Délai de 2 jours dépassé lors de la réception de l'échantillon.

Numéro de l'échantillon : Q123617-09

Préleur: Jake Chadwick

Date de prélèvement: 25 octobre 2020

Description de l'échantillon: W3

Description de prélèvement: Wentworth Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Résultat Unité LDM

Date d'analyse: 13 novembre 2020

Phosphore total

3,0 µg/l 0,6

Les résultats ne se rapportent qu'à l'échantillon soumis à l'analyse.

J'atteste avoir formellement constaté ces faits

Certificat approuvé le 20 novembre 2020



Jean-Luc Pilote, M.Sc. Chimiste
Division chimie inorganique, Québec

Légende:

ABS: Absence

ND: Non détecté

RNF: Résultat non disponible

VR: Voir remarque

DNQ: Résultat entre la LDM et la LQM

ST: Sous-traitance

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INT: Interférences - Analyse impossible

PR: Présence

TNI: Colonies trop nombreuses pour être identifiées

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Version 1 (1284951)

Certificat d'analyse

Direction des expertises et des études
2700, rue Einstein
Québec (Québec) G1P 3W8
Tél.: 418 643-1301
Téléc.: 418 528-1091

Client: Ville de Barkmere
182, chemin Barkmere
Barkmere (Québec) J0T 1A0

Nom de projet: Lac des Écorces

Responsable: Jake Chadwick

Téléphone: 514-928-6778

Code projet client:

Date de réception: 28 août 2020

Numéro de dossier: Q122033

Bon de commande:

Code projet CEAEQ: 3175

Numéro de l'échantillon : Q122033-01

Préleveur: Jake Chadwick

Date de prélèvement: 27 août 2020

Description de l'échantillon: C1

Description de prélèvement: G. Miller

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Résultat

LDM

Date d'analyse: 28 août 2020

3 UFC/100 ml

2

Remarque(s)

Niveau: Paramètre

No Éch.: Q122033-01 **Paramètre:** Coliformes thermotolérants (fécaux) -
dnb

Bouteille de prélèvement trop pleine

Numéro de l'échantillon : Q122033-02

Préleveur: Jake Chadwick

Date de prélèvement: 27 août 2020

Description de l'échantillon: C2

Description de prélèvement: @ Village bridge

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Résultat

LDM

Date d'analyse: 28 août 2020

25 UFC/100 ml

2

Préleveur: Jake Chadwick

Description de l'échantillon: C3

Description de prélèvement: de la Montagne

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Résultat

Unité

LDM

Date d'analyse: 28 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

82 UFC/100 ml

2

Remarque(s)**Niveau: Paramètre**No Éch.:Q122033-03 Paramètre: Coliformes thermotolérants (fécaux) -
dnb

Bouteille de prélèvement trop pleine

*Les résultats ne se rapportent qu'à l'échantillon soumis à l'analyse.**J'atteste avoir formellement constaté ces faits**Certificat approuvé le 31 août 2020*


Manuela Villion, Ph.D., microbiologiste
Division biologie et microbiologie

Légende:

ABS: Absence

ND: Non détecté

RNF: Résultat non disponible

VR: Voir remarque

DNQ: Résultat entre la LDM et la LQM

ST: Sous-traitance

NDR: DéTECTé - Mais ne satisfait pas le rapport isotopique

INT: Interférences - Analyse impossible

PR: Présence

TNI: Colonies trop nombreuses pour être identifiées

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Certificat d'analyse

Direction des expertises et des études
2700, rue Einstein
Québec (Québec) G1P 3W8
Tél.: 418 643-1301
Téléc.: 418 528-1091

Client: Ville de Barkmere
182, chemin Barkmere
Barkmere (Québec) J0T 1A0

Nom de projet: Lac des Écorces

Responsable: Jake Chadwick

Téléphone: 514-928-6778

Code projet client:

Date de réception: 21 août 2020

Numéro de dossier: Q121848

Bon de commande:

Code projet CEAEQ: 3175

Numéro de l'échantillon : Q121848-01

Préleveur: Jake Chadwick

Date de prélèvement: 19 août 2020

Description de l'échantillon: C1

Description de prélèvement: Outlet

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Résultat **Unité** **LDM**

Date d'analyse: 21 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

11 UFC/100 ml

2

Remarque(s)

Niveau: Échantillon

No Éch.:Q121848-01

Non-conformité: préservation non conforme

Numéro de l'échantillon : Q121848-02

Préleveur: Jake Chadwick

Date de prélèvement: 19 août 2020

Description de l'échantillon: C2

Description de prélèvement: Whittal Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Résultat **Unité** **LDM**

Date d'analyse: 21 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

23 UFC/100 ml

2

Certificat d'analyse (suite de l'échantillon numéro : Q121848-03)

Numéro de l'échantillon : Q121848-03

Préleur: Jake Chadwick

Description de l'échantillon: C3

Description de prélèvement: Patry Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Date d'analyse: 21 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

Date de prélèvement: 19 août 2020

Résultat Unité LDM

2 UFC/100 ml 2

Remarque(s)

Niveau: Paramètre

No Éch.:Q121848-03 Paramètre: Coliformes thermotolérants (fécaux) -
dnb

Bouteille de prélèvement trop pleine

Numéro de l'échantillon : Q121848-04

Préleur: Jake Chadwick

Description de l'échantillon: C4

Description de prélèvement: Green Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Date d'analyse: 21 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

Date de prélèvement: 19 août 2020

Résultat Unité LDM

3 UFC/100 ml 2

Numéro de l'échantillon : Q121848-05

Préleur: Jake Chadwick

Description de l'échantillon: C5

Description de prélèvement: Dugan Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Date d'analyse: 21 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

Date de prélèvement: 19 août 2020

Résultat Unité LDM

<2 UFC/100 ml 2

Certificat d'analyse (suite de l'échantillon numéro : Q121848-06)

Numéro de l'échantillon : Q121848-06

Préleur: Jake Chadwick

Description de l'échantillon: C6

Description de prélèvement: Cope Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Date d'analyse: 21 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

Date de prélèvement: 19 août 2020

Résultat Unité

LDM

<2 UFC/100 ml

2

Numéro de l'échantillon : Q121848-07

Préleur: Jake Chadwick

Description de l'échantillon: C7

Description de prélèvement: Silver Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Coliformes thermotolérants (fécaux) - dnb

Méthode: MA. 700 - Fec.Ec. 1.0

Date d'analyse: 21 août 2020

Coliformes thermotolérants (fécaux) - dénombrement

Date de prélèvement: 19 août 2020

Résultat Unité

LDM

2 UFC/100 ml

2

Remarque(s)

Niveau: Paramètre

No Éch.:Q121848-07 Paramètre: Coliformes thermotolérants (fécaux) -
dnb

Bouteille de prélèvement trop pleine

Les résultats ne se rapportent qu'à l'échantillon soumis à l'analyse.

J'atteste avoir formellement constaté ces faits

Certificat approuvé le 31 août 2020



Manuela Villion, Ph.D., microbiologiste
Division biologie et microbiologie

Légende:

ABS: Absence

ND: Non détecté

RNF: Résultat non disponible

VR: Voir remarque

DNQ: Résultat entre la LDM et la LQM

ST: Sous-traitance

NDR: DéTECTé - Mais ne satisfait pas le rapport isotopique

INT: Interférences - Analyse impossible

PR: Présence

TNI: Colonies trop nombreuses pour être identifiées

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Version 1 (1271457)

Certificat d'analyse

Direction de l'analyse chimique
2700, rue Einstein
Québec (Québec) G1P 3W8
Tél.: 418 643-1301
Téléc.: 418 528-1091

Client: Ville de Barkmere
182, chemin Barkmere
Barkmere (Québec) J0T 1A0

Nom de projet: Lac des Écorces

Responsable: Jake Chadwick

Téléphone: 514-928-6778

Code projet client:

Date de réception: 28 août 2020

Numéro de dossier: Q122033

Bon de commande:

Code projet CEAEQ: 3175

Numéro de l'échantillon : Q122033-04

Préleveur: Jake Chadwick

Description de l'échantillon: pH 1

Description de prélèvement: Priest's

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 26 août 2020

pH

Méthode: MA. 303 - Titre Auto 2.1

Date d'analyse: 28 août 2020

	Résultat	Unité	LDM
pH	7,1		2,0

Numéro de l'échantillon : Q122033-05

Préleveur: Jake Chadwick

Description de l'échantillon: pH 2

Description de prélèvement: Wentworth

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 26 août 2020

pH

Méthode: MA. 303 - Titre Auto 2.1

Date d'analyse: 28 août 2020

	Résultat	Unité	LDM
pH	7,1		2,0

Préleur: Jake Chadwick

Description de l'échantillon: pH 3

Description de prélèvement: Silver Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

pH

Méthode: MA. 303 - Titre Auto 2.1

Date d'analyse: 28 août 2020

	Résultat	Unité	LDM
pH	7,0		2,0

Les résultats ne se rapportent qu'à l'échantillon soumis à l'analyse.

J'atteste avoir formellement constaté ces faits

Certificat approuvé le 31 août 2020

Jean-Luc Pilote, M.Sc. Chimiste
Division chimie inorganique, Québec

Légende:

ABS: Absence

ND: Non détecté

RNF: Résultat non disponible

VR: Voir remarque

DNQ: Résultat entre la LDM et la LQM

ST: Sous-traitance

NDR: DéTECTé - Mais ne satisfait pas le rapport isotopique

INT: Interférences - Analyse impossible

PR: Présence

TNI: Colonies trop nombreuses pour être identifiées

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Version 1 (1271134)

Certificat d'analyse

Direction de l'analyse chimique
2700, rue Einstein
Québec (Québec) G1P 3W8
Tél.: 418 643-1301
Téléc.: 418 528-1091

Client: Ville de Barkmere
182, chemin Barkmere
Barkmere (Québec) J0T 1A0

Nom de projet: Lac des Écorces

Responsable: Jake Chadwick

Téléphone: 514-928-6778

Code projet client:

Date de réception: 26 juin 2020

Numéro de dossier: Q120062

Bon de commande:

Code projet CEAEQ: 3175

Numéro de l'échantillon : Q120062-01

Préleveur: Jake Chadwick

Description de l'échantillon: S3

Description de prélèvement: Silver Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 21 juin 2020

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 7 juillet 2020

Phosphore total

Résultat

Unité

LDM

3,6 µg/l

0,6

Numéro de l'échantillon : Q120062-02

Préleveur: Jake Chadwick

Description de l'échantillon: P3

Description de prélèvement: Priest's Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 21 juin 2020

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 7 juillet 2020

Phosphore total

Résultat

Unité

LDM

5,4 µg/l

0,6

Préleur: Jake Chadwick**Description de l'échantillon:** W3**Description de prélèvement:** Wentworth Bay**Point de prélèvement:****Nature de l'échantillon:** eau naturelle de surface**Phosphore total - Persul. trace verre à 660 nm****Méthode:** MA. 303 - P 5.2**Date d'analyse:** 7 juillet 2020

Phosphore total

Date de prélèvement: 21 juin 2020**Résultat****Unité****LDM**

2,9 µg/l

0,6

*Les résultats ne se rapportent qu'à l'échantillon soumis à l'analyse.**J'atteste avoir formellement constaté ces faits**Certificat approuvé le 13 juillet 2020*


**Jean-Luc Pilote, M.Sc. Chimiste
Division chimie inorganique, Québec**

Légende:

ABS: Absence

ND: Non détecté

RNF: Résultat non disponible

VR: Voir remarque

DNQ: Résultat entre la LDM et la LQM

ST: Sous-traitance

NDR: DéTECTé - Mais ne satisfait pas le rapport isotopique

INT: Interférences - Analyse impossible

PR: Présence

TNI: Colonies trop nombreuses pour être identifiées

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Certificat d'analyse

Direction de l'analyse chimique
2700, rue Einstein
Québec (Québec) G1P 3W8
Tél.: 418 643-1301
Téléc.: 418 528-1091

Client: Ville de Barkmere
182, chemin Barkmere
Barkmere (Québec) J0T 1A0

Nom de projet: Lac des Écorces

Responsable: Jake Chadwick

Téléphone: 514-928-6778

Code projet client:

Date de réception: 28 juillet 2020

Numéro de dossier: Q121003

Bon de commande:

Code projet CEAEQ: 3175

Numéro de l'échantillon : Q121003-01

Préleveur: Jake Chadwick

Description de l'échantillon: W1

Description de prélèvement: Whittal Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 26 juillet 2020

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Résultat

Unité

LDM

6,6 µg/l

0,6

Numéro de l'échantillon : Q121003-02

Préleveur: Jake Chadwick

Description de l'échantillon: W2

Description de prélèvement: Whittal Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Date de prélèvement: 26 juillet 2020

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Résultat

Unité

LDM

3,6 µg/l

0,6

Certificat d'analyse (suite de l'échantillon numéro : Q121003-03)

Numéro de l'échantillon : Q121003-03

Préleur: Jake Chadwick

Description de l'échantillon: W3

Description de prélèvement: Whittal Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Date de prélèvement: 26 juillet 2020

Résultat

Unité

LDM

5,5 µg/l

0,6

Numéro de l'échantillon : Q121003-04

Préleur: Jake Chadwick

Description de l'échantillon: I1

Description de prélèvement: Inlet

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Date de prélèvement: 26 juillet 2020

Résultat

Unité

LDM

13,1 µg/l

0,6

Numéro de l'échantillon : Q121003-05

Préleur: Jake Chadwick

Description de l'échantillon: I2

Description de prélèvement: Inlet

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Date de prélèvement: 26 juillet 2020

Résultat

Unité

LDM

10,3 µg/l

0,6

Certificat d'analyse (suite de l'échantillon numéro : Q121003-06)

Numéro de l'échantillon : Q121003-06

Préleur: Jake Chadwick

Description de l'échantillon: I3

Description de prélèvement: Inlet

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Date de prélèvement: 21 juin 2020

Résultat

Unité

LDM

10,2 µg/l

0,6

Numéro de l'échantillon : Q121003-07

Préleur: Jake Chadwick

Description de l'échantillon: C1

Description de prélèvement: Cope Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Date de prélèvement: 26 juillet 2020

Résultat

Unité

LDM

47,6 µg/l

0,6

Numéro de l'échantillon : Q121003-08

Préleur: Jake Chadwick

Description de l'échantillon: C2

Description de prélèvement: Cope Bay

Point de prélèvement:

Nature de l'échantillon: eau naturelle de surface

Phosphore total - Persul. trace verre à 660 nm

Méthode: MA. 303 - P 5.2

Date d'analyse: 5 août 2020

Phosphore total

Date de prélèvement: 26 juillet 2020

Résultat

Unité

LDM

35,8 µg/l

0,6

Préleur: Jake Chadwick**Description de l'échantillon:** C3**Description de prélèvement:** Cope Bay**Point de prélèvement:****Nature de l'échantillon:** eau naturelle de surface**Phosphore total - Persul. trace verre à 660 nm****Méthode:** MA. 303 - P 5.2**Date d'analyse:** 5 août 2020**Date de prélèvement:** 26 juillet 2020

Phosphore total

Résultat**Unité****LDM**

26,5 µg/l

0,6

*Les résultats ne se rapportent qu'à l'échantillon soumis à l'analyse.**J'atteste avoir formellement constaté ces faits**Certificat approuvé le 10 août 2020*


**Steeve Roberge, M. Sc. chimiste
Division chimie inorganique, Québec**

Légende:

ABS: Absence

ND: Non détecté

RNF: Résultat non disponible

VR: Voir remarque

DNQ: Résultat entre la LDM et la LQM

ST: Sous-traitance

NDR: DéTECTé - Mais ne satisfait pas le rapport isotopique

INT: Interférences - Analyse impossible

PR: Présence

TNI: Colonies trop nombreuses pour être identifiées

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