Aquality
Environmental Consulting Ltd.

2022 Annual Report

Summerside Lake Environmental Services

Prepared for:

Summerside Residents Association

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2022 Annual Report

Summerside Lake Environmental Services
Signature Page

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Contents

Table of Contents

List of Figures

List of Tables

1 Introduction

The community of Summerside Lake was constructed in the early 2000s and surrounds a 32-acre man-made lake. The lake provides opportunities for recreation including swimming, fishing, and boating in the summer, and ice fishing and skating in the winter. The lake is managed and maintained by the Summerside Residents Association (SSRA). Since its creation, SSRA has been contracting environmental services for lake and fisheries management to assess the health of the lake, identify aquatic ecosystem trends, and provide recommendations for management. Aquality Environmental Consulting Ltd. (Aquality) has been providing professional guidance on lake management since 2021.

2 Objectives

The SSRA identified three main goals for lake management in 2021 which included maintaining safe water quality for recreation, clear water for aesthetics, and improved angling opportunities. The primary objective of the 2022 program was to continue a trajectory from basic lake monitoring towards a more robust lake management framework to meet the three goals. To achieve the goals, the following activities were undertaken in 2022:

- Water quality monitoring (winter and summer)
- Yellow perch removal
- Phosphorus binding treatment (including pre- and post-water quality measurements)
- Cyanobacterial treatments (for blue green algae)
- Communication to the SSRA and messaging for residents

The following describes the methods used to complete these studies, the results of the programs, and recommendations to further achieve the goals of Summerside into the future.

In addition to the activities listed above led by Aquality, SSRA also completed the following programs:

- Spring and fall fish stockings,
- Weekly beach monitoring during the summer for coliforms in partnership with Alberta Health
- Documenting cases of Swimmer's Itch, and
- Harvesting of aquatic vegetation using machinery (one day using Truxor) and by hand (with volunteer divers).

3 Methods

Generally, the methods employed during the 2022 field surveys were conducted in similar locations and times as in 2022 and earlier monitoring. Many of the same limnological parameters were measured throughout the year and the methods used were similar to those in 2021 to better understand the nutrient interaction between the water and the substrate.

3.1 Water Quality

Water quality parameters were measured at several predetermined locations in Summerside Lake throughout the year (Figure 1). Table 1 outlines the reoccurring methods of the Summerside Water Quality Monitoring Program.

Table 1. Water quality parameters measured as part of the Summerside Lake Water Quality Program, 2022.

Parameter	18 Feb	25 May	2 Jun	9 Aug
Water temperature (°C) and dissolved oxygen (mg/L and percent saturation [%])	X			X
Nutrients	X	X	X	X
Routine and Metals	X [1]	X	X	X [1]
Zooplankton				X
Chlorophyll *a*				X

[1] Conductivity and pH also measured during dissolved oxygen profiles

Water quality results were compared to the Environmental Quality Guidelines for Alberta Surface Waters (Government of Alberta, 2018) and the Water Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment, 1999.)

3.1.1 Dissolved Oxygen and Temperature

Dissolved oxygen (DO) and water temperature profiles were conducted during the winter and summer to document changes and as supplemental information for other parameters. Profiles were measured under ice to assess the available oxygen during winter to supplement the sediment sampling to determine potential phosphorus release. They were also measured in open water to assess the available oxygen during summer conditions.

The profiles were measured at the two deepest locations (north and south sites) in Summerside Lake (Figure 1) for year over year comparison. DO and temperature were measured using an optical dissolved oxygen probe (YSI ProODO) in February, and a membrane-style probe (YSI Pro Quatro) in August.

Measurements for water temperature (°C) and dissolved oxygen (mg/L and percent saturation [%]) were recorded at 0.5 m depth intervals along a vertical profile. Measurements were recorded on the way down and were additionally recorded on the way back up for comparison.

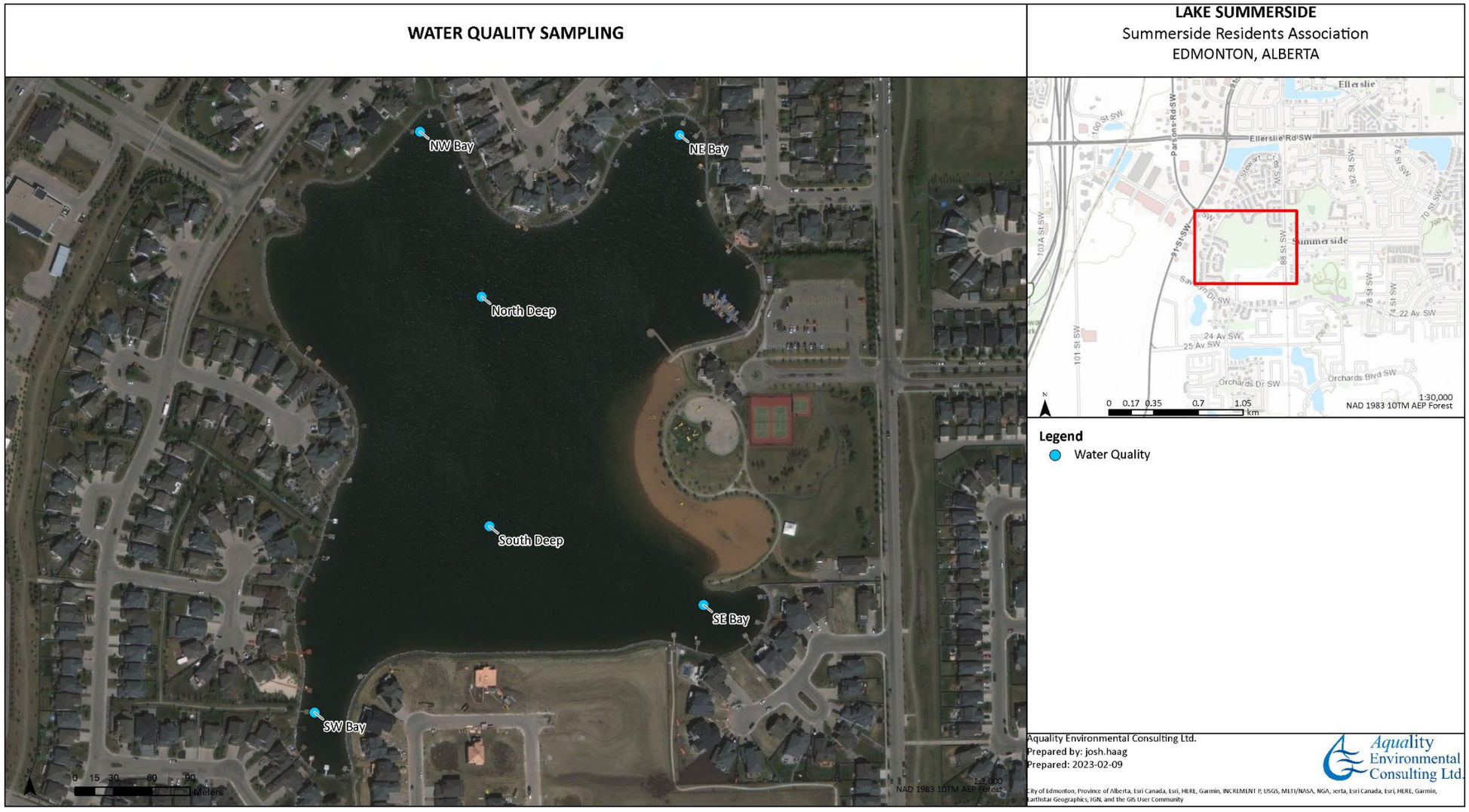

Figure 1. Water quality monitoring locations at Summerside Lake, 2022.

3.1.2 Nutrients

The water quality results were analyzed to determine potential nutrient sources that may contribute to growth of phytoplankton, algae and submergent vegetation (Table 2).

Table 2. Nutrient parameters analyzed in Summerside Lake, 2022.

Category	Parameters
Nutrients	Total nitrogen, total Kjeldahl nitrogen, nitrate, nitrite, ammonia, total phosphorus (low level), dissolved phosphate (low level), orthophosphate

Sampling for nutrients in 2022 focused on collecting water closer to the water-substrate interface. This was achieved by using a horizontal Beta sampler. Lower detection analyses for total and dissolved phosphorus were also completed. Additional water samples were for nutrient analysis, which included the parameters of Ammonium-N, Total and Kjeldahl nitrogen, nitrate, and nitrite. Each of the sampling container bottles was labelled with the date, time, and sampling location. The samples were preserved, placed in a cooler, and submitted at the end of the day to Element Materials Technology (Element) in Edmonton for analysis.

3.1.3 Routine Parameters and Metals

Routine water chemistry and metals were measured during winter 2022 from the north and south deep water quality sites (Table 3). Samples were collected from the two deep sites and from the four bays during the summer.

Table 3. Routine water chemistry and metal parameters measured in Summerside Lake in 2021.

Category	Parameters
Routine Water Chemistry	pH, Electrical Conductivity (EC), Calcium, Magnesium, Sodium, Potassium, Iron, Sulphate, Chloride, Manganese, carbonate, bicarbonate, nitrate, nitrite, alkalinity, hardness, total dissolved solids, colour, turbidity, total suspended solids
Metals (total and dissolved)	Aluminum (Al), Antimony (Sb), Arsenic (Ar), Barium (Ba), Beryllium (Be), Bismuth (Bi), Boron (B), Cadmium (Cd), Calcium (Ca), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Lithium (Li), Magnesium (Mg), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Potassium (K), Selenium (Se), Silicon (Si), Silver (Ag), Sodium (Na), Strontium (Sr), Sulphur (S), Thallium (Tl), Titanium (Ti), Uranium (U), Vanadium (V), Zinc (Zn)

A sampling tube fitted with a one-way foot valve was used to collect a full column composite water sample. The tube was decanted into a clean bucket to obtain sufficient sample volume. The composite sample was then transferred to the appropriate sample containers and preservatives were added as needed. Field filtering of water samples was not conducted. Each of the sampling container bottles was labelled with the date, time, and sampling location, placed in a cooler, and transported to Element in Edmonton for analysis.

Conductivity and pH were also recorded in the winter and summer as part of the dissolved oxygen profile measurements. EnviroMak Inc. had previously recommended monitoring the pH levels due to potential leaching from large rip rap placed around the perimeter of the lake (D. Marchuk, pers comm.), and the higher pH values reported in previous studies.

Odour sampling measuring Threshold Odour Number (TON) was not conducted in 2022 as there were no odour concerns raised by residents.

3.1.4 Zooplankton

Zooplankton were sampled from the north and south sites during the summer event. Samples were collected with a Wisconsin net (20 cm mouth opening, approximately 70 cm long, with 63 µm mesh). A vertical haul was used to obtain an integrated depth sample through the fill column depth. Each haul was condensed as a single sample and decanted into a 1 L bottle, and the volume further reduced to a single 250 mL bottle per site. Each sample was labelled and then preserved with 100 mL of isopropyl alcohol. The samples were submitted to Invert Solutions for analysis including zooplankton counts and identification of major taxa.

3.1.5 Chlorophyll *a*

Chlorophyll *a* samples were collected from the north and south sites during the summer event. The water clarity was measured using a Secchi disk and the distance visible was used to approximate the euphotic zone (area of sufficient light for photosynthesis to occur). It is within this zone that water samples were collected chlorophyll *a*.

The water sample was collected using the sampling tube fitted with the one-way foot valve. The tube was decanted into a clean bucket to obtain sufficient sample volume. All samples were submitted to ALS Environmental for analysis.

3.2 Yellow Perch Eradication

The removal of Yellow Perch has been conducted annually, primarily using gill nets. Minnow traps have also been used due to reports of Goldfish in the lake. Spruce boughs were used previously to remove deposited Yellow Perch eggs, but this method was not used in 2022. In 2022, gill nets and minnow traps were the primary sampling methods used, but hoop /Fyke nets were tested as an option.

Yellow perch removal was conducted between May 2 and 4, 2022 under Alberta Environment and Parks (AEP) Fish Research License (FRL) #22-3802. Each gill net consisted of one panel of 19.1 mm (¾”) mesh and one panel of 25.4 mm (1”) mesh. Each panel was 2.4 m (8’) high and 15.2 m (50’) long. Gill nets were bottom set at four locations around the lake parallel to the shoreline across each embayment (Figure 2). The nets were initially checked between approximately 2.7 and 3.2 h and then fished overnight.

Ten minnow traps were baited with dry cat food and set at various locations around the lake (Figure 2). Individual traps were not left for more than 24 hours at a time.

Two hoop nets were set on both ends of the beach. Each hoop net was 3.8 m long x 0.8 m diameter and consisted of three compartments with a terminal cod end. The compartments were separated by five rings 0.8 m apart, with throat openings of 0.2 m. The outer frame was enclosed in 6 mm mesh and there were zippers between hoops to facilitate fish removal. The hoop net also had two wings (7.6 m long x 1.2 m wide; 13 mm mesh) with a lead line along bottom and floats along top.

Upon equipment retrieval, captured Yellow Perch were removed. The site, method, and the mesh size (as applicable for gill nets) were documented. The fish were then placed into buckets and euthanized using a concentrated clove oil solution.

Representative Yellow Perch were retained, and fork length, weight, sex, and spawning status were recorded. Fin and otolith structures were also retained for aging purposes.

All Yellow Perch removed from Summerside Lake were tabulated and the data were submitted to AEP per conditions of the FRL.

3.3 Cyanobacteria Control

Harmful algal blooms first started to appear in Summerside in the summer of 2021. To combat the growth of undesirable cyanobacteria, Lake Summerside was treated with granular hydrogen peroxide (sodium percarbonate). Application of hydrogen peroxide were conducted by Summerside staff in areas of visible blooms periodically. A full treatment application was completed on September 1, 2022 following the emergence of visible blooms. Two applicators dispersed the granules using handheld Chapin fertilizer spreaders from the stern of a boat that navigated around the perimeter of the lake at a constant speed.

Two hundred and twenty-seven kilograms (10 X 22.7 kg bags) of sodium percarbonate were applied in September. Baseline measurements of hydrogen peroxide concentration (ppm) were measured using Bartovation Low Level residual test strips. Peroxide residual measurements were taken at ten locations prior to initial treatment in September and for 24 h following application to protect recreational users.

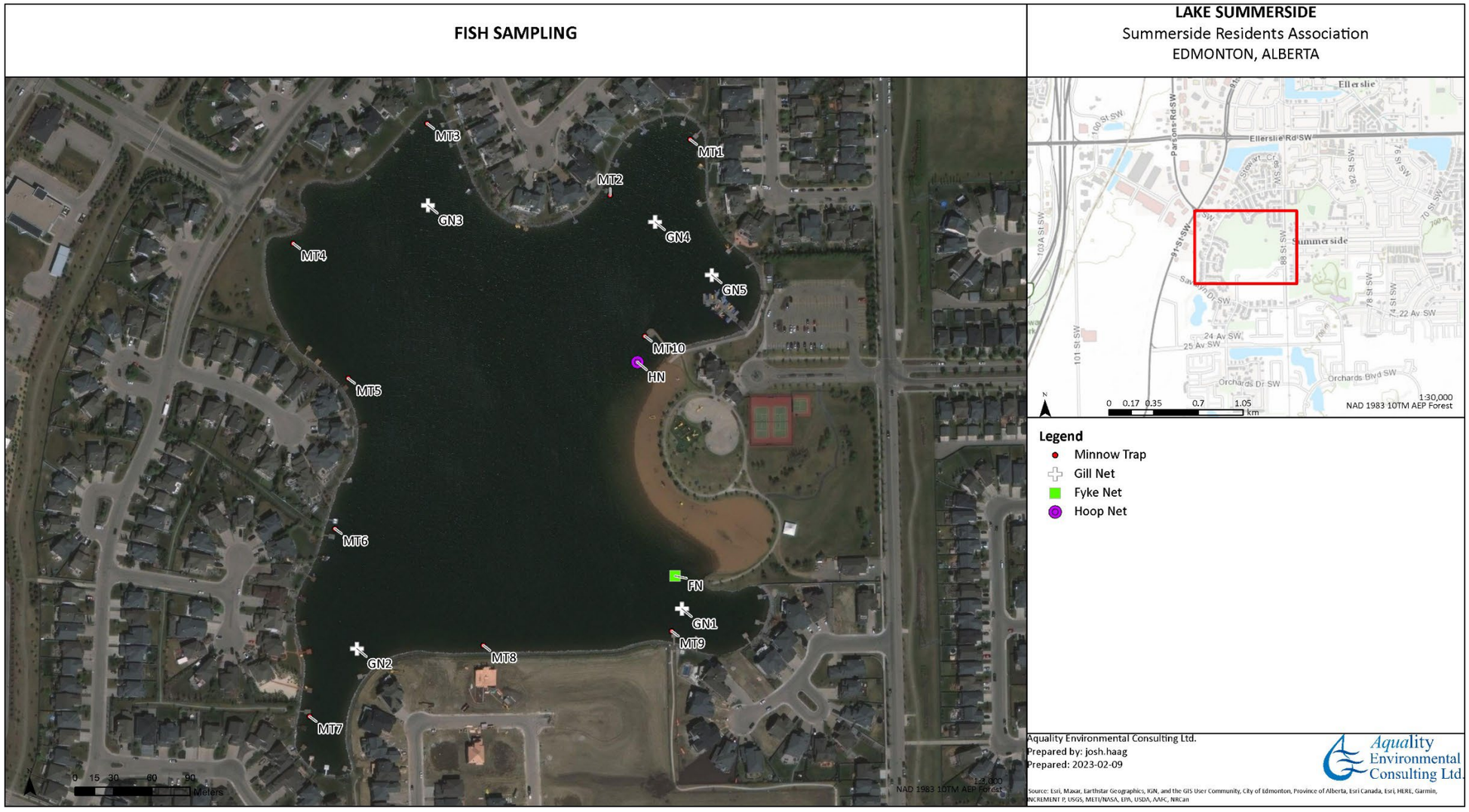

Figure 2. Fish sampling locations at Summerside Lake, 2022.

4 Results

4.1 Water Quality

4.1.1 Dissolved Oxygen and Temperature

4.1.1.1 Winter 2022

Dissolved oxygen (DO) and temperature profiles were conducted on 18 February 2022 (late winter) to understand the overwintering conditions for fish survival. DO typically decreases with depth and water temperature is typically warmer at the bottom. Some fish species are more tolerant of decreased DO and can survive at lower depths where the temperatures and DO are both lower.

As expected, the lowest water temperatures were less than 1.0°C at the ice-water interface, and the highest at the bottom, measuring 4.4°C (Appendix A, Table A1 and A2, Figure 3). The rate of temperature increase was highest within the first 1.5 to 4.0 m (thermocline), and then the rate declined.

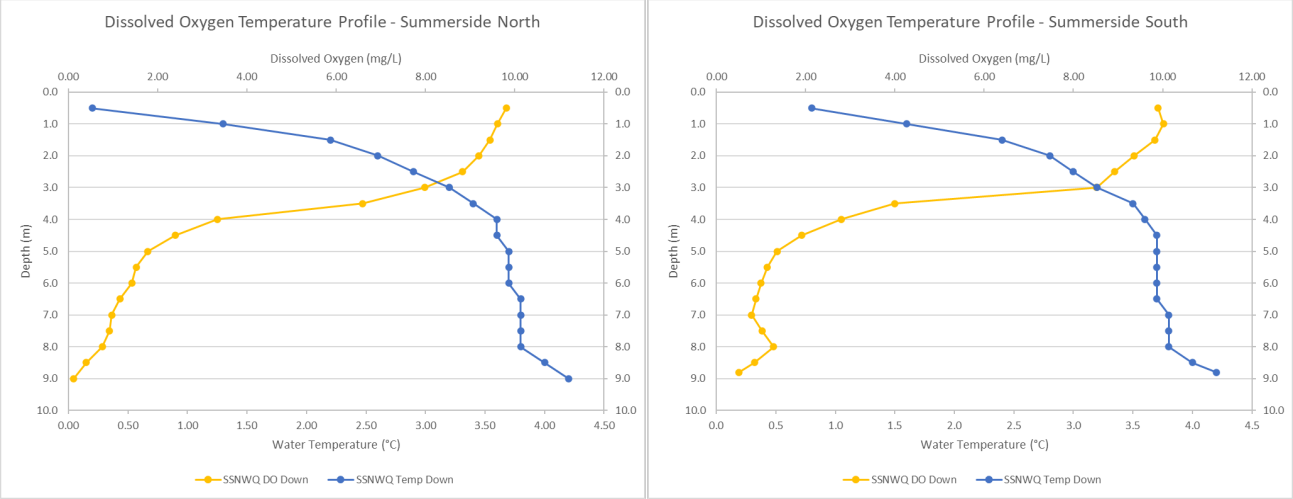

Figure 3. Dissolved oxygen and temperature profile for Summerside Lake at the north and south sites, February 18, 2022.

The DO declined with depth (Appendix A, Table A1 and A2). At the north site, the DO was 9.8 mg/L at the surface, was below 5.0 mg/L at a depth of approximately 3.75 m and was below 1.0 mg/L at a depth of 7.0 m (Figure 3). At the south site, the DO was 9.9 mg/L near the surface, was below 5.0 mg/L at a depth of approximately 3.25 m and below 1.0 mg/L at a depth of 6.0 m. The short-term (acute) DO guideline for the protection of freshwater aquatic life is 5.0 mg/L (EQGASW 2018). For certain times of the year and some invertebrates, 8.3 mg/L is considered a long-term guideline (or chronic guideline).

DO concentrations were lower at a shallower depth in February 2022 than in January 2021, but the sampling occurred approximately three weeks later in the winter when concentrations were expected to be lower.

As in 2021, Yellow Perch were observed using an AquaVu® 715c underwater camera at both sites. No other fish species were observed, but the camera was stationed near the bottom where the DO concentrations were lower and less suitable for trout.

4.1.1.2 Summer DO

Water temperatures at both sites decreased with depth in contrast to measurements collected during winter ice conditions. The coldest location at the north site was at a depth of 9 m and was 9.0°C (Appendix A, Table A3; Figure 4). The coldest location at the south site was at a depth of 8 m and was 10.7°C (Appendix A, Table A4). The maximum surface temperature measured was 21.3 °C measured at 0.5 m depth (Appendix A, Table A3 and A4). The thermocline was located between 5.5 and 6.0 m.

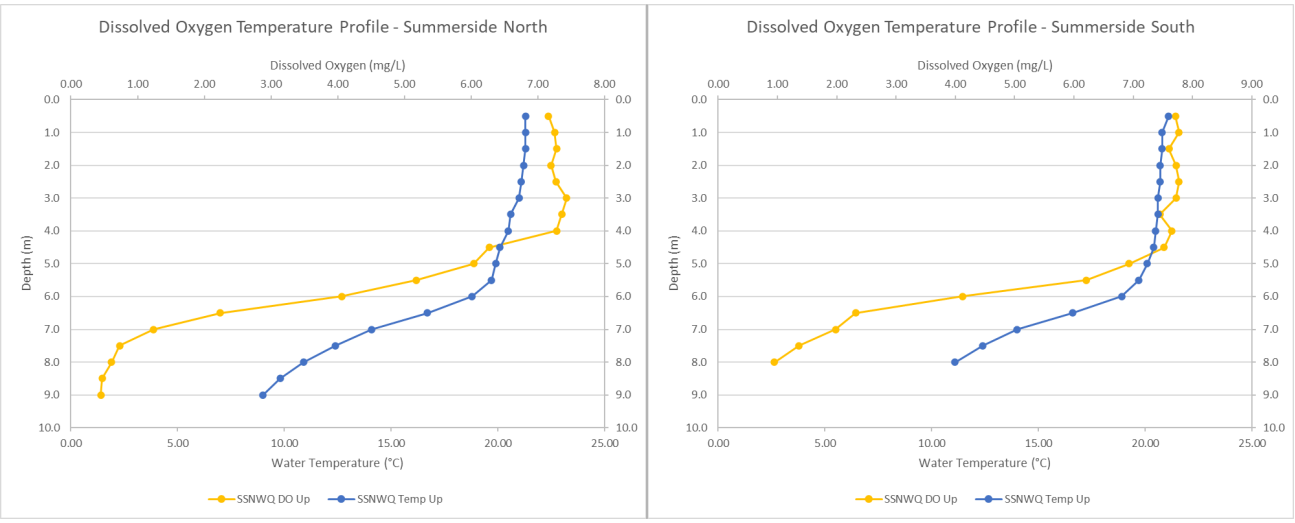

Figure 4. Dissolved oxygen and temperature profile for Summerside Lake at the north and south sites, August 9, 2022.

The DO again declined with depth, like the under-ice conditions. The highest DO concentrations were approximately 7.7 mg/L, due to wind and wave action (Appendix A, Tables A3 and A4; Figure 4). The lowest concentrations were measured at 9 m depth (near bottom) at the north site (0.45 mg/L) and 8 m depth in the south (0.95 mg/L). DO concentrations also decreased at a higher rate below 5.5 and 6.5 m, but were below 5.0 mg/L at a depth of approximately 5.75 m.

The summer DO concentrations and water temperature measured in August 2022 were similar to those measured in August 2021.

4.1.2 Nutrients

4.1.2.1 Winter 2022

Composite (full column) and discrete (near the bottom substrate) water samples were collected and analyzed for nutrient concentrations February 2022. Low level detection analyses were requested for phosphorus compounds in 2022 compared to 2021. Most of the nutrient parameter concentrations were higher from the bottom sample than the composite. Total and Kjeldahl Nitrogen (Total) were the only parameters where there was no discernible difference between sampling locations. As the nutrient parameters were typically higher than the full column, subsequent sampling focused on nutrient exchange near the bottom sediments.

Most of the nutrient parameters were above detection limits at the north and south sites (Appendix B, Tables B1 and B2). Total, dissolved, and Orthophosphate–P phosphorus were detected in all the bottom samples, but Orthophosphate was not detected in the composite samples. It is this Orthophosphate that is biologically available to be taken up by growing plants.

All the nitrogen-based parameters were above the detection limits for both sites (Appendix B, Table B1 and B2).

4.1.2.2 Pre- and Post- Treatment

On 30 May 2022, Floc N'Lock (an alum-based treatment) was applied to the entire shoreline of Lake Summerside. The product is alum-based and acts to bind phosphate to the top of the sediment layer, thus removing or "locking" phosphorus from the system. Water samples were collected for analysis pre- and post-alum treatment (May 25 and June 2, 2022, respectively) to determine changes in the phosphorus concentrations. Water samples were collected from the bottom near the substrate water interface at six locations, including four shallow sites (bays) and two deep sites. Low level detection limits were requested for dissolved and total phosphorus, but unfortunately, low level dissolved phosphorus results were not provided for the pre-treatment samples.

A reduction in the total available phosphorus was observed between the pre- and post-alum treatment at all sites. The reduction was more than half in several cases; however, the reduction was less pronounced at one shallow site (southeast bay) and one deep site (north) (Figure 5; Appendix B, Table B1).

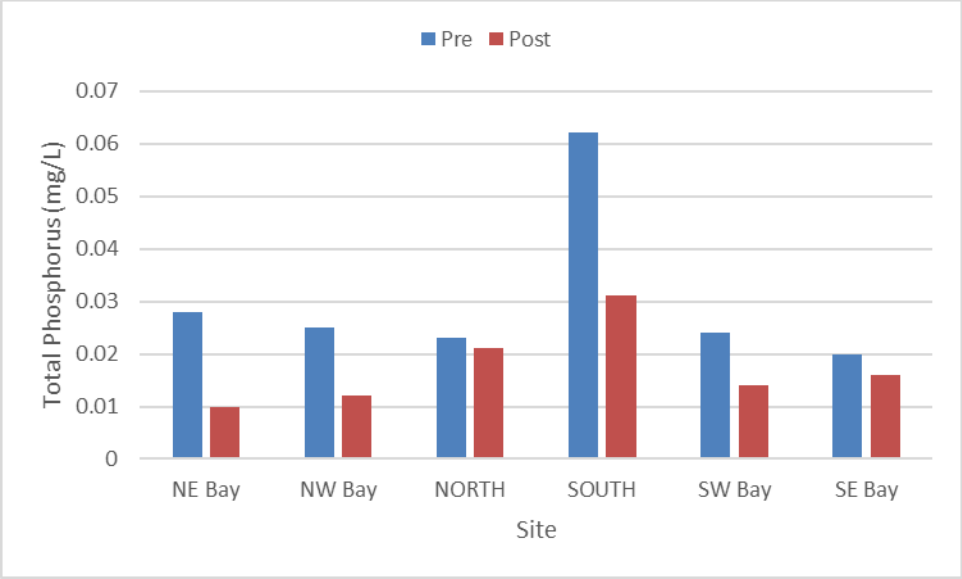

Figure 5. Total phosphorus concentrations (mg/L) pre- and post-treatment, 2022.

4.1.2.3 Summer 2022

The dissolved phosphorus and Ortho-phosphate concentrations at the six sites were below detection during the 2022 summer sampling event. The total phosphorus concentrations were generally similar to or lower than those concentrations measured during the post-treatment sampling in June. However, the total phosphorus at the north site was considerably higher than the other sites, but was lower than that reported during the summer event in 2021 (0.392 and 0.476 mg/L, respectively) (Appendix B, Table B1).

A previous iteration of the guidelines for Alberta, *Alberta Surface Water Quality Guidelines for the Protection of Freshwater Aquatic Life* (ASWQG-FAL) (Alberta Environment, 1999) included a total phosphorus guideline value of 0.05 mg/L. Using the 1999 guidance document, the total phosphorus concentration measured in August was considered an exceedance. However, the *Environmental Quality Guidelines for Alberta Surface Waters* (EQGASW) (Government of Alberta, 2018) suggests lake-specific nutrient objectives be developed where nitrogen or phosphorus have increased due to human activity. Though phosphorus is likely more bioavailable near the substrate due to the near anoxic conditions, the results suggest the alum treatment continues to bind phosphorus. The development of a lake-specific management plan for nutrients per EQGASW is not warranted.

Nitrate and nitrite concentrations were below detection for all sites (Appendix B, Table B1). Ammonium was also below detection, except for the north deep site. Total nitrogen concentrations were similar to concentrations measured during the post alum treatment (between 0.54 and 0.59 mg/L) at all sites except for the north site (2.19 mg/L).

The cause(s) for the elevated concentrations of total phosphorus and total nitrogen at the north site are unknown.

4.1.3 Routine Parameters and Metals

Routine parameters were analyzed during all sampling events in 2022. The results were similar between all sites (Appendix B, Table B2) and were comparable to those reported in August 2021 by Aquality and in 2020 by EnviroMak (EnviroMak 2020). Water pH ranged between 7.84 (composite sample) in the winter 2022 and 8.39 in the spring 2022. The peak pH was higher than that reported in January 2021, but was still lower than the pH of 8.81 reported in August 2020 by EnviroMak (2020).

All the dissolved and total metals analyzed were either below detection or were within the guidelines for the protection of aquatic life (Appendix B, Table B3 and B4). Generally, the dissolved and total metal concentrations were higher in the winter than in the summer, but these differences may have been due to sampling location (i.e., composite versus bottom sampling). Total calcium levels appeared to decline over the year. Total manganese was highest in the south deep site in the spring post-alum treatment but was below guidelines. Total copper and total zinc were highest in the south deep site during winter but were not in exceedance of the guidelines for the protection of aquatic life (Appendix B, Table B4).

4.1.4 Zooplankton

Zooplankton abundance and biomass analysis were conducted on samples from the north and south sites. Zooplankton were identified as either subphylum Crustacea or phylum Rotifera and then further classified to species (Appendix E). Zooplankton abundance results from 2021 and 2022 could not be directly compared to results from previous years due to changes in sampling methods.

Crustacea zooplankton were more abundant than Rotifera zooplankton and due to the size difference, Crustacea zooplankton provided more biomass, similar to 2021 (Appendix D, Tables D1 and D2). In 2022, the abundance of zooplankton was higher in the north site; however, the species diversity was higher in the south site.

Polyarthra sp. were the dominant rotifer species encountered (Appendix D, Table D1, Figure D1). The abundance was higher in the north site in 2022. *Ascomorpha sp.* abundance decreased and *Keratella cochlearis* abundance increased in 2022 compared to 2021.

Of the crustaceans, *Ceriodaphnia sp*. were most abundant in both the north and south sides (Appendix D, Table D1, Figure D2). Juvenile Cyclopoid abundance was substantially higher in the north site compared to the south site. Nauplii (early stage copepods) abundance was lower in 2022 than in 2021. Cyclopoids and Daphnids contributed the most to overall biomass (Appendix D, Figures D3 and D4).

The changes observed in the zooplankton species composition, abundance, and biomass are not understood. They may be attributed to the reduction in Yellow Perch numbers, the addition of Tiger Trout, natural variation, or the chemical treatments undertaken (alum and hydrogen peroxide).

4.1.5 Chlorophyll a

Chlorophyll *a* is a green pigment found in plants and algae that is responsible for photosynthesis. In 2022, the chlorophyll *a* was higher in the south site (5.22 µg/L) than the north site (4.14 µg/L), but these

concentrations were within the range reported previously by Aquality (Aquality 2022) and EnviroMak (EnviroMak 2020).

4.2 Yellow Perch Eradication

A total of 8,264 invasive Yellow Perch were removed from Summerside Lake between May 2 and 4, 2022. Minnow traps captured 675 Yellow Perch over a combined effort of 396.6 trap-h (Appendix D). Gill nets captured 2,912 Yellow Perch over 174 h of net soak time. Most (*n*=2,841) of the Yellow Perch were captured in the 25.4 mm (1") mesh versus the smaller 19.1 mm (3/4") mesh. Fyke and hoop trapnets were new methods deployed in 2022. The Fyke net captured of 2,312 Yellow Perch in 20.0 trap-h and the hoop net captured 2,365 Yellow Perch in 17.9 trap-h.

Fish length (fork) and weight data were collected from representative fish (Table 4). The fork lengths ranged from 85 mm to 166 mm and the weights ranged from 7.3 g to 53.9 g.

Table 4. Summary of fork length and weight data from representative Yellow Perch captured from Summerside Lake between May 2 and 4, 2022.

Sample Method	*n*	Fork Length (mm)			Weight (g)		
		Min.	Max.	Ave.	Min.	Max.	Ave.
Minnow Trap	0	-	-	-	-	-	-
Gill Net (19.1 mm)	16	85	133	108.8	7.3	29.9	16.3
Gill Net (25.4 mm)	35	99	124	108.5	11.0	22.8	14.6
Fyke Net	15	100	114	105.0	10.9	18.9	12.9
Hoop Net	15	120	166	133.0	22.9	53.5	31.0

Several egg masses were also observed along the shoreline near the boat ramp and piers in 2022. Some of the masses were removed where possible.

There was no by-catch of stocked trout species or other fishes.

4.3 Cyanobacteria Control

Visible blue green algal blooms (cyanobacteria) prompted sporadic spot treatments using food grade granular hydrogen peroxide (sodium perchlorate) throughout the year to prevent larger cyanobacteria blooms. A treatment of the shoreline was completed on 1 September 2022. Pre-treatment peroxide measurements in Lake Summerside were generally 1 ppm, except at Dock 1 which was 3 ppm. Treatment started at 09:45, and the residual hydrogen peroxide measurements rose to between 8 and 10 ppm at five of the ten monitoring locations (Table 5). Application was completed by approximately 13:30, and it took approximately three hours for the sites measuring 10 ppm to decline to 3 to 5 ppm. By approximately 18:00, most of the sites had returned to the pre-treatment levels and within 24 hours, all the hydrogen peroxide concentrations were at or below pre-treatment levels. Treatment results were

immediately effective, with residuals decaying to background levels within 24 hours. An unintended yet positive consequence was improved water clarity observed for a period of weeks following treatment.

Table 5. Hydrogen peroxide concentrations (ppm) in Lake Summerside before and after treatment, 1 to 2 September 2022.

Sample Location	1-Sep-22								2-Sep-22	
	Time (24 h)	Reading (ppm)	Time (24 h)	Reading (ppm)	Time (24 h)	Reading (ppm)	Time (24 h)	Reading (ppm)	Time (24hr)	Reading (ppm)
DOCK 1	9:20	3	10:57	5	14:23	3	18:42	1	9:17	1
DOCK 2	9:22	1	11:00	10	14:18	3	18:35	1	9:20	1
ENTRY	9:24	1	11:02	3	14:14	5	18:30	1	9:21	0
DOCK 3	9:25	1	11:03	3	14:07	3	18:28	1	9:24	1
DOCK 4	9:26	1	11:05	8	14:03	3	18:21	1	9:25	1
DOCK 5	9:27	1	11:06	10	13:55	5	18:12	2	9:27	1
DOCK 6	9:29	1	11:08	10	13:50	5	18:03	1	9:31	1
BEACH	9:31	1	11:09	5	13:45	3	17:52	2	9:33	1
BOAT DOCK	9:14	1	10:54	6	13:36	5	17:48	3	9:14	1
BOAT LAUNCH	9:18	1	10:56	8	13:38	5	18:51	1	9:15	1

NOTE: treatment started after baseline readings on 1 September at 09:45 and was completed before the next readings started at 14:23 the same day.

4.4 SSRA Activities

Reports of Swimmer's Itch in 2022 were infrequent in 2022, but similar with typical years based on records maintained by SSRA. Swim baffles have been used in other water bodies to reduce or prevent Swimmer's Itch in the swimming area. Preliminary cost estimates have been obtained for the swim baffles for potential installation in 2023.

The Beach Pooch Patrol Program used to deter waterfowl from the swimming area was successful. Coliforms and *Enterococcus* bacteria were not an issue within the swimming area in 2022.

Aquatic vegetation harvesting continued in 2022 with reduced efforts. The Truxor harvester was only used once and the divers only harvested 20 garbage bags of submergent vegetation.

5 Discussion and Conclusions

Summerside Lake health was very good overall. The water transparency was very clear and noted by the divers that it was markedly improved following the alum treatment. Recreational users were frequently observed in and on the water during all times of the year. No public use advisories were issued by Alberta Health.

Most of the measured parameters met the surface water quality guidelines for the protection of aquatic life (Canadian Council of Ministers of the Environment, 1999). DO levels were recorded below 5.0 mg/L during the winter and summer sampling events. These depressed oxygen concentrations can create

conditions when phosphorus can be released from the sediments. Reduced oxygen concentrations can also affect fish survival and their depth location in the water body.

Under previous water quality guidelines for Alberta (Alberta Environment, 1999), the total phosphorus concentration of 0.392 mg/L recorded at the north deep site in August would have been considered an exceedance. The elevated concentrations of phosphorus may be correlated to the depressed oxygen concentrations measured near the water-substrate interface. Phosphorus is released from bottom sediments during anoxic (low oxygen) conditions. However, given the wide range and the numerous factors influencing nutrient concentrations, it is impossible to determine a single value that would be protective or desirable for all Alberta waters. This numeric guideline of 0.05 mg/L had been removed in the most recent version of the Environmental Quality Guidelines for Alberta Surface Waters (Government of Alberta, 2018). Further, the concentration at all sites including the north deep site were reduced following the alum treatment in late May.

Nitrates were only detected in the winter (February) sampling event. The total Kjeldahl Nitrogen concentrations were consistent throughout the year, though a spike was noted in the north deep site in August. Nitrogen and phosphorus nutrients contribute to the growth of phytoplankton, algae, and aquatic macrophytes. Though phosphorus concentrations declined following the alum treatment, nitrogen concentrations have also declined from 2021 but at a reduced rate.

Orthophosphate is biologically available to be taken up by growing plants. Most of the samples collected were not analyzed by the lab using the low-level detection criteria. However, orthophosphate concentrations were detected during the winter near the bottom, but not during other times of the year. It is possible the alum treatments bound the available orthophosphate, thus the non-detect results.

There were no dissolved or total metal exceedances of the guidelines for the protection of aquatic life in 2022.

The variation in zooplankton species diversity, abundance and biomass will continue to be monitored.

The Yellow Perch eradication program successfully removed over 8,264 fish with no by-catch. The trap nets deployed overnight captured more than half of the recorded fish and will be used again in 2023. Though the number of fish encountered using gill nets was reduced, nets remain an effective method for fish removal.

Hydrogen peroxide continues to be an effective treatment in controlling undesirable cyanobacteria.

Alum treatment resulted in reduced in-lake plant growths and resulted in reduced harvesting costs for 2022. The Truxor mechanical harvester was only required once and divers only removed 20 bags of vegetation versus several hundred in 2020.

6 Recommendations

The following actions are recommended for Summerside Lake as part of the 2023 field season:

- Measure full column DO and temperature profiles monthly to assess timing or need for aeration during open-water conditions.
- Aerate during summer to late fall to reduce summer oxygen declines and releases of bioavailable phosphorus from the sediments.
- Monitor variation in zooplankton species diversity, abundance, and biomass.
- Conduct annual perch eradication program using Fyke/hoop trap nets and small mesh gill net panels (19.1 mm and 25.4 mm).
- Continue aquatic vegetation harvesting as needed.
- Monitor phosphorus levels and plant growth.
- Apply P-binding treatment during summer in water depths greater than 5 m to reduce potential release of phosphorus during late summer and winter periods (anoxic conditions).
- Continue control of cyanobacteria using hydrogen peroxide treatments. Source liquid forms to reduce negative health and safety effects during application.
- Procure and install exclusion system to deter Swimmer's Itch schistosomes from entering the beach area.
- Continue existing SSRA-lead initiatives to manage contributing factors to nutrient loading (e.g., waterfowl deterrent program).

7 References

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Site Photographs

Photo 1	
Date: 2 May 2022	
Location of Photo: Summerside Lake	
Photo Direction: N/A	
Description: Yellow Perch egg mass collected from boat launch.	

Photo 2	
Date: 2 May 2022	
Location of Photo: Summerside Lake	
Photo Direction: N/A	
Description: Yellow Perch egg "ribbons" in situ near boat launch.	

Photo 3	
Date: 3 May 2022	
Location of Photo: Summerside Lake	
Photo Direction: West	
Description: Hoop net set on the south side of the beach.	

Photo 4	
Date: 3 May 2022	
Location of Photo: Summerside Lake	
Photo Direction: Northwest	
Description: Retrieving hoop net set south of beach.	

Photo 5	
Date: 30 May 2022	
Location of Photo: Summerside Lake	
Photo Direction: N/A	
Description: Boat configured for treating shoreline with Floc N Lock alum treatment.	

Photo 6	
Date: 30 May 2022	
Location of Photo: Summerside Lake	
Photo Direction: N/A	
Description: Application of Floc N Lock alum treatment.	

Appendix A Dissolved Oxygen and Temperature Profiles

Table A1. Dissolved oxygen and temperature profile for Summerside Lake at the north site, 18 February 2022.

Project Number:	21-086		**Comments:**		
Project Location:	Summerside Lake		**YSI Pro ODO, Ice 0.5m, Total Depth 9.9m (Sonar) and 9.3m (DO probe/tape)**		
Samplers:	C. Stefura, T. McLean				
Date:	18-Feb-22				
Time:	10:15		**Perch observed in camera.**		
Site ID:	SSN WQ				
Site Location:	**NAD83**	**Easting:**	335704	**Northing:**	5921640

Depth (m)	Water Temp. (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen % Sat	pH	Conductivity (µS/cm)
Surface (0.0)					
0.5	0.20	9.81	67.5		
1.0	1.30	9.61	68.1		
1.5	2.20	9.44	68.6		
2.0	2.60	9.20	67.6		
2.5	2.90	8.83	65.4		
3.0	3.20	7.98	59.6		
3.5	3.40	6.59	49.3		
4.0	3.60	3.34	25.0		
4.5	3.60	2.39	18.2		
5.0	3.70	1.78	13.5		
5.5	3.70	1.52	11.5		
6.0	3.70	1.42	11.0		
6.5	3.80	1.15	8.7		
7.0	3.80	0.97	7.4		
7.5	3.80	0.92	7.0		
8.0	3.80	0.76	5.8		
8.5	4.00	0.40	3.1		
9.0	4.20	0.12	0.9		
9.3	-	-	-		
9.0	4.40	0.02	0.2		
8.5	4.10	0.13	1.0		
8.0	3.90	0.40	3.0		
7.5	3.90	0.59	4.5		
7.0	3.80	0.70	5.4		
6.5	3.80	0.71	5.4		
6.0	3.80	0.87	6.6		
5.5	3.70	1.09	8.3		
5.0	3.70	1.45	11.1		
4.5	3.60	1.94	14.8		
4.0	3.60	2.44	18.4		
3.5	3.50	5.04	37.9		
3.0	3.40	6.02	45.2		
2.5	3.30	6.63	49.6		
2.0	3.10	7.99	59.6		
1.5	2.80	8.69	63.9		
1.0	1.80	9.08	65.3		
0.5	0.00	9.31	64.3		
Surface (0.0)					

Table A2. Dissolved oxygen and temperature profile for Summerside Lake at the south site, 18 February 2022.

Project Number:	21-086		**Comments:**		
Project Location:	Summerside Lake		**YSI Pro ODO, Ice 0.5m, Total Depth 9.9m (Sonar) and 9.3m (DO probe/tape)**		
Samplers:	C. Stefura, T. McLean				
Date:	18-Feb-22				
Time:	13:20		**Perch observed in camera.**		
Site ID:	SSS WQ				
Site Location:	**NAD83**	**Easting:**	335722	**Northing:**	5921457

Depth (m)	Water Temp. (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen % Sat	pH	Conductivity (µS/cm)
Surface (0.0)					
0.5	0.8	9.90	68.6		
1.0	1.6	10.02	71.6		
1.5	2.4	9.83	71.9		
2.0	2.8	9.36	69.2		
2.5	3.0	8.92	66.2		
3.0	3.2	8.52	63.6		
3.5	3.5	4.00	30.1		
4.0	3.6	2.80	21.2		
4.5	3.7	1.91	14.4		
5.0	3.7	1.36	10.3		
5.5	3.7	1.14	8.6		
6.0	3.7	1.00	7.6		
6.5	3.7	0.89	6.8		
7.0	3.8	0.79	6.0		
7.5	3.8	1.02	7.7		
8.0	3.8	1.28	9.7		
8.5	4.0	0.85	6.5		
8.8	4.2	0.51	3.9		
8.5	4.1	0.69	5.2		
8.0	3.9	1.10	8.4		
7.5	3.8	1.04	7.9		
7.0	3.8	0.91	6.9		
6.5	3.8	0.86	6.5		
6.0	3.7	0.85	6.4		
5.5	3.7	1.05	7.9		
5.0	3.7	1.28	9.6		
4.5	3.7	1.54	11.6		
4.0	3.7	1.85	14.0		
3.5	3.6	2.19	16.6		
3.0	3.5	4.82	36.2		
2.5	3.4	6.92	51.9		
2.0	3.1	8.34	62.1		
1.5	2.8	9.11	66.9		
1.0	2.1	9.77	70.6		
0.5	0.5	9.88	68.5		
Surface (0.0)					

Table A3. Dissolved oxygen and temperature profile for Summerside Lake at the north site, 9 August 2022.

Project Number:	21-086		**Comments:**		
Project Location:	Summerside Lake				
Samplers:	C. Stefura, J. White				
Date:	09-Aug-22				
Time:	12:58				
Site ID:	SSN WQ				
Site Location:	**NAD83**	**Easting:**	335720	**Northing:**	5921643

Depth (m)	Water Temp. (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen % Sat	pH	Conductivity (µS/cm)
Surface (0.0)					
0.5	21.2	7.88	89.0	8.49	584
1.0	21.2	7.75	84.0	8.47	584
1.5	21.1	7.49	85.5	8.47	583
2.0	21.2	7.66	85.8	8.46	583
2.5	21.1	7.56	85.0	8.46	582
3.0	21.0	7.58	84.9	8.47	581
3.5	20.7	7.53	84.0	8.50	577
4.0	20.6	7.63	84.6	8.42	575
4.5	20.3	6.93	76.6	8.32	572
5.0	19.9	6.25	68.4	8.16	569
5.5	19.7	5.70	62.8	8.03	568
6.0	19.0	4.22	45.5	7.84	567
6.5	17.4	2.56	26.6	7.50	567
7.0	14.2	1.44	14.1	7.33	537
7.5	12.9	0.92	8.6	7.20	521
8.0	11.2	0.82	7.5	7.10	506
8.5	10.2	0.63	5.6	7.11	490
9.0	9.0	0.45	3.9	7.16	477
8.5	9.8	0.47	4.2	7.11	484
8.0	10.9	0.61	5.5	7.08	495
7.5	12.4	0.73	7.1	7.08	514
7.0	14.1	1.24	12.1	7.15	535
6.5	16.7	2.24	22.9	7.35	565
6.0	18.8	4.06	44.0	7.65	565
5.5	19.7	5.18	56.2	8.07	569
5.0	19.9	6.04	66.5	8.32	568
4.5	20.1	6.27	69.7	8.46	571
4.0	20.5	7.28	81.0	8.65	574
3.5	20.6	7.36	82.2	8.65	575
3.0	21.0	7.43	83.0	8.66	580
2.5	21.1	7.27	81.8	8.67	582
2.0	21.2	7.20	81.2	8.66	582
1.5	21.3	7.28	82.0	8.66	584
1.0	21.3	7.25	82.0	8.66	584
0.5	21.3	7.16	80.0	8.63	584
Surface (0.0)					

Table A4. Dissolved oxygen and temperature profile for Summerside Lake at the south site, 9 August 2022.

Project Number:	21-086		**Comments:**		
Project Location:	Summerside Lake				
Samplers:	C. Stefura, J. White				
Date:	09-Aug-22				
Time:	12:06				
Site ID:	SSS WQ				
Site Location:	**NAD83**	**Easting:**	335722	**Northing:**	5921457

Depth (m)	**Water Temp. (°C)**	**Dissolved Oxygen (mg/L)**	**Dissolved Oxygen % Sat**	**pH**	**Conductivity (µS/cm)**
Surface (0.0)					
0.5	20.9	8.23	92.0	8.39	630
1.0	21.0	8.12	91.0	8.48	582
1.5	20.7	8.04	91.7	8.45	578
2.0	20.6	8.13	90.6	8.43	578
2.5	20.6	8.47	94.5	8.44	577
3.0	20.6	8.59	94.8	8.43	577
3.5	20.5	8.59	95.9	8.43	577
4.0	20.5	8.76	97.2	8.41	575
4.5	20.4	8.36	92.5	8.36	575
5.0	20.0	7.34	80.9	8.24	571
5.5	19.0	6.50	70.8	8.13	570
6.0	19.0	5.15	55.3	7.76	568
6.5	16.4	3.01	31.0	7.39	564
7.0	14.0	2.74	26.6	7.27	536
7.5	12.7	1.66	15.6	7.13	517
8.0	11.1	0.95	8.8	6.92	500
7.5	12.4	1.36	12.9	6.93	517
7.0	14.0	1.98	19.3	7.04	539
6.5	16.6	2.32	23.8	7.18	567
6.0	18.9	4.12	44.1	7.64	568
5.5	19.7	6.21	68.2	8.17	570
5.0	20.1	6.93	76.3	8.44	571
4.5	20.4	7.52	83.4	8.57	575
4.0	20.5	7.65	85.2	8.62	576
3.5	20.6	7.45	82.5	8.65	576
3.0	20.6	7.72	86.2	8.64	576
2.5	20.7	7.77	86.2	8.64	577
2.0	20.7	7.72	86.0	8.62	578
1.5	20.8	7.60	85.5	8.63	578
1.0	20.8	7.77	86.7	8.61	578
0.5	21.1	7.71	86.8	8.65	582
Surface (0.0)					

Appendix B Element Lab Water Quality Results

Table B1. Nutrient water quality results for Summerside Lake, 2022.

				Parameter Name	Ammonia - N	Phosphorus (Dissolved - Low Level)	Kjeldahl Nitrogen (Total)	Phosphorus (Total - Low Level)	Orthophosphate-P (Dissolved)	Orthophosphate-P (Low Level)	Nitrate - N	Nitrite - N	Nitrate and Nitrite - N	Organic Carbon (Total)
				Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Site Id	Sample Description	Season	Date	D.L.	*0.025*	*0.005*	*0.1*	*0.005*	*0.01*	*0.003*	*0.5*	*0.5*	*0.5*	*0.5*
NORTH Deep	Composite	Winter	2022-02-18	Result Text	0.050	0.021	0.64	0.025	<0.01	0.008	0.16	<0.005	0.16	-
NORTH Deep	Bottom	Winter	2022-02-18	Result Text	0.189	0.025	0.63	0.038	0.02	0.019	0.27	<0.005	0.27	-
SOUTH Deep	Composite	Winter	2022-02-18	Result Text	0.045	0.016	0.63	0.020	<0.01	0.006	0.16	<0.005	0.16	-
SOUTH Deep	Bottom	Winter	2022-02-18	Result Text	0.158	0.025	0.65	0.027	0.02	0.017	0.24	<0.005	0.24	-
NE Bay	Bottom	Spring	2022-05-25	Result Text	<0.025	-	0.63	0.028	<0.01	-	<0.01	<0.005	<0.01	6.4
NW Bay	Bottom	Spring	2022-05-25	Result Text	<0.025	-	0.57	0.025	<0.01	-	<0.01	<0.005	<0.01	6.5
NORTH Deep	Bottom	Spring	2022-05-25	Result Text	<0.025	-	0.59	0.023	<0.01	-	<0.01	<0.005	<0.01	6.1
SOUTH Deep	Bottom	Spring	2022-05-25	Result Text	<0.025	-	0.61	0.062	<0.01	-	<0.01	<0.005	<0.01	5.8
SW Bay	Bottom	Spring	2022-05-25	Result Text	<0.025	-	0.75	0.024	<0.01	-	<0.01	<0.005	<0.01	6.4
SE Bay	Bottom	Spring	2022-05-25	Result Text	<0.025	-	0.59	0.020	<0.01	-	<0.01	<0.005	<0.01	5.7
NE Bay	Bottom	Spring	2022-06-02	Result Text	<0.025	0.011	0.55	0.010	<0.01	-	<0.01	<0.005	<0.01	6.4
NW Bay	Bottom	Spring	2022-06-02	Result Text	<0.025	0.009	0.56	0.012	<0.01	-	<0.01	<0.005	<0.01	5.8
NORTH Deep	Bottom	Spring	2022-06-02	Result Text	<0.025	0.020	0.59	0.021	<0.01	-	<0.01	<0.005	<0.01	5.7
SOUTH Deep	Bottom	Spring	2022-06-02	Result Text	<0.025	0.014	0.59	0.031	<0.01	-	<0.01	<0.005	<0.01	6.0
SW Bay	Bottom	Spring	2022-06-02	Result Text	<0.025	0.013	0.53	0.014	<0.01	-	<0.01	<0.005	<0.01	5.6
SE Bay	Bottom	Spring	2022-06-02	Result Text	<0.025	0.016	0.54	0.016	<0.01	-	<0.01	<0.005	<0.01	5.8
NE Bay	Bottom	Summer	2022-08-09	Result Text	<0.025	<0.005	0.54	0.012	<0.01	-	<0.01	<0.005	<0.01	6.8
NW Bay	Bottom	Summer	2022-08-09	Result Text	<0.025	<0.005	0.56	<0.005	<0.01	-	<0.01	<0.005	<0.01	6.8
NORTH Deep	Bottom	Summer	2022-08-09	Result Text	0.775	<0.005	2.19	0.392	<0.01	-	<0.01	<0.005	<0.01	8.4
SOUTH Deep	Bottom	Summer	2022-08-09	Result Text	<0.025	<0.005	0.59	0.037	<0.01	-	<0.01	<0.005	<0.01	5.8
SE Bay	Bottom	Summer	2022-08-09	Result Text	<0.025	<0.005	0.54	0.007	<0.01	-	<0.01	<0.005	<0.01	5.9
SW Bay	Bottom	Summer	2022-08-09	Result Text	<0.025	<0.005	0.54	0.006	<0.01	-	<0.01	<0.005	<0.01	6.4

Table B2. Routine water quality results for Summerside Lake, 2022.

			Parameter Name	pH	Temp. of observed pH	E.C. (at 25°C)	Ca (Diss.)	Mg (Diss.)	Na (Diss.)	K (Diss.)	Fe (Diss.)	Mn (Diss.)	Cl (Diss.)	Sulfate (SO4) (Diss.)	OH	CO3	HCO3	P-Alkalinity (as CaCO3)	T-Alkalinity (as CaCO3)	TDS (Calculated)	Hardness (as CaCO3)	Ionic Balance (Diss.)
			Unit		°C	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%
			D.L.	*1*		*1*	*0.2*	*0.2*	*0.4*	*0.4*	*0.01*	*0.005*	*0.4*	*0.9*				*5*	*5*	*1*		
Site Id	**Sample Description**	**Season**	**Sampled Date**																			
NORTH Deep	Composite	Winter	2022-02-18	7.85	20.5	746	57.2	27.1	61.8	4.7	<0.01	0.059	10.7	244	<5	<6	146	<5	120	478	254	102
NORTH Deep	Bottom	Winter	2022-02-18	-	-	-	-	-	-	-	-	-	-									
SOUTH Deep	Composite	Winter	2022-02-18	7.84	20.8	743	56.7	26.9	62.9	4.8	<0.01	<0.005	10.7	247	<5	<6	143	<5	118	479	252	101
SOUTH Deep	Bottom	Winter	2022-02-18	-	-	-	-	-	-	-	-	-	-									
NE Bay	Bottom	Spring	2022-05-25	8.30	19.9	702	49.1	23.8	55.2	4.2	<0.01	<0.005	10.7	220	<5	<6	129	<5	106	427	221	99
NW Bay	Bottom	Spring	2022-05-25	8.30	20.1	684	50.1	24.1	55.0	4.2	<0.01	<0.005	10.3	221	<5	<6	137	<5	112	431	224	98
NORTH Deep	Bottom	Spring	2022-05-25	8.32	19.8	679	50.0	23.6	54.7	4.1	<0.01	<0.005	10.2	217	<5	<6	135	<5	111	426	222	99
SOUTH Deep	Bottom	Spring	2022-05-25	8.16	19.7	682	49.8	23.5	54.4	4.1	<0.01	<0.005	10.2	222	<5	<6	131	<5	108	428	221	98
SW Bay	Bottom	Spring	2022-05-25	8.37	19.7	679	50.0	23.7	54.9	4.1	<0.01	<0.005	10.3	221	<5	<6	137	<5	112	431	223	98
SE Bay	Bottom	Spring	2022-05-25	8.39	19.9	679	49.9	23.7	54.3	4.1	<0.01	<0.005	10.2	219	<5	<6	131	<5	107	426	222	99
NE Bay	Bottom	Spring	2022-06-02	8.39	20.4	668	50.0	24.8	57.2	4.3	<0.01	<0.005	10.0	227	<5	<6	137	<5	113	441	227	98
NW Bay	Bottom	Spring	2022-06-02	8.32	20.6	665	51.2	24.8	56.8	4.2	<0.01	<0.005	10.3	226	<5	<6	129	<5	106	437	230	101
NORTH Deep	Bottom	Spring	2022-06-02	8.29	20.8	663	50.9	24.9	56.8	4.2	<0.01	<0.005	10.3	223	<5	<6	140	<5	115	439	230	99
SOUTH Deep	Bottom	Spring	2022-06-02	7.92	20.7	686	53.4	25.1	58.7	4.4	<0.01	<0.005	10.0	229	<5	<6	155	<5	127	457	237	98
SW Bay	Bottom	Spring	2022-06-02	8.34	20.6	665	51.2	24.8	56.5	4.2	<0.01	<0.005	10.4	226	<5	<6	129	<5	106	437	230	101
SE Bay	Bottom	Spring	2022-06-02	8.37	20.7	663	50.3	24.8	56.4	4.1	<0.01	<0.005	10.4	229	<5	<6	133	<5	109	440	228	98
NE Bay	Bottom	Summer	2022-08-09	8.11	22.1	648	43.8	24.0	56.0	4.1	<0.01	<0.005	11.2	217	<5	<6	109	<5	90	410	208	101
NW Bay	Bottom	Summer	2022-08-09	8.12	22.0	651	43.8	24.0	55.8	4.1	<0.01	<0.005	12.5	216	<5	<6	116	<5	95	414	208	99
NORTH Deep	Bottom	Summer	2022-08-09	7.94	22.2	668	46.8	24.1	55.9	4.2	<0.01	<0.005	10.1	216	<5	<6	121	<5	99	417	216	102
SOUTH Deep	Bottom	Summer	2022-08-09	7.97	22.2	659	45.4	23.8	55.5	4.1	<0.01	<0.005	10.3	214	<5	<6	118	<5	97	411	211	101
SE Bay	Bottom	Summer	2022-08-09	8.15	22.2	651	43.3	23.5	55.2	4.1	<0.01	<0.005	10.4	215	<5	<6	111	<5	91	407	205	100
SW Bay	Bottom	Summer	2022-08-09	8.11	22.3	653	44.3	24.1	56.6	4.1	<0.01	<0.005	10.6	220	<5	<6	105	<5	87	412	210	102

Table B3. Dissolved metals water quality results for Summerside Lake, 2022.

		Site Id	NORTH Deep	NORTH Deep	SOUTH Deep	SOUTH Deep	NE Bay	NW Bay	NORTH Deep	SOUTH Deep	SE Bay	SW Bay
		Sample Description	Composite	Bottom	Composite	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
		Season	Winter	Winter	Winter	Winter	Summer	Summer	Summer	Summer	Summer	Summer
		Sampled Date	2022-02-18	2022-02-18	2022-02-18	2022-02-18	2022-08-09	2022-08-09	2022-08-09	2022-08-09	2022-08-09	2022-08-09
Parameter Name	**Unit**	**D.L.**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**
Silicon (Dissolved)	mg/L	*0.05*	0.71	-	0.68	-	0.39	0.41	0.42	0.38	0.40	0.42
Sulfur (Dissolved)	mg/L	*0.3*	81.4	-	82.3	-	72.4	72.1	71.8	71.5	71.8	73.5
Mercury (Dissolved)	mg/L	*0.000005*	-	-	-	-	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Aluminum (Dissolved)	mg/L	*0.002*	<0.002	-	0.003	-	0.007	0.006	0.005	0.005	0.007	0.006
Antimony (Dissolved)	mg/L	*0.0002*	<0.0002	-	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic (Dissolved)	mg/L	*0.0002*	0.0017	-	0.0021	-	0.0014	0.0014	0.0015	0.0014	0.0014	0.0014
Barium (Dissolved)	mg/L	*0.001*	0.047	-	0.046	-	0.037	0.037	0.037	0.037	0.038	0.038
Beryllium (Dissolved)	mg/L	*0.0001*	<0.0001	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth (Dissolved)	mg/L	*0.0005*	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron (Dissolved)	mg/L	*0.002*	0.07	-	0.072	-	0.076	0.073	0.075	0.076	0.074	0.076
Cadmium (Dissolved)	mg/L	*0.00001*	<0.00001	-	<0.00001	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium (Dissolved)	mg/L	*0.0005*	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Dissolved)	mg/L	*0.0001*	<0.0001	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper (Dissolved)	mg/L	*0.001*	0.004	-	0.005	-	0.003	0.003	<0.001	0.001	0.002	0.001
Lead (Dissolved)	mg/L	*0.0001*	<0.0001	-	<0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium (Dissolved)	mg/L	*0.001*	0.035	-	0.036	-	0.031	0.031	0.032	0.031	0.031	0.031
Molybdenum (Dissolved)	mg/L	*0.001*	<0.001	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel (Dissolved)	mg/L	*0.0005*	0.0011	-	0.0013	-	0.0008	0.0009	0.0008	0.0007	0.0007	0.0007
Selenium (Dissolved)	mg/L	*0.0002*	<0.0002	-	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Silver (Dissolved)	mg/L	*0.00001*	<0.00001	-	<0.00001	-	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium (Dissolved)	mg/L	*0.001*	0.622	-	0.632	-	0.498	0.489	0.522	0.507	0.495	0.497
Thallium (Dissolved)	mg/L	*0.00005*	<0.00005	-	<0.00005	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Tin (Dissolved)	mg/L	*0.001*	<0.001	-	<0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Dissolved)	mg/L	*0.0005*	<0.0005	-	<0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Uranium (Dissolved)	mg/L	*0.0005*	0.0005	-	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Vanadium (Dissolved)	mg/L	*0.0001*	<0.0001	-	<0.0001	-	<0.0001	0.0001	<0.0001	<0.0001	0.0001	<0.0001
Zinc (Dissolved)	mg/L	*0.001*	0.013	-	0.017	-	0.006	0.005	<0.001	0.002	0.002	0.002

Table B4. Total metals water quality results for Summerside Lake within the deep sites, 2022.

		Site Id	NORTH Deep	SOUTH Deep	NORTH Deep	SOUTH Deep	NORTH Deep	SOUTH Deep	NORTH Deep	SOUTH Deep
		Sample Description	Composite	Composite	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
		Season	Winter	Winter	Spring	Spring	Spring	Spring	Summer	Summer
		Sampled Date	18 Feb	18 Feb	25 May	25 May	2 Jun	2 June	9 Aug	9 Aug
Parameter Name	**Unit**	**D. L.**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**	**Result Text**
Aluminum (Total)	mg/L	*0.02*	0.03	0.03	<0.02	0.02	0.04	<0.02	<0.02	<0.02
Calcium (Total)	mg/L	*0.2*	57.7	56.3	52.9	52.6	50.6	55.8	48.7	47.3
Iron (Total)	mg/L	*0.05*	0.05	0.06	<0.05	<0.05	<0.05	0.10	<0.05	<0.05
Magnesium (Total)	mg/L	*0.2*	27.4	27.0	24.8	24.5	24.0	25.3	25.0	24.7
Manganese (Total)	mg/L	*0.005*	0.180	0.109	0.076	0.119	0.047	0.671	0.185	0.059
Potassium (Total)	mg/L	*0.4*	4.9	4.8	4.7	4.7	4.5	4.4	4.4	4.2
Silicon (Total)	mg/L	*0.05*	0.77	0.70	0.06	0.12	0.06	0.82	0.44	0.39
Sodium (Total)	mg/L	*0.4*	64.5	63.9	59.5	59.4	57.0	57.1	57.2	56.9
Sulfur (Total)	mg/L	*0.3*	84.9	83.6	78.1	76.6	74.9	78.3	73.3	73.8
Mercury (Total)	mg/L	*0.000005*	-	-	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Antimony (Total)	mg/L	*0.0002*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic (Total)	mg/L	*0.0002*	0.0018	0.0021	0.0013	0.0014	0.0012	0.0016	0.0017	0.0016
Barium (Total)	mg/L	*0.001*	0.047	0.046	0.045	0.042	0.040	0.048	0.037	0.036
Beryllium (Total)	mg/L	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth (Total)	mg/L	*0.0005*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron (Total)	mg/L	*0.002*	0.083	0.082	0.069	0.068	0.068	0.071	0.108	0.071
Cadmium (Total)	mg/L	*0.00001*	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium (Total)	mg/L	*0.0005*	0.0009	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Total)	mg/L	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Copper (Total)	mg/L	*0.001*	0.007	0.010	<0.001	0.002	<0.001	<0.001	0.002	0.002
Lead (Total)	mg/L	*0.0001*	0.0003	0.0003	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Lithium (Total)	mg/L	*0.001*	0.038	0.038	0.035	0.034	0.034	0.036	0.031	0.030
Molybdenum	mg/L	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Nickel (Total)	mg/L	*0.0005*	0.0012	0.0016	0.0008	0.0009	0.0007	0.0009	0.0008	0.0008
Selenium (Total)	mg/L	*0.0002*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Silver (Total)	mg/L	*0.00001*	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium (Total)	mg/L	*0.001*	0.671	0.662	0.548	0.533	0.538	0.558	0.553	0.537
Thallium (Total)	mg/L	*0.00005*	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Tin (Total)	mg/L	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Total)	mg/L	*0.0005*	<0.0005	<0.0005	<0.0005	0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Uranium (Total)	mg/L	*0.0005*	0.0006	0.0005	<0.0005	<0.0005	0.0005	<0.0005	<0.0005	<0.0005
Vanadium (Total)	mg/L	*0.0001*	0.0003	0.0003	<0.0001	<0.0001	<0.0001	0.0001	0.0002	0.0002
Zinc (Total)	mg/L	*0.004*	0.016	0.027	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Zirconium (Total)	mg/L	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table B5. Total metals water quality results for Summerside Lake within the shallow bay sites, 2022.

		Site Id	NE Bay	NW Bay	SW Bay	SE Bay	NE Bay	NW Bay	SW Bay	SE Bay	NE Bay	NW Bay	SE Bay	SW Bay
		Sample Description	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom	Bottom
		Season	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Spring	Summer	Summer	Summer	Summer
		Sampled Date	25 May	25 May	25 May	25 May	2 Jun	2 Jun	2 Jun	2 Jun	9 Aug	9 Aug	9 Aug	9 Aug
Parameter Name	**Unit**	**D.L.**	Result Text	Result Text	Result Text	Result Text	Result Text	Result Text	Result Text	Result Text	Result Text	Result Text	Result Text	Result Text
Aluminum (Total)	mg/	*0.02*	<0.02	<0.02	<0.02	<0.02	0.05	0.05	0.05	0.05	<0.02	<0.02	<0.02	<0.02
Calcium (Total)	mg/	*0.2*	52.8	52.6	52.4	52.5	52.1	51.2	51.2	50.8	44.5	47.3	46.1	45.6
Iron (Total)	mg/	*0.05*	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Magnesium (Total)	mg/	*0.2*	24.9	24.7	24.8	24.8	25.1	24.7	24.6	24.6	24.7	25.6	25.2	25.0
Manganese (Total)	mg/	*0.005*	0.048	0.052	0.056	0.054	0.037	0.039	0.043	0.040	0.018	0.018	0.018	0.022
Potassium (Total)	mg/	*0.4*	4.8	4.8	4.8	4.8	4.8	4.6	4.7	4.6	4.3	4.6	4.4	4.3
Silicon (Total)	mg/	*0.05*	0.06	0.07	0.08	0.07	0.05	0.06	0.07	0.05	0.41	0.43	0.44	0.43
Sodium (Total)	mg/	*0.4*	60.4	61.1	60.1	60.1	60.2	58.1	59.5	58.9	55.7	59.7	57.9	57.0
Sulfur (Total)	mg/	*0.3*	77.7	77.3	77.7	77.7	78.2	77.0	76.9	77.1	73.9	76.8	75.4	74.8
Mercury (Total)	mg/	*0.000005*	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Antimony (Total)	mg/	*0.0002*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Arsenic (Total)	mg/	*0.0002*	0.0013	0.0012	0.0012	0.0013	0.0013	0.0013	0.0013	0.0013	0.0015	0.0016	0.0016	0.0015
Barium (Total)	mg/	*0.001*	0.048	0.041	0.041	0.041	0.040	0.040	0.039	0.039	0.035	0.036	0.036	0.036
Beryllium (Total)	mg/	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth (Total)	mg/	*0.0005*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron (Total)	mg/	*0.002*	0.070	0.068	0.069	0.069	0.073	0.071	0.072	0.071	0.075	0.070	0.072	0.074
Cadmium (Total)	mg/	*0.00001*	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Chromium (Total)	mg/	*0.0005*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt (Total)	mg/	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper (Total)	mg/	*0.001*	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.004	0.004	0.003	0.002
Lead (Total)	mg/	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0001	0.0001	<0.0001
Lithium (Total)	mg/	*0.001*	0.035	0.034	0.034	0.034	0.036	0.036	0.036	0.035	0.029	0.029	0.030	0.030
Molybdenum (Total)	mg/	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel (Total)	mg/	*0.0005*	0.0009	0.0008	0.0008	0.0008	0.0010	0.0008	0.0008	0.0007	0.0009	0.0008	0.0008	0.0008
Selenium (Total)	mg/	*0.0002*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Silver (Total)	mg/	*0.00001*	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Strontium (Total)	mg/	*0.001*	0.554	0.550	0.533	0.539	0.543	0.546	0.539	0.543	0.544	0.561	0.569	0.542
Thallium (Total)	mg/	*0.00005*	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Tin (Total)	mg/	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium (Total)	mg/	*0.0005*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Uranium (Total)	mg/	*0.0005*	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Vanadium (Total)	mg/	*0.0001*	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	0.0002	0.0002	0.0002
Zinc (Total)	mg/	*0.004*	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.009	0.005	<0.004	0.005
Zirconium (Total)	mg/	*0.001*	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Appendix C Fish Data

Table C1. Raw fish data for representative Yellow Perch captured from Summerside Lake, 2 to 4 May 2022.

Method [1]	Species [2]	Fork Length (mm)	Weight (g)	Sex	Maturity	Comments
GN1	YLPR	109	18.2	F	Immature	1" mesh
	YLPR	104	12.2	M		1" mesh
	YLPR	103	11.3	M		1" mesh
	YLPR	102	12.2	M		1" mesh
	YLPR	116	18.4	F	Ripe	1" mesh / ovaries 4.4 g
GN3	YLPR	115	14.3	U		1" mesh
	YLPR	101	12.4	M		1" mesh
	YLPR	106	14.4	M		1" mesh / tapeworm
	YLPR	105	13.0	M		1" mesh
	YLPR	99	11.6	M		1" mesh
GN1	YLPR	116	20.4	F	Ripe	3/4" mesh / ovaries 4.6 g
	YLPR	115	17.4	M		3/4" mesh
	YLPR	133	29.9	F	Ripe	3/4" mesh / ovaries 6.1 g
	YLPR	85	7.3	M		3/4" mesh
	YLPR	106	17.1	F	Ripe	3/4" mesh / ovaries 4.0 g
GN2	YLPR	117	15.1	F	Immature	1" mesh
	YLPR	112	17.5	F	Ripe	1" mesh / ovaries 3.6 g
	YLPR	112	16.7	F	Immature	1" mesh
	YLPR	105	14.1	M		1" mesh
	YLPR	124	22.8	F	Ripe	1" mesh / ovaries 5.1 g
GN4	YLPR	101	13.2	M		1" mesh
	YLPR	121	16.9	F	Ripe	1" mesh / tapeworm / ovaries 3.3 g
	YLPR	113	16.3	F	Ripe	1" mesh / ovaries 3.0 g
	YLPR	104	13.4	M		1" mesh
	YLPR	105	12.7	M		1" mesh
GN3	YLPR	114	15.5	U		3/4" mesh
	YLPR	106	13.7	F	Immature	3/4" mesh
	YLPR	127	26.0	F	Ripe	3/4" mesh / ovaries 6.1 g
	YLPR	116	16.1	F	Immature	1" mesh
	YLPR	111	16.0	F	Ripe	1" mesh / tapeworm / ovaries 3.5 g
	YLPR	104	12.9	M		1" mesh
	YLPR	118	19.1	F	Ripe	1" mesh / ovaries 3.9 g
	YLPR	104	13.1	M		1" mesh
GN5	YLPR	119	20.4	F		3/4" mesh / ovaries 5.3 g
	YLPR	103	14.0	M		3/4" mesh
	YLPR	102	11.3	M		3/4" mesh
	YLPR	99	13.1	M		3/4" mesh
	YLPR	103	13.3	M		3/4" mesh
	YLPR	99	10.4	F	Immature	3/4" mesh
	YLPR	101	14.2	M		3/4" mesh

Method [1]	Species [2]	Fork Length (mm)	Weight (g)	Sex	Maturity	Comments
	YLPR	112	17.4	F	Ripe	3/4" mesh / smaller eggs / ovaries 2.7 g
GN1	YLPR	110	13.8	F	Immature	1" mesh
	YLPR	110	15.5	F		1" mesh / ovaries 3.6 g
	YLPR	102	11.0	M		1" mesh
	YLPR	110	11.8	M		1" mesh / tapeworm
	YLPR	107	13.3	M		1" mesh
	YLPR	109	15.9	F		1" mesh / ovaries 3.1 g
	YLPR	111	15.0	M		1" mesh
	YLPR	103	13.0	M		1" mesh
	YLPR	102	11.8	M		1" mesh
	YLPR	106	14.6	M		1" mesh
FN	YLPR	107	13.2	M		
	YLPR	106	12.8	M		
	YLPR	105	12.9	M		
	YLPR	111	13.9	M		
	YLPR	102	12.7	M		
	YLPR	102	12.3	M		
	YLPR	101	10.9	M		
	YLPR	105	12.3	M		
	YLPR	100	11.2	M		
	YLPR	105	12.6	M		
	YLPR	104	11.2	M		
	YLPR	114	18.9	M		
	YLPR	104	13.5	M		
	YLPR	105	12.3	M		
	YLPR	104	12.4	M		
HN	YLPR	166	53.5	M		
	YLPR	120	23.3	F		ovaries 4.5 g
	YLPR	135	32.7	F		ovaries 6.3 g
	YLPR	135	35.0	F		ovaries 8.3 g
	YLPR	120	23.5	F		ovaries 6.1 g
	YLPR	123	22.9	M		
	YLPR	129	23.4	M		
	YLPR	137	35.2	F		ovaries 6.6 g
	YLPR	144	44.0	F		ovaries 8.5 g
	YLPR	140	30.6	M		
	YLPR	139	38.9	F		ovaries 8.0 g
	YLPR	128	26.4	F		ovaries 6.3 g
	YLPR	132	26.6	M		
	YLPR	123	24.2	F		ovaries 6.6 g
	YLPR	123	25.1	F		ovaries 6.7 g

[1] FN = Fyke Net, HN = Hoop Net, GN = Gill Net

[2] YLPR = Yellow Perch

Appendix D Invert Solutions Data

Table D1. Invert Solutions zooplankton lab results from Summerside north site, 9 August 2022.

Lake:	Summerside
Project No.	21-086
Station No.	North SSRA
Sample No.	1
Sample Date:	09-Aug-22
Sample Time:	13:00
Net Size (m) (13cm= 0.065) or (20 cm=0.1)	0.065
Sampling depth (m):	8.5
Volume of Water Sampled	112.822

Date Counted:	18-Aug-22
Rotifer Sample	
Total Volume (mL)	10
Subsample volume (mL)	2.25
Crustacea	
Total Volume (mL)	15
Subsample volume (mL)	0.25

Species	Total # in sub sample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	461	2049	18.160	5.35E-09	0.11		0.12	0.10	0.00016214	0.002945				McCauley 1984
Collotheca sp.	32	142	1.261	6.63E-10	0.10	0.04	0.17	0.06	0.004169255	0.005256				McCauley 1984
Filinia sp.	20	89	0.788	1.50E-11	0.12		0.16	0.10	0.000242033	0.000191				McCauley 1984
Kellikottia longispina	37	164	1.458	2.04E-11	0.15		0.15	0.13	9.62003E-05	0.000140				McCauley 1984
Keratella quadrata	2	9	0.079	4.44E-13	0.15		0.15	0.14	0.000714902	0.000056				McCauley 1984
Keratella cochlearis	980	4356	38.605	1.02E-08	0.15		0.19	0.01	6.85227E-05	0.002645				McCauley 1984
Lecane bulla	1	4	0.039	9.65E-14	0.18		0.18	0.18	0.000621638	0.000024				McCauley 1984
Mytilina sp.	1	4	0.039	9.96E-14	0.19	0.08	0.19	0.19	0.0006419	0.000025				McCauley 1984
Polyarthra sp.	1161	11610	102.905	2.66E-07	0.09		0.11	0.06	0.000251496	0.025880				McCauley 1984
Synchaeta sp.	1	4	0.039	9.19E-14	0.18	0.13	0.18	0.18	0.000592036	0.000023				McCauley 1984
Cladocerans														
Bosminidae														
Bosmina sp.	15	900	7.977	3.01	0.26		0.34	0.19			-1.33693	3.09	3.04	Bot76
Daphniidae														
Ceriodaphnia sp.	315	18900	167.520	155.17	0.45		0.65	0.31			-0.79	2.562	3.34	Bot76
Daphnia parvula	48	2880	25.527	131.17	1.06		1.19	0.96			0.056089	1.478	2.83	Bot76
Sididae														
Diaphanosoma sp.	1	60	0.532	1.41	0.81		0.81	0.81			-0.21357	1.624	3.05	Bot76
Calanoida														
Skistodiaptomus oregonensis	21	1260	11.168	126.71	1.22		1.35	1.13			0.198258	1.953	2.40	Bot76
Cyclopoida														
Diacyclops thomasi	66	3960	35.099	215.80	0.94		1.06	0.77			-0.05702	1.953	2.40	Bot76
Mesocyclops edax	2	120	1.064	12.30	1.23		1.52	0.94			0.206132	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	24	1440	12.763	53.43	0.80		1.18	0.07			-0.21714	1.953	2.40	Bot76
Cyclopoid Juvenile	247	14820	131.357	435.29	0.73		0.87	0.60			-0.31455	1.953	2.40	Bot76
Daphnia sp. (juvenile)	23	1380	12.232	11.74	0.58		0.88	0.42			-0.5368	1.478	2.83	Bot76
Nauplii	91	5460	48.395	4.29	0.16		0.29	0.10			-1.82359	1.953	2.40	Bot76

Total Individuals Counted	3549
Total Rotifer Abundance	18432
Total Crustacea Abundance	51180
Total Abundance (Rotifers+Crustacea)	69612
Total Number of Species - Rotifera	10
Total Number of Species - Crustacea	7
Richness (S)	17

Notes:

Polyarthra estimated in 1ml

Table D2. Invert Solutions zooplankton lab results from Summerside south site, 9 August 2022.

Lake:	Summerside
Project No.	21-086
Station No.	South SSRA
Sample No.	1
Sample Date:	09-Aug-22
Sample Time:	12:10
Net Size (m) (13cm= 0.065) or (20 cm=0.1)	0.065
Sampling depth (m):	7.5
Volume of Water Sampled	99.549

Date Counted:	25-Aug-22
Rotifer Sample	
Total Volume (mL)	15
Subsample volume (mL)	4
Crustacea	
Total Volume (mL)	15
Subsample volume (mL)	0.35

Species	Total # in sub sample	Sample Abundance	Abundance/L	Total Biomass (µg/L)	Mean Length (mm)	Mean Width (mm)	Max Length (mm)	Min Length (mm)	Mean Individual Biovolume (mm^3)	Total Biovolume (mm^3/L)	Ln (L)	Lnα	β	Source
Rotifera														
Ascomorpha sp.	941	3529	35.447	1.67E-08	0.10		0.12	0.09	0.000133114	0.004719				McCauley 1984
Conochilus sp.	14	53	0.527	2.08E-12	0.11	0.05	0.15	0.07	7.49377E-05	0.000040				McCauley 1984
Collotheca sp.	26	98	0.979	2.99E-10	0.09	0.03	0.11	0.07	0.003113087	0.003049				McCauley 1984
Dissotrocha sp.	1	4	0.038	7.43E-14	0.17	0.05	0.17	0.17	0.000523681	0.000020				McCauley 1984
Filinia sp.	1	4	0.038	7.75E-14	0.16		0.16	0.16	0.000545953	0.000021				McCauley 1984
Gastropus sp.	1	4	0.038	2.88E-14	0.10		0.10	0.10	0.00020303	0.000008				McCauley 1984
Kellikottia longispina	30	113	1.130	1.18E-11	0.14		0.16	0.13	9.23008E-05	0.000104				McCauley 1984
Keratella quadrata	6	23	0.226	2.95E-12	0.14		0.14	0.13	0.000576958	0.000130				McCauley 1984
Keratella cochlearis	815	3056	30.701	6.99E-09	0.15		0.17	0.14	7.4152E-05	0.002277				McCauley 1984
Lecane bulla	2	8	0.075	2.72E-13	0.17		0.17	0.16	0.00047882	0.000036				McCauley 1984
Lepadella sp.	2	8	0.075	5.19E-14	0.10	0.05	0.11	0.08	9.13884E-05	0.000007				McCauley 1984
Monommata grandis	1	4	0.038	7.75E-14	0.16	0.06	0.16	0.16	0.000545953	0.000021				McCauley 1984
Notholca sp.	1	4	0.038	6.71E-15	0.11		0.11	0.11	4.72908E-05	0.000002				McCauley 1984
Polyarthra sp.	1101	4129	41.474	7.76E-08	0.11		0.12	0.09	0.000451146	0.018711				McCauley 1984
Testudinella sp.	1	4	0.038	7.39E-14	0.18		0.18	0.18	0.000520992	0.000020				McCauley 1984
Trichotria sp.	1	4	0.038	8.44E-14	0.23	0.07	0.23	0.23	0.000594919	0.000022				McCauley 1984
Cladocerans														
Bosminidae														
Bosmina sp.	18	771	7.749	6.13	0.33		0.39	0.29			-1.0938	3.09	3.04	Bot76
Daphniidae														
Ceriodaphnia sp.	343	14700	147.666	214.41	0.52		0.69	0.35			-0.65541	2.562	3.34	Bot76
Daphnia longispina complex	7	300	3.014	21.45	1.19		1.42	1.04			0.171272	1.478	2.83	Bot76
Daphnia parvula	23	986	9.902	44.84	1.01		1.15	0.08			0.011472	1.478	2.83	Bot76
Calanoida														
Skistodiaptomus oregonensis	25	1071	10.763	134.63	1.27		1.37	1.13			0.238922	1.953	2.40	Bot76
Cyclopoida														
Diacyclops thomasi	96	4114	41.329	216.93	0.88		1.08	0.77			-0.12292	1.953	2.40	Bot76
Mesocyclops edax	4	171	1.722	21.84	1.28		1.64	0.94			0.244598	1.953	2.40	Bot76
Juvenile Copepodids/Cladocera														
Calanoid Juvenile	33	1414	14.207	51.29	0.76		1.13	0.07			-0.27889	1.953	2.40	Bot76
Cyclopoid Juvenile	42	1800	18.082	57.57	0.72		0.89	0.07			-0.33119	1.953	2.40	Bot76
Daphnia sp. (juvenile)	42	1800	18.082	27.56	0.69		0.88	0.58			-0.3733	1.478	2.83	Bot76
Nauplii	124	5314	53.384	4.40	0.16		0.24	0.10			-1.85389	1.953	2.40	Bot76

Total Individuals Counted	3701
Total Rotifer Abundance	11040
Total Crustacea Abundance	32443
Total Abundance (Rotifers+Crustacea)	43483
Total Number of Species - Rotifera	16
Total Number of Species - Crustacea	7
Richness (S)	23

Notes:

Table D3. Total abundance of zooplankton sampled at Summerside north and south sites, August 26, 2021.

Zooplankton Species	Sum of Abundance/L Summerside North	Summerside South	Grand Total
Crustacea	**453.63**	**325.90**	**779.53**
Bosminidae	**7.98**	**7.75**	**15.73**
Bosmina sp.	7.98	7.75	15.73
Cyclopidae	**167.52**	**61.13**	**228.65**
Cyclopoid Juvenile	131.36	18.08	149.44
Diacyclops thomasi	35.10	41.33	76.43
Mesocyclops edax	1.06	1.72	2.79
Daphniidae	**205.28**	**178.66**	**383.94**
Ceriodaphnia sp.	167.52	147.67	315.19
Daphnia longispina complex		3.01	3.01
Daphnia parvula	25.53	9.90	35.43
Daphnia sp. (juvenile)	12.23	18.08	30.31
Diaptomidae	**23.93**	**24.97**	**48.90**
Calanoid Juvenile	12.76	14.21	26.97
Skistodiaptomus oregonensis	11.17	10.76	21.93
Nauplii	**48.39**	**53.38**	**101.78**
Nauplii	48.39	53.38	101.78
Sididae	**0.53**		**0.53**
Diaphanosoma sp.	0.53		0.53
Rotifera	**163.37**	**110.90**	**274.27**
Brachionidae	**40.14**	**32.09**	**72.24**
Kellikottia longispina	1.46	1.13	2.59
Keratella cochlearis	38.61	30.70	69.31
Keratella quadrata	0.08	0.23	0.30
Notholca sp.		0.04	0.04
Collothecidae	**1.26**	**0.98**	**2.24**
Collotheca sp.	1.26	0.98	2.24
Conochilidae		**0.53**	**0.53**
Conochilus sp.		0.53	0.53
Filiniidae	**0.79**	**0.04**	**0.83**
Filinia sp.	0.79	0.04	0.83
Gastropodidae	**18.16**	**35.48**	**53.65**
Ascomorpha sp.	18.16	35.45	53.61
Gastropus sp.		0.04	0.04
Lecanidae	**0.04**	**0.08**	**0.11**
Lecane bulla	0.04	0.08	0.11
Lepadellidae		**0.08**	**0.08**
Lepadella sp.		0.08	0.08
Mytilinidae	**0.04**		**0.04**
Mytilina sp.	0.04		0.04

Zooplankton Species	Sum of Abundance/L Summerside North	Summerside South	Grand Total
Notommatidae		**0.04**	**0.04**
Monommata grandis		0.04	0.04
Philodinidae		**0.04**	**0.04**
Dissotrocha sp.		0.04	0.04
Synchaetidae	**102.94**	**41.47**	**144.42**
Polyarthra sp.	102.91	41.47	144.38
Synchaeta sp.	0.04		0.04
Testudinellidae		**0.04**	**0.04**
Testudinella sp.		0.04	0.04
Trichotriidae		**0.04**	**0.04**
Trichotria sp.		0.04	0.04
Grand Total	**617.0**	**436.8**	**1053.8**

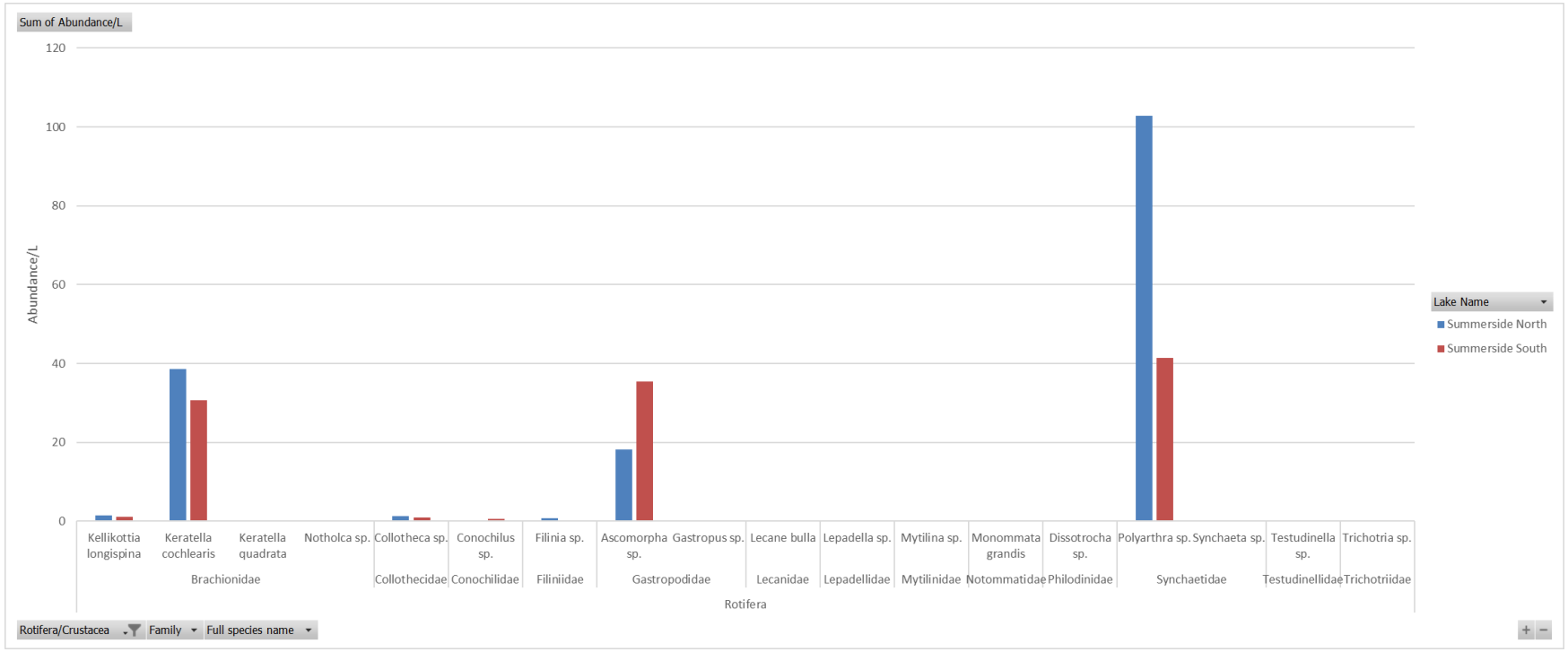

Figure D1. Comparison of the overall Rotifera zooplankton abundance for the Summerside north and south sites, 9 August 2022.

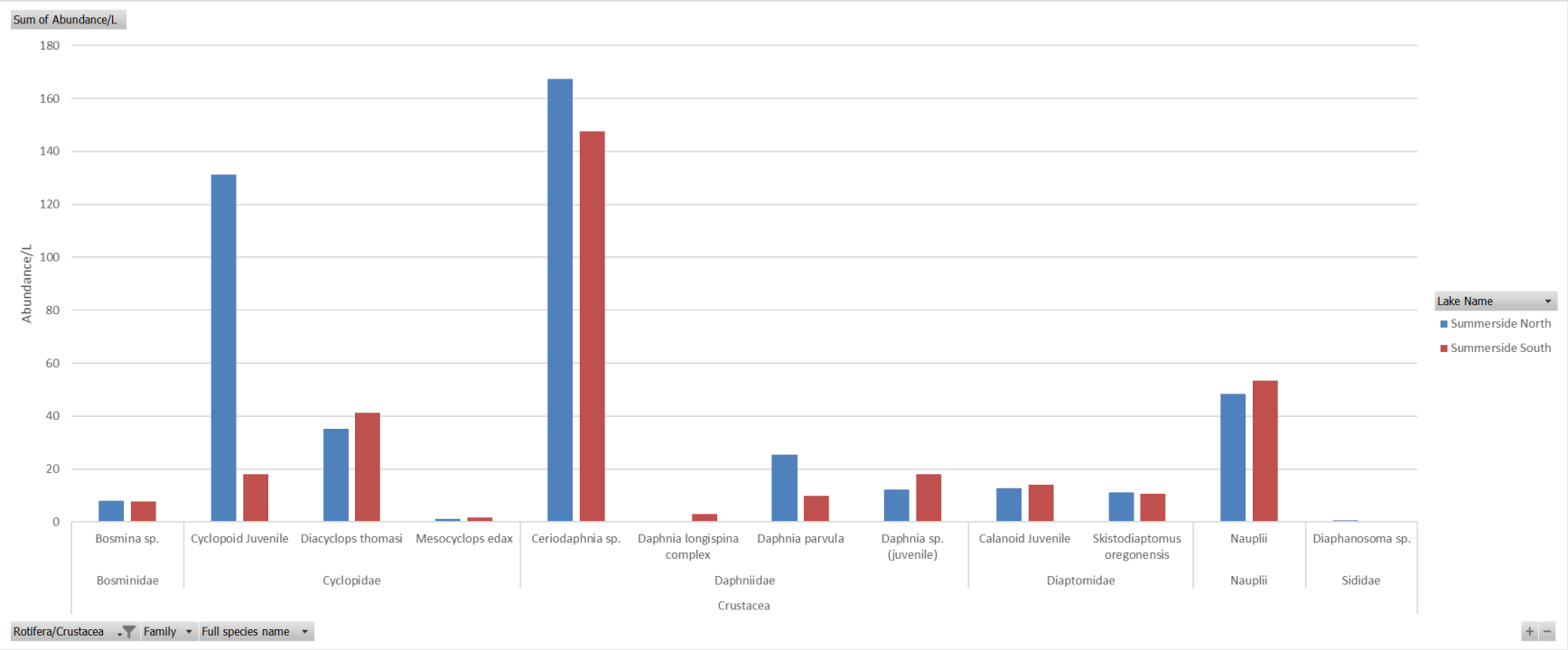

Figure D2. Comparison of the overall Crustacea zooplankton abundance for the Summerside north and south sites, 9 August 2022.

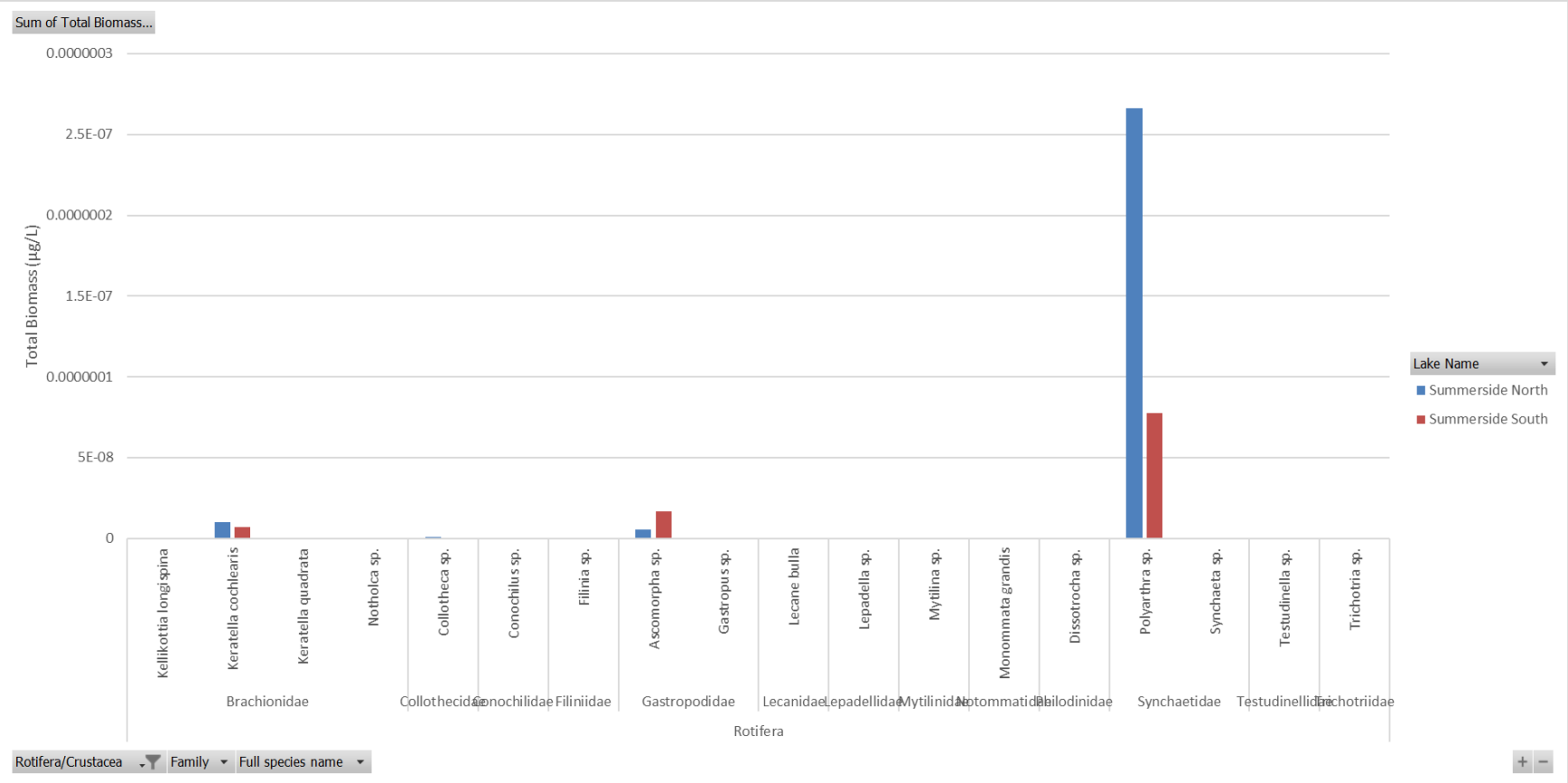

Figure D3. Comparison of the overall Rotifera zooplankton biomass for the Summerside north and south sites, 9 August 2022.

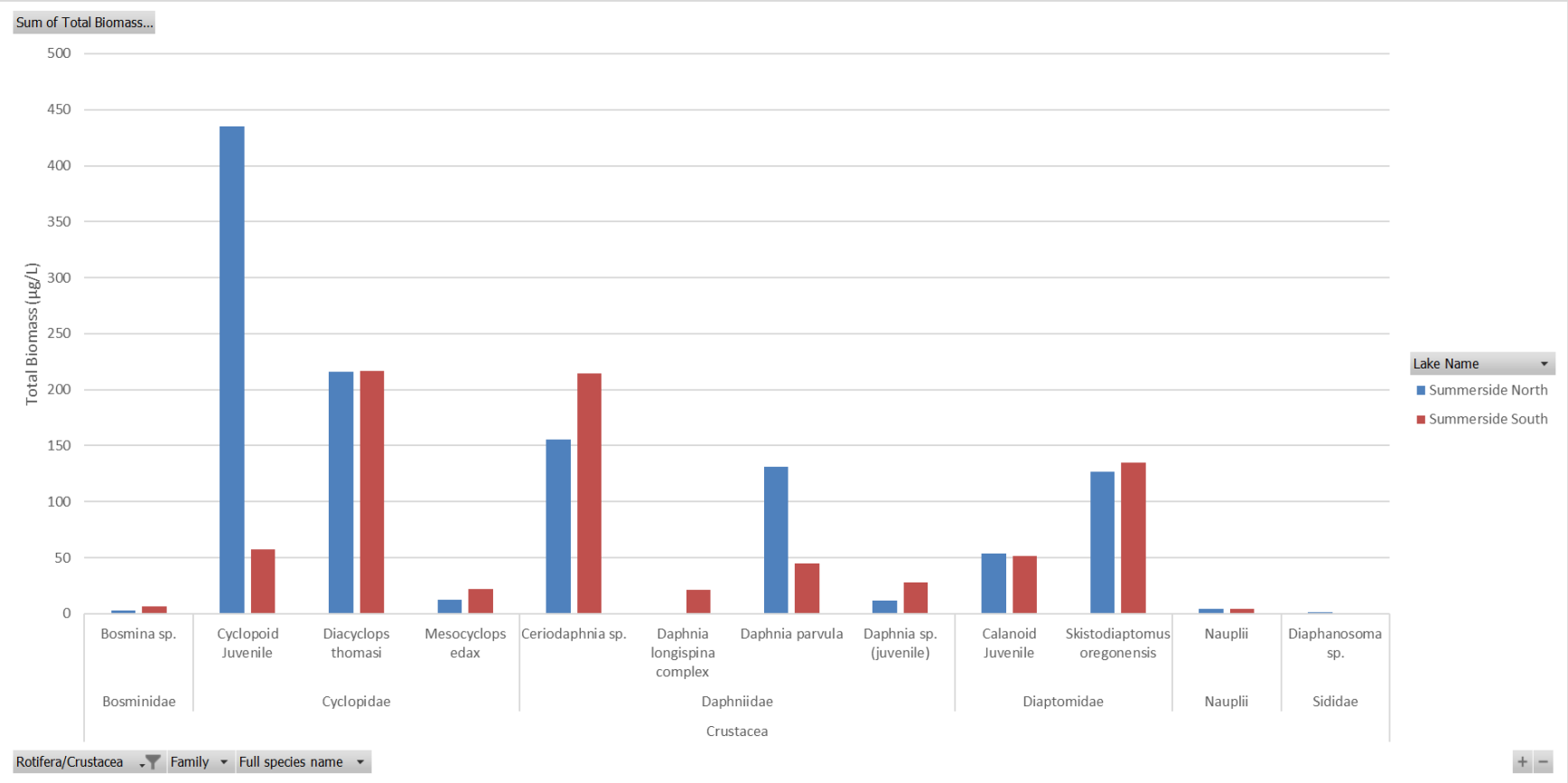

Figure D4. Comparison of the overall Crustacea zooplankton biomass for the Summerside north and south sites, 9 August 2022.