Hutchinson

Environmental Sciences Ltd.

Lake of Bays Water Quality Report 2024

Prepared for: Lake of Bays Association
Job #: J100013

June 2025

Final Report

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June, 2025 HESL Job #: J100013

Penny Thomas
Environment Chair
Lake of Bays Association
PO Box 8
Baysville, ON P0B 1A0

Dear Ms. Gossage:

Re: Lake of Bays Water Quality Report 2024

I am pleased to submit this final report for the Lake of Bays Water Quality Monitoring Program presenting the results of total phosphorus and bacteria sampling from the summer of 2024.

As in previous years, total phosphorus and bacteria levels were well below applicable Provincial guidelines indicating excellent water quality in 2024. Statistically significant increases in total phosphorus that have been noted in the past were absent with the addition of the 2024 data. The unprecedented number of bad splits and outliers recorded in the 2023 data were corrected in 2024. We recommend the continued training refreshers for volunteers and diligence in the field to reduce sample contamination and that any deviations from the prescribed methodology be discussed with HESL and the Environmental Committee before sampling begins.

I thank you and the Lake of Bays Association for the continued opportunity to assist with this project.

Sincerely,
per: Hutchinson Environmental Sciences Ltd.

Kris Hadley

Kristopher Hadley, Ph.D.
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Signatures

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Table of Contents

List of Figures

List of Tables

Appendices

1. Introduction

The Lake of Bays Association (LOBA) has championed a volunteer-based water quality monitoring program in Lake of Bays since the 1970s. The aim of the program is to characterize phosphorus and bacteria levels as an indication of general lake and watershed health and to compare different sites across the lake, while fostering community involvement and education.

LOBA has been monitoring spring turnover phosphorus levels as part of the Ministry of Environment, Conservation and Park's Lake Partner Program but the independent monitoring program began in 1970 to monitor bacteria levels in the lake during the ice-free season. In 1972, LOBA became a MoE Self-Help Program participant collecting Secchi depth measurements and water samples for Chlorophyll *a* analysis. In 1978 the program transitioned to analysing Total Phosphorus. This project was successful, deemed valuable and LOBA expanded the area of study in the summer of 2001 to include near-shore sites adjacent to developed and undeveloped properties, and areas influenced by wetlands and rivers. In 2002, the program was again expanded to include monitoring of total phosphorus concentrations in near-shore areas and in the Hollow and Oxtongue rivers and river deltas (deep water sites were already being monitored). Site selection has changed as our understanding of water quality conditions in Lake of Bays has increased and, since 2009, sampling has focused on deep water sites, nearshore disturbed and undisturbed locations, and inflowing rivers. In 2020, the Covid-19 pandemic suspended the data collection program, however the program was able to return to operation in 2021.

In July 2020 an algae bloom was reported and confirmed by the MECP on Ten Mile Bay. Water quality in Ten Mile Bay does not suggest changes in phosphorus concentrations have occurred in Ten Mile Bay, however we are lacking data from 2020 to confirm the conditions during or prior to the bloom. Following the report of the blooms, HESL and LOBA coordinated to gather additional information beyond the MECP sampling, however the bloom could not be located by LOBA residents and therefore may have been a small-scale localized bloom that quickly dissipated. To our knowledge no blooms on Lake of Bays were reported in 2024.

The LOBA monitoring program continues to focus on total phosphorus concentrations. For recreational lakes on the Precambrian Shield like Lake of Bays, water quality concerns are most often associated with nutrient enrichment due to increased human phosphorus sources. Phosphorus is a natural element in the environment and enters lakes from the atmosphere through precipitation, from streams and overland flow, and to a lesser degree through groundwater. Human sources to recreational lakes include storm water runoff and erosion from altered land uses, fertilizers on manicured lawns and faulty septic systems. Increases in phosphorus loads to lakes from human sources can result in increased growth of aquatic plants and algae, which in turn can lead to a deterioration of water clarity and coldwater fish habitat through a decrease in deep-water oxygen concentrations.

Previous monitoring reports have suggested that a reduction in bacteria sampling frequency was warranted; beginning in 2016, it was recommended that bacteria sampling be conducted only in the mid-summer each year at the nearshore sites. Every five years the collection of bacteria samples on all sampling dates was recommended. The reduced sampling frequency will continue to allow for the assessment of long-term trends while maintaining familiarity with bacteria sampling techniques. In 2024, bacteria were sampled on three occasions for the first time since 2018.

The program continues to demonstrate that Lake of Bays is a clear water lake with low phosphorus and bacteria levels with no obvious impact of development on water quality. In this report we present the results of the summer phosphorus monitoring completed by the LOBA in 2024 and discuss them in the context of long-term water quality data collected by the LOBA and local precipitation records.

2. Methods

Volunteers, coordinated by the LOBA Environment Committee, collected samples for analysis of total phosphorus and bacteria (*E. coli* and total coliforms) on three occasions during the summer of 2024 (July 1, August 5 and 24). The sampling and analytical methods in 2024 were consistent with those used in previous monitoring years and are summarized below. Detailed sampling instructions that are provided to the volunteers are presented in Appendix A.

2.1 Sample Collection

Water samples for bacteria and total phosphorus were collected at 23 sites in Lake of Bays to include deep, open water locations (‘Deep Water’ sites, n=9), nearshore sites adjacent to developed areas (‘Disturbed’ sites, n=5),undeveloped shorelines (‘Nearshore Undisturbed’ sites, n=5), and both river (Oxtongue and Hollow rivers) and river-influenced (Oxtongue Delta) sites (‘River’ sites, n=4) (Table 1, Figure 1).

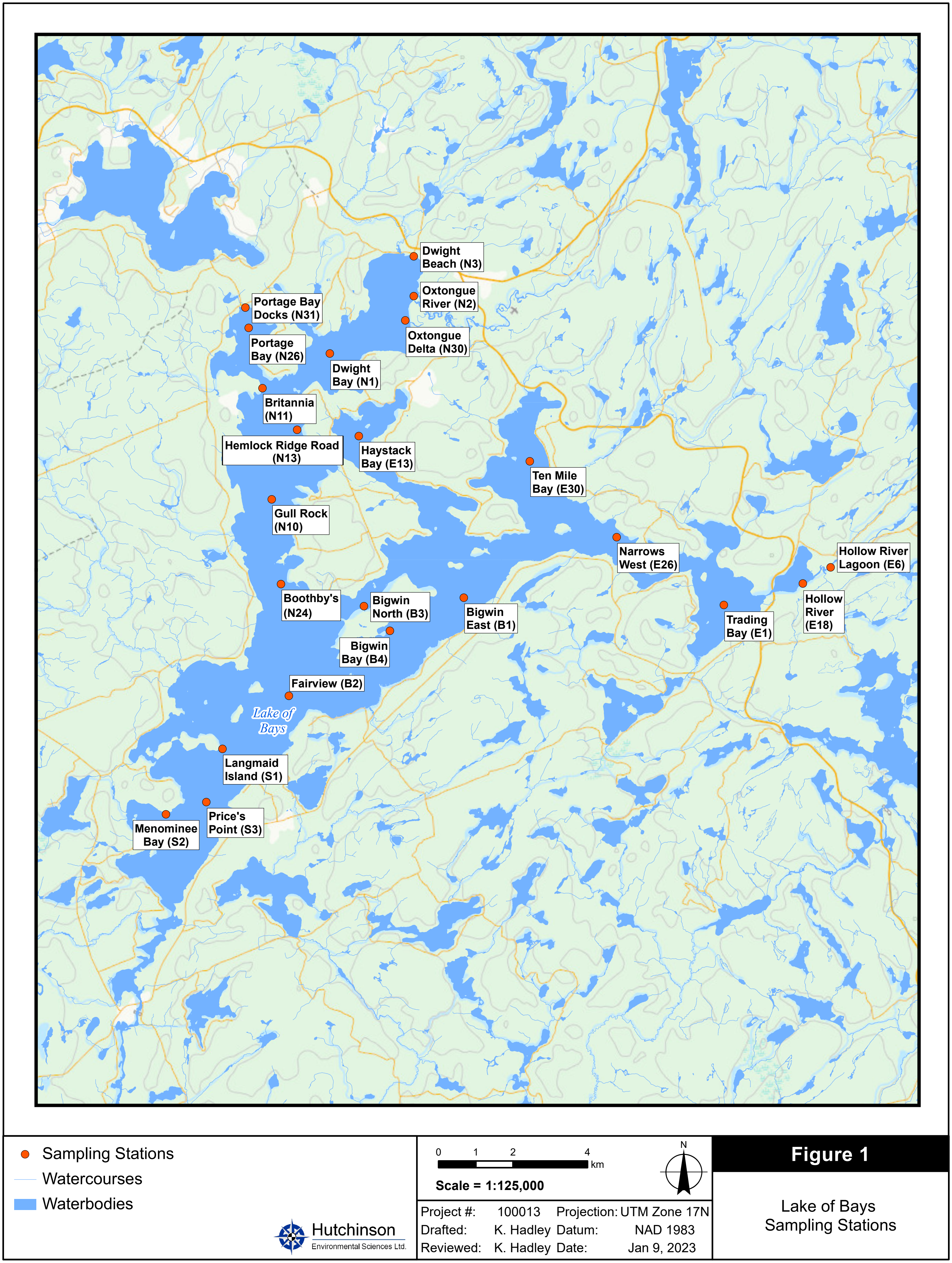
At each Deep Water site, a composite water sample was collected from the euphotic zone, at approximately two times the Secchi depth. At all other sites, the water sample was collected at a depth of ~30 cm. Seventeen field duplicate samples for bacteria were collected in 2024. Twenty field duplicate samples for total phosphorus were collected to assess the variability of results related to sampling and analytical procedures (Table 1).

Phosphorus samples were coarse-filtered using a filtered syringe in order to remove zooplankton (microscopic animals living in the water, such as water fleas) or other large debris that can contaminate the sample and result in non-representative, high phosphorus values (Clark et al., 2010). Samples were then directly poured into sampling containers with acid preservative, stored in a cool place and submitted for analysis to ALS Environmental Laboratory.

Table 1. 2024 Sampling Sites and Dates

Site Name	Total Phosphorus Sampling			Bacteria Sampling		
	01-Jul	05-Aug	24-Aug	01-Jul	05-Aug	24-Aug
Deep Water Sites						
Bigwin East	1	1	1	1	2	1
Dwight Bay	1	1	2	1	1	1
Fairview	1	1	1	1	1	2
Gull Rock	1	1	1	2	1	1
Haystack Bay	1	1	2	1	1	1
Portage Bay	1	1	2	1	1	1
Price Point	1	1	2	2	1	1
Ten Mile Bay	1	2	1	1	1	1
Trading Bay	1	1	2	1	1	1
Disturbed Sites						
Bigwin Bay	1	2	1	1	1	2
Bigwin North	1	1	2	1	2	1
Britannia	1	1	2	1	1	1
Dwight Beach	1	2	1	1	2	1
Portage Bay Docks	2	1	1	1	1	2
Nearshore Undisturbed						
Langmaid Island	1	1	2	1	2	1
Boothby's	2	1	1	1	2	1
Menominee Bay	2	1	1	1	1	2
Hemlock Ridge Road	1	1	2	1	1	2
Narrows West	2	1	1	1	2	1
River Sites						
Hollow River Lagoon	1	1	1	1	2	2
Hollow River mouth	2	2	1	1	1	1
Oxtongue Delta	1	1	2	1	1	2
Oxtongue River mouth*	1	1	2	1	1	2

Notes: 1 = single sample collected, 2 = field duplicate samples collected, - = No Sample *Sampled in the mouth of the rivers just upstream of their discharge to the lake.



Project #:	100013	Projection:	UTM Zone 17N
Drafted:	K. Hadley	Datum:	NAD 1983
Reviewed:	K. Hadley	Date:	Jan 9, 2023

Figure 1

Lake of Bays
Sampling Stations

2.2 Quality Control

2.2.1 Bacteria

Three field duplicate bacteria concentrations were collected and compared to assess variability in the results due to sampling and analysis by the Coliplate method.

2.2.2 Total Phosphorus

2.2.2.1 Field Duplicates

Duplicate samples were collected for 20 of the 69 samples. Bad splits in the LOBA dataset were identified for duplicate samples that were >35% different or had an absolute difference of >5 μg/L (Hyatt et al., 2012). If a bad split was identified, the higher of the two values was discarded.

2.2.2.2 Outliers

In relatively small datasets like the LOBA dataset, the calculation of average total phosphorus concentration is sensitive to outliers, that is, extreme values that are not representative of the site condition. Rosner's ESD Many-Outlier Procedure (Rosner's Test; Rosner, 1983) was performed in the R statistical Software Environment V. 3.3.3, using the "rosnerTest" function of the "EnvStats" package (Millard, 2013), to identify outliers in total phosphorus concentrations collected since 2002 for each LOBA monitoring site. This procedure detects high and low extreme values and is not limited for multiple outliers.

Statistically significant outliers (at $p<0.05$) were removed from the dataset for further analyses (as detailed in Section 3.1.3) but will be re-evaluated each year as additional data are collected, as outliers may, over time, indicate a change to representative conditions.

2.2.2.3 Detection Limits

Laboratory detection limits changed in 2018 (0.1 to 3 μg/L) as the result of an unavoidable laboratory change from Trent University at the Dorset Environmental Science Centre to ALS Environmental. In 2022 detection limits were 3.0 μg/L in July but improved to 2.0 μg/L during sampling in August. A detection limit of 2.0 μg/L was maintained during the 2023 and 2024 sampling season. Values below detection were substituted with the full detection limit to make the most conservative estimate of total phosphorus concentrations in the samples collected. In 2024, 29 of the 89 (33%) samples collected were below the detection limit.

2.3 Data Analysis

2.3.1 Bacteria

Bacteria (*E. coli* and total coliform) levels were compared to the Provincial Water Quality Objectives (PWQO) for recreational water use (MOEE, 1994). The former benchmark for total coliform was 1,000 colony forming units (cfu) per 100 mL, based on a geometric mean for a series of water samples and is intended as a general guideline. Bacterial assessment of water quality should be based on more specific fecal bacteria indicators such as *E. coli*. The PWQO for *E. coli* is 100 cfu per 100 mL, based on a geometric mean of at least five samples taken from one site within one month. Where testing indicates sewage or fecal contamination, a site-specific judgment must be made as to the severity of the problem and the appropriate course of action. This type of assessment is not possible under the current program design.

2.3.2 Total Phosphorus

Mean total phosphorus concentrations were calculated for each site and site type for the 2024 monitoring period following the assessment of bad splits between duplicate samples and outliers.

Total phosphorus (TP) results were evaluated against the interim PWQO for phosphorus, which suggests average ice-free period TP concentrations should not exceed 20 μg/L in order to avoid nuisance algal growth and that maintaining TP concentrations at or below 10 μg/L provides protection against aesthetic deterioration (MOE 1994). Furthermore, excessive macrophyte growth in rivers and streams should be reduced below 30 μg/L of TP (MOEE, 1994).

Mann Kendall Trend analysis was performed using the “mk.test” and “sens.slope” functions of the “Trend” package in R (Pohlert, 2017) to assess any long-term changes in total phosphorus concentrations over time (2002-2024) for each site.

3. 2024 Monitoring Results

3.1 Quality Control

3.1.1 Bacteria

The quality control program of the Coliplate samples in 2024 provided a high degree of confidence in the sampling protocols and analyses for bacteria (Figure 2). The maximum differences between bacteria duplicates using the Coliplate method was 27 cfu/100 mL for *E. coli* and 34 cfu/100 mL for total coliforms, both from a single sample at Dwight Beach suggesting potential contamination. Pairwise testing of the Coliplate duplicate samples showed no significant difference ($p<0.05$).

3.1.2 Total Phosphorus

3.1.2.1 Field Duplicates

In 2024, 1 of the 20 field duplicates (5%) collected were bad splits (i.e., >5 μg/L difference or >35% difference between sample pairs) (Figure 3; Table 2). By contrast, the average annual proportion of bad splits in samples since 2005, when duplicate sampling began, is 18%. The increased occurrence of bad splits in 2022 and 2023 may be the result of sample contamination during collection or changes in methodology made prior to sampling. One additional field duplicate was detected as bad splits however as it was near the detection limit (2 μg/L) where measurement error at the lab would be expected to increase, they were retained in the dataset. Continued diligent compliance to and review of sampling protocols are necessary to ensure the integrity of the data. These data suggest excellent QA/QC practices in 2024.

Figure 2. Comparison of field duplicate results for total coliform and *E. coli*, 2024

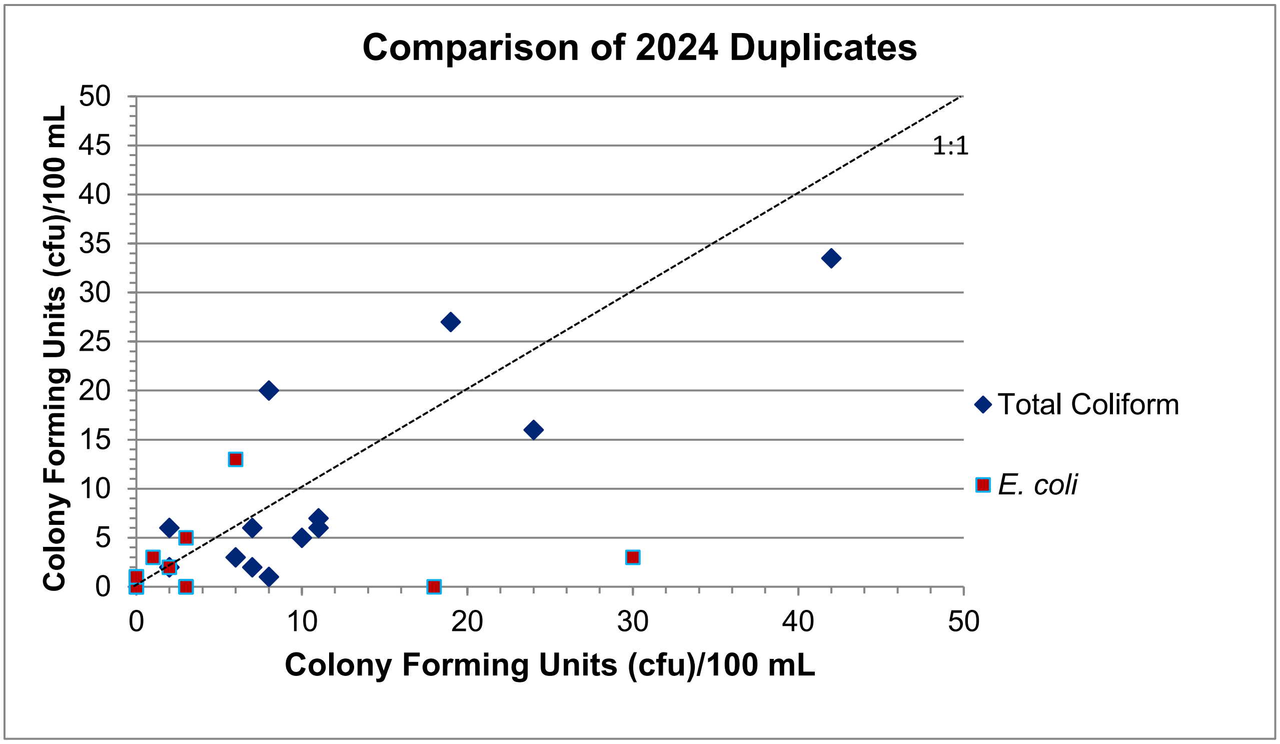


Figure 3. Total phosphorus field duplicates in Lake of Bays, 2024.

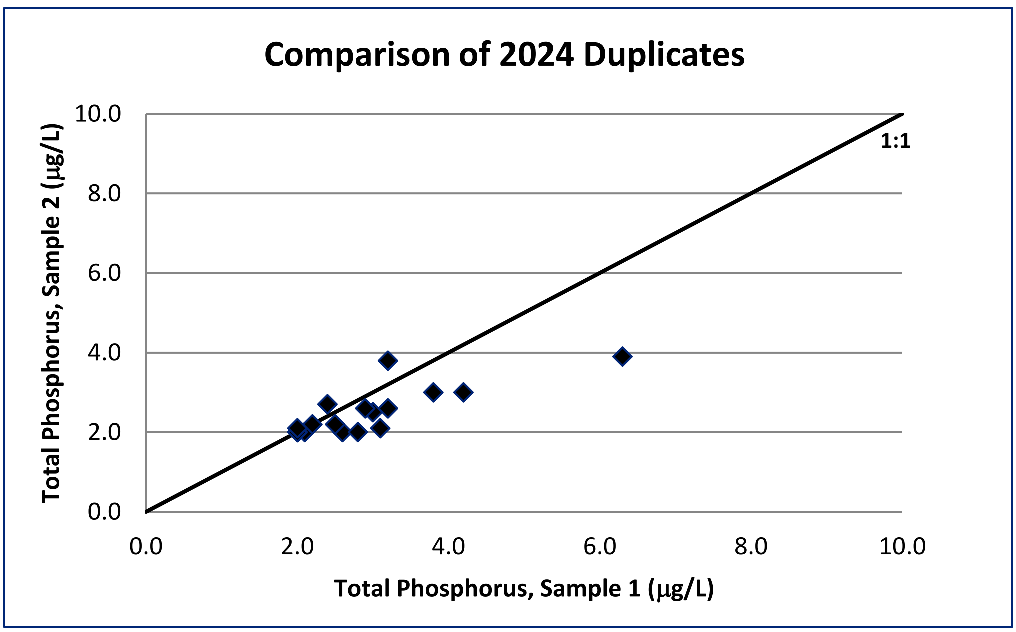


Table 2. Summary of Bad Splits between Total Phosphorus Field Duplicates in Lake of Bays, 2005-2024.

Site Name	Date	TP 1 (μg/L)	TP2 (μg/L)
Langmaid Island	1-Sep-06	7.7	4.1
	1-Sep-17	11.2	4.6
	4-Jul-22	3	19.6
Bigwin Bay	5-Jul-21	4.4	3
Bigwin East	20-Jul-14	6	9.5
	1-Aug-22	2	6.1
Bigwin North	2-Sep-11	5.9	3.7
	4-Sep-15	4.5	8.7
	4-Aug-15	19.3	4
	14-Aug-16	5.9	3.5
	5-Jul-21	10.1	6.5
	4-Jul-22	3	21.4
Boothby's	20-Jul-15	4.1	7.4
	1-Jul-16	8.7	3.3
	26-Aug-22	2	3.7
	27-Aug-23	7	38.8
Britannia	1-Aug-16	3.9	5.9
	4-Jul-22	13.8	5.6
	3-Jul-23	5	11.5
	27-Aug-23	25.3	39.4
Dwight Bay	1-Sep-06	9.2	31.9
	4-Sep-15	7	4.4
	20-Jul-15	4.3	8.3
	14-Aug-16	11.2	7.3
	26-Aug-22	31.4	15.5
Dwight Beach	1-Aug-22	3.1	2
Fairview	7-Aug-06	4.3	7.5
	14-Aug-16	3.7	10.2
Gull Rock	29-Jun-14	5.5	9
	5-Aug-19	4.1	11.1

Haystack Bay	26-Aug-22	3	2
Hollow River Lagoon	27-Aug-23	7.2	31.6
Menominee Bay	1-Sep-06	15.9	8.1
	1-Jul-16	4.8	3.1
	26-Aug-22	2	3.8
Hemlock Ridge Road	4-Jul-05	5.7	4
	7-Sep-10	5.1	3.3
	18-Aug-13	4.1	6.1
	28-Aug-14	4.4	6.9
	23-Aug-15	3.9	1.8
	5-Aug-19	7.6	3.4
	5-Jul-21	5.8	3
	1-Aug-22	4.3	6.7
Narrows West	23-Jul-07	8.2	4.1
	18-Jul-16	12.3	5.9
	21-Aug-17	6.1	29.5
	3-Jul-17	6.2	12.7
	30-Aug-19	4.5	3
	7-Aug-23	34.1	24.2
Oxtongue Delta	30-Aug-19	16	3.8
	1-Aug-22	5.3	15.8
Oxtongue mouth	7-Aug-23	17.7	30.9
	24-Aug-24	6.3	3.9
Portage Bay	27-Aug-23	2	3.1
	7-Aug-23	7.6	3.6
Portage Bay docks	30-Aug-19	20.7	3
	26-Aug-22	4.9	2
Price's Point	1-Aug-16	6.2	3.9
	23-Jul-17	5.4	8.5
Ten Mile Bay	14-Jul-08	4.7	6.9
	7-Sep-10	6.1	12.9
Trading Bay	17-Jul-06	7.3	4.5
	21-Aug-17	11.1	6.1
	1-Aug-22	4.9	2

Note: Values in grey shaded cells were considered to be contaminated and were excluded from further analyses.

3.1.3 Outliers

A total of 68 samples were identified as outliers in the LOBA dataset (excluding River sites) using the Rosner's Test, 1 of which occurred in the 2024 monitoring year (Table 3). Bad splits (Section 3.1.2) were infrequent in 2024 suggesting ongoing training and adherence to sampling methods improved significantly since 2023. We recommend continuing to use the ALS sampling equipment provided with the sampling bottles as this method appears to significantly reduce potential for contamination in phosphorus samples. Future sampling in 2025 and beyond will be needed to determine if the 2023 results should be retained in the dataset or removed entirely. Outliers were removed from all analyses in this report but will be reassessed each year as additional data are added to the dataset.

Table 3. Outliers in the LOBA Dataset (2002-2024), Rosner's Test (*p* <0.01)

Lake	Date	Total Phosphorus (µg/L)
Langmaid Island	18-Jul-11	15.1
	31-Aug-12	7.9
	18-Aug-13	9.9
	18-Jul-16	8.9
	7-Aug-23	28.2
	1-Jul-24	9.6
Bigwin Bay	15-Jul-02	9.6
	20-Jul-14	10.1
	4-Aug-15	12.0
	27-Aug-23	10.3
Bigwin East	7-Aug-23	10.7
Bigwin North	23-Aug-04	27.7
	6-Aug-07	97.7
	3-Jul-23	64.9
Britannia	1-Sep-03	12.6
	1-Sep-05	9.4
	18-Aug-13	21.6
	28-Aug-13	13.3
	7-Aug-23	22.0
	27-Aug-23	25.3
Dwight Bay	23-Jul-17	15.5
	1-Sep-17	15.4

Fairview	31-Aug-07	12.5
	17-Jul-09	12.3
	23-Jul-17	10.4
	4-Jul-22	33.4
	7-Aug-23	36.3
	27-Aug-23	38.2
Gull Rock	14-Jul-03	16.9
	3-Jul-23	10.9
Haystack Bay	6-Sep-04	74.0
	7-Aug-06	40.3
	1-Sep-06	14.1
	17-Jul-09	57.7
	31-Aug-12	22.4
	28-Jun-15	14.6
	4-Sep-15	15.7
	3-Jul-23	15.5
Menominee Bay	4-Jul-05	11.0
	1-Sep-16	12.0
	3-Jul-23	11.0
Hemlock Ridge Road	5-Aug-02	36.7
	6-Aug-07	15.1
	5-Aug-13	11.4
	18-Jul-16	17.2
	4-Jul-22	13.5
	7-Aug-23	11.6
	27-Aug-23	15.6
Narrows West	4-Jul-11	11.4
	3-Jul-23	45.7
	7-Aug-23	24.2
	27-Aug-23	10.6
Price's Point	2-Aug-10	12.7
	18-Jul-11	12.8
	2-Jul-18	102.0
	6-Aug-18	12.3
	1-Jul-19	12.1
	4-Jul-22	21.6
	3-Jul-23	30.2
	7-Aug-23	11.9

Ten Mile Bay	18-Jul-16	15.0
	3-Jul-23	12.1
Trading Bay	19-Aug-02	17.7
	19-Jul-04	12.3
	1-Sep-16	15.8
	5-Aug-19	19.5
	3-Jul-23	30.2
	27-Aug-23	27.2

3.2 Bacteria

E.coli counts in Lake of Bays were low (0-5 cfu/100 mL) at all Deep Water sites (Table 4). Higher total coliform counts have typically been observed in the river-influenced and nearshore sites and have been attributed to increased exposure to bacteria sources from wildlife and human activity, lower dilution and less time for assimilation or attenuation in comparison to the offshore Deep Water sites. The highest bacteria count in 2024 was recorded at Hollow River Lagoon (17 cfu/100ml). Absolute bacteria counts were below the PWQO of 100 cfu/100 mL for *E. coli* and benchmark value of 1,000 cfu/100 mL for total coliform at all sampling sites (Table 4).

Table 4. Summer E. coli and Total Coliform Concentration in Surface Water Collected by Coliplate Technique, 2024

Site	*E. coli* (cfu/100 mL)			Total Coliform (cfu/100 mL)		
Deep water						
	01-Jul	05-Aug	24-Aug	01-Jul	05-Aug	24-Aug
Bigwin East	3	2	2	3	9	14
Dwight Bay	2	1	0	4	35	1
Fairview	0	0	0	2	4	2
Gull Rock	1	0	0	4	18	1
Haystack Bay	1	0	1	4	5	5
Price Point	1	0	1	2	7	3
Ten Mile Bay	2	0	0	8	1	3
Trading Bay	0	0	2	4	1	7
Portage Bay	1	0	2	2	37	7
Disturbed						
Bigwin Bay	3	3	1	6	34	6
Bigwin North	3	2	1	16	14	7
Britannia	4	1	1	15	48	4
Dwight Beach	10	3	4	13	30	11
Portage Bay Docks	7	5	2	9	20	23
Nearshore Undisturbed						
Langmaid Island	0	2	1	1	9	5
Boothby's	7	0	1	20	8	2
Menominee Bay	0	2	2	1	22	7
Hemlock Ridge Road	1	0	0	6	30	5
Narrows West	1	1	1	7	5	4
River						
Hollow River Lagoon	4	17	3	7	40	36
Hollow River Mouth	3	5	4	6	31	43
Oxtongue Delta	0	1	9	4	24	5
Oxtongue River	2	7	4	9	37	20

3.3 2024 Total Phosphorus Concentrations

Samples collected during the 2024 monitoring campaign were characterized by low phosphorus concentrations typical in oligotrophic, clear-water lakes on the Precambrian Shield. The summer total phosphorus concentrations of the Deep Water, Disturbed, Nearshore Undisturbed and River sites ranged from 2.0 to 5.8 µg/L, with an overall mean concentration of 2.7 µg/L (Table 5). Mean annual phosphorus concentrations for Deep Water (2.5 µg/L), Disturbed (2.6 µg/L), Nearshore Undisturbed (2.5 µg/L) groups were similar. River sampling sites were more phosphorus-enriched (mean TP = 3.5.0 µg/L), as would be expected given the higher concentrations of particulate matter and dissolved organic carbon typical in rivers.

Mean summer total phosphorus concentration was less than the interim PWQO for phosphorus of 10 µg/L for all sites, suggesting a low risk of aesthetic deterioration due to nuisance aquatic plant growth (MOEE, 1994). Total phosphorus concentrations at the Deep Water, and Nearshore Undisturbed sites remained stable at most sampling locations throughout the summer (e.g., Figure 4, Figure 5, Figure 8). We found no consistent pattern in total phosphorus concentrations for Disturbed or River sites (Figure 6, Figure 7, Figure 8).

There was no significant difference (Mann-Whitney test; p >0.05) in phosphorus concentration between the Nearshore Undisturbed (mean TP = 2.5 µg/L) and Disturbed (mean TP = 2.6 µg/L) sites suggesting that shoreline disturbance has had little impact on summer phosphorus concentrations.

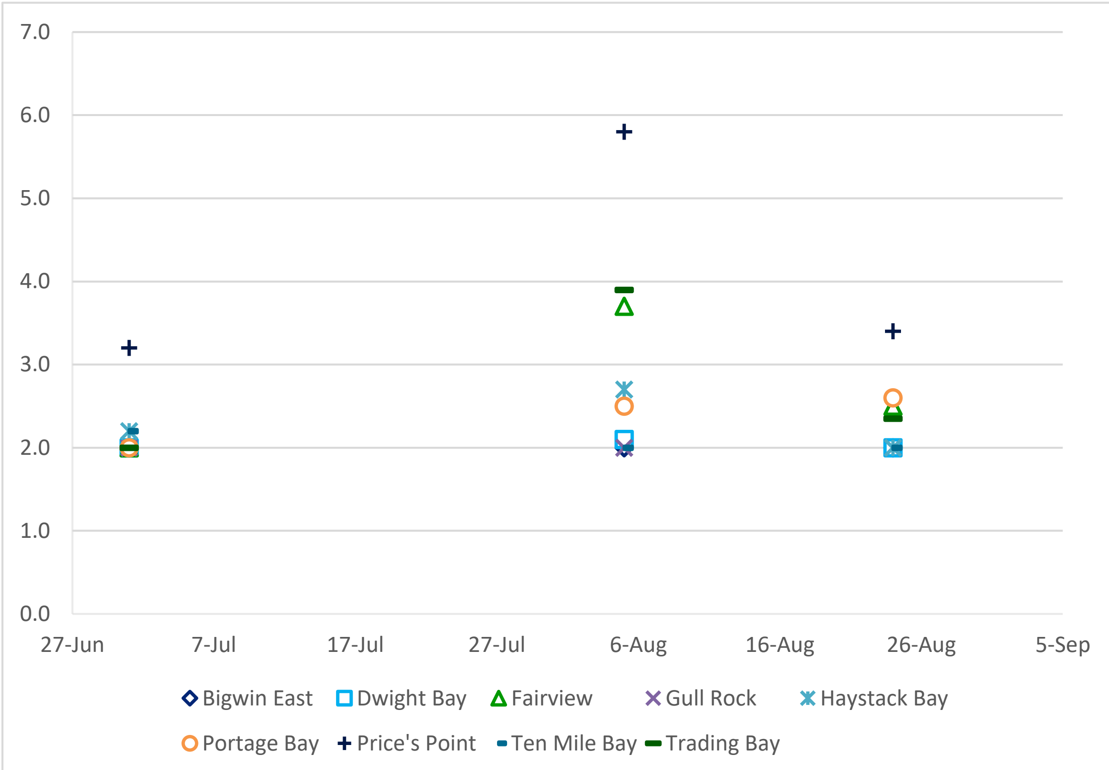
Table 5. Total Phosphorus Concentrations (µg/L) in Lake of Bays, 2024

Site ID	Site Name	1-Jul	5-Aug	24-Aug	AVG	SD
Deep water (mean)		**2.2**	**3.0**	**2.3**	**2.5**	**0.5**
B1	Bigwin East	2.0	2.0	2.0	2.0	0.0
N1	Dwight Bay	2.0	2.1	2.0	2.0	0.1
B2	Fairview	2.0	3.7	2.5	2.7	0.9
N10	Gull Rock	2.0	2.0	2.0	2.0	0.0
E13	Haystack Bay	2.2	2.7	2.0	2.3	0.4
N26	Portage Bay	2.0	2.5	2.6	2.4	0.3
S3	Price Point	3.2	5.8	3.4	4.1	1.4
E30	Ten Mile Bay	2.2	2.0	2.0	2.1	0.1
E1	Trading Bay	2.0	3.9	2.4	2.8	1.0
Disturbed (mean)		**3.0**	**2.4**	**2.4**	**2.6**	**0.4**
B3	Bigwin Bay	2.1	2.0	2.3	2.1	0.2
B4	Bigwin North	2.0	2.0	2.1	2.0	0.0
N11	Britannia	4.2	2.6	2.9	3.2	0.9
	Dwight Beach	4.6	3.6	2.8	3.7	0.9
	Portage Bay Docks	2.1	2.0	2.1	2.1	0.1
Nearshore Undisturbed (mean)		**2.7**	**2.4**	**2.3**	2.5	0.2
S1	Langmaid Island		2.0	2.0	2.0	0.0

N24	Boothby's	2.2	2.0	2.4	2.2	0.2
S2	Menominee Bay	3.5	2.0	2.3	2.6	0.8
N13	Hemlock Ridge Road	2.8	2.5	2.3	2.5	0.3
E26	Narrows West	2.4	3.6	2.5	2.8	0.7
River (mean)		**3.5**	**3.5**	**3.5**	**3.5**	**0.0**
E18	Hollow River Lagoon	2.5	3.3	4.1	3.3	0.8
	Hollow River Mouth	2.6	2.8	3.2	2.8	0.3
N2	Oxtongue Delta	4.6	3.3	2.8	3.6	1.0
N30	Oxtongue Mouth	4.5	4.6	3.9	4.3	0.4
				All sites	2.7	0.3
				All sites excluding River sites	2.5	0.3

An additional site at Portage Bay (i.e., N26 – Portage Bay), initially sampled in 2012 to address concerns over potential water quality degradation following construction activities, has been maintained as a part of the LOBA sampling program. Mean total phosphorus concentration in Portage Bay have declined from 8.1 μg/L to 3.0 μg/L from 2013 to 2021 and remained low in 2024 (2.1 μg/L) representing a consistent and sustained decline from elevated concentrations observed in 2012 (mean TP = 9.6 μg/L) that were coincident with construction activities. Based on these results, ongoing sampling at Portage Bay to monitor long-term construction effects appears unnecessary. Ongoing sampling at the Portage Bay site will be discussed with the LOBA to determine if there is an interest or benefit in maintaining the sampling station.

Figure 4. Total phosphorus concentrations in Lake of Bays 2024, Deep Water sites.



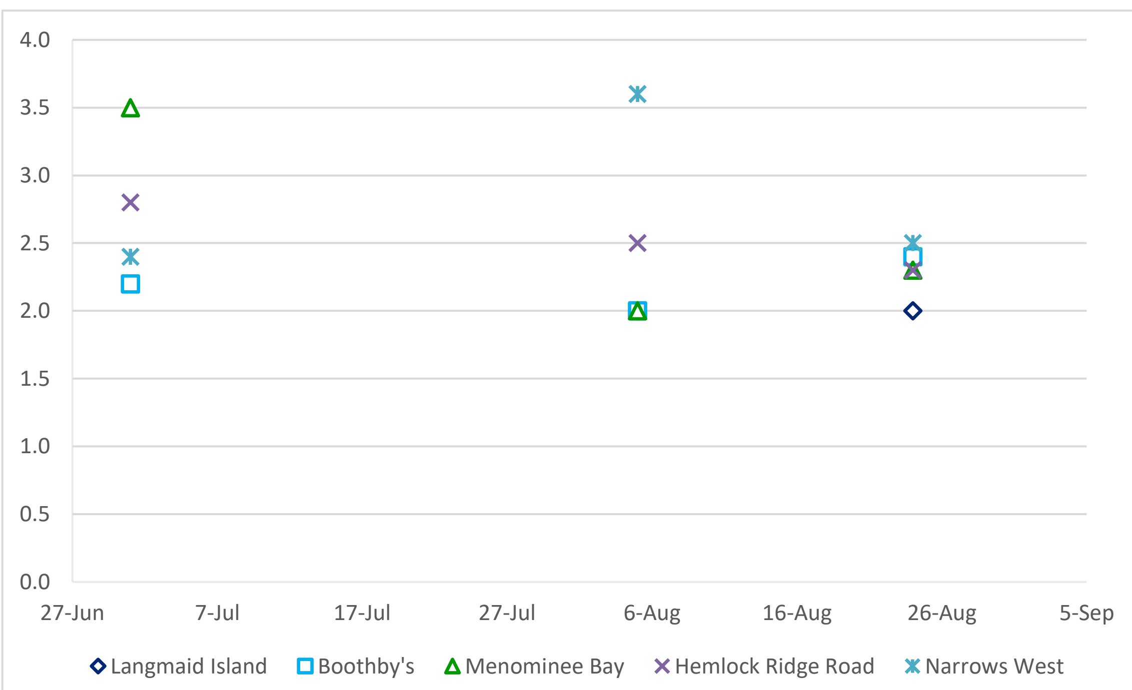


Figure 5. Total phosphorus concentrations in Lake of Bays 2024, Nearshore Undisturbed sites.

Figure 6. Total phosphorus concentrations in Lake of Bays 2024, Disturbed sites.

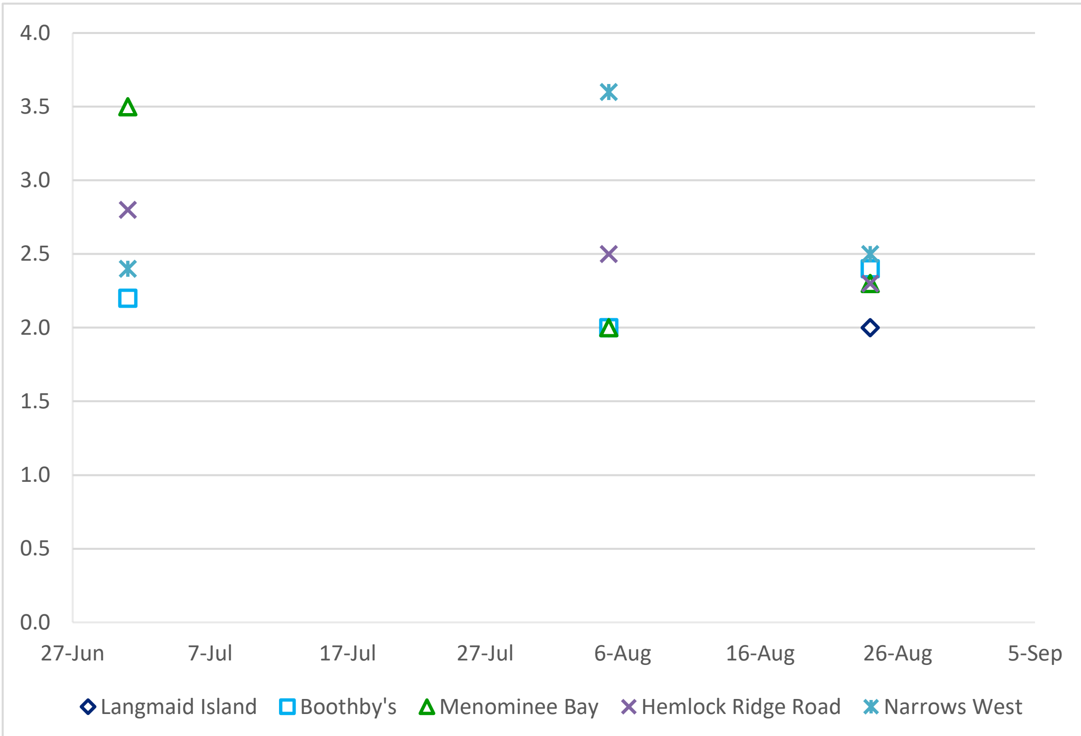


Figure 7. Total phosphorus concentrations in Lake of Bays 2024, River sites.

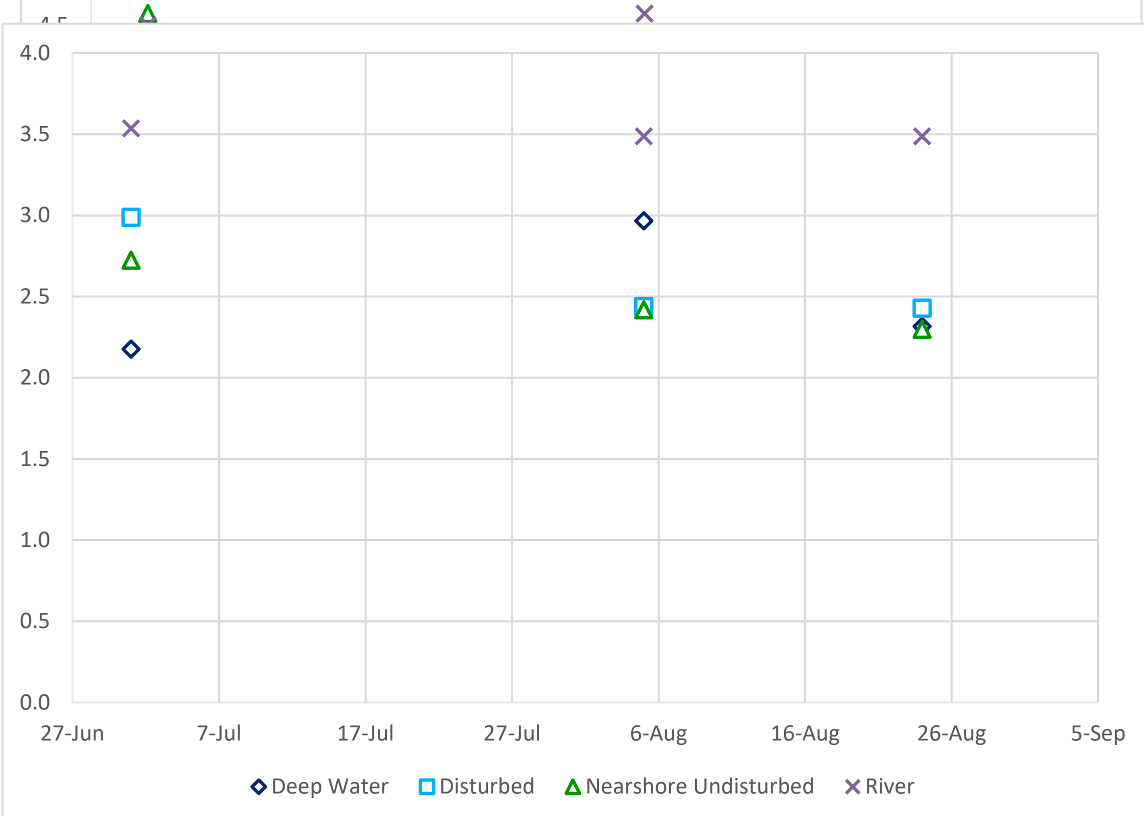


Figure 8. Average total phosphorus concentrations in Lake of Bays 2024 by Site Type.

Note: Data points for each date represent mean values of all sites of one type.

4. Long-term Phosphorus Patterns

The Lake of Bays Water Quality Monitoring Program has collected data over the summer season for 21 years at 12-23 locations throughout the lake. The yearly number of samples collected including QA/QC samples ranged from 50 in 2002 to 123 in 2012, with a total of 2,001 samples collected by the end of the 2024 program (Table 6). The large number of sites monitored, and samples collected under the program since 2002 provide for a robust data set for assessing long-term trends and inter-annual variability in total phosphorus concentration in Lake of Bays. The complete LOBA monitoring program data set since 2002 is provided in Appendix B.

Mean summer total phosphorus concentrations were significantly lower in 2024 compared to 2023 in the Disturbed (mean TP = 2.6 μg/L vs 6.5 μg/L), Nearshore Undisturbed sites (mean TP = 2.5 μg/L vs 6.1 μg/L) and Deep Water sites (mean TP = 2.5 μg/L vs 6.2 μg/L) (Table 7, Figure 8). As in the past, River sites were more variable with generally higher concentrations than lake stations with a range of 2.5 to 4.6 μg/L, and mean TP (3.5 μg/L). Elevated TP at the River stations is not uncommon in the dataset and therefore we recommend LOBA consider the addition of total suspended solids sampling at river stations to the program to determine if river total phosphorus is associated with high sediment loads and runoff in the river or if it is the result of sample contamination. The addition of suspended solids sampling to the 2025 program will be discussed with the program administrator and Environment Committee.

A statistically significant increasing trend in mean summer total phosphorus concentration of the Deep Water sites was last identified in 2017. Considering all data collected since 2002, there are no significant trends in total phosphorus concentrations in the Deep Water sites of Lake of Bays between 2002 and 2024 (Figure 9; Mann Kendall Trend Test: $p>0.05$, Sen's Slope = 0).

Assessment of total phosphorus concentrations at each individual monitoring station did not identify any significant increasing trends. Significant increasing trends in TP at Trading Bay were identified in 2019, however, with the addition of the 2021-2024 data, there was no longer a statistically significant increase in TP over time in Trading Bay.

Table 6. Number of Total Phosphorus Samples Collected by the Lake of Bays Monitoring Program (2002-2024)

Year	Deep Water	Disturbed	Nearshore Undisturbed	River	Total # of Samples
2002	30	15	5		50
2003	39	22	7	16	84
2004	28	13	5	7	53
2005	29	8	14	8	59
2006	53		21		74
2007	54	10	36	10	110
2008	48	13	32	15	108
2009	47	15	21	10	93
2010	46	15	29	16	106
2011	44	28	28	13	113
2012	51	26	31	15	123
2013	57	19	25	15	116
2014	53	16	32	18	119
2015	52	19	32	19	122
2016	52	19	30	16	117
2017	54	16	29	19	118
2018	29	10	15	8	62
2019	33	13	19	10	75
2021	27	14	16	9	66
2022	33	13	16	12	74
2023	34	11	18	15	78
2024	33	12	20	16	81
Total # of Samples	926	327	481	267	2001

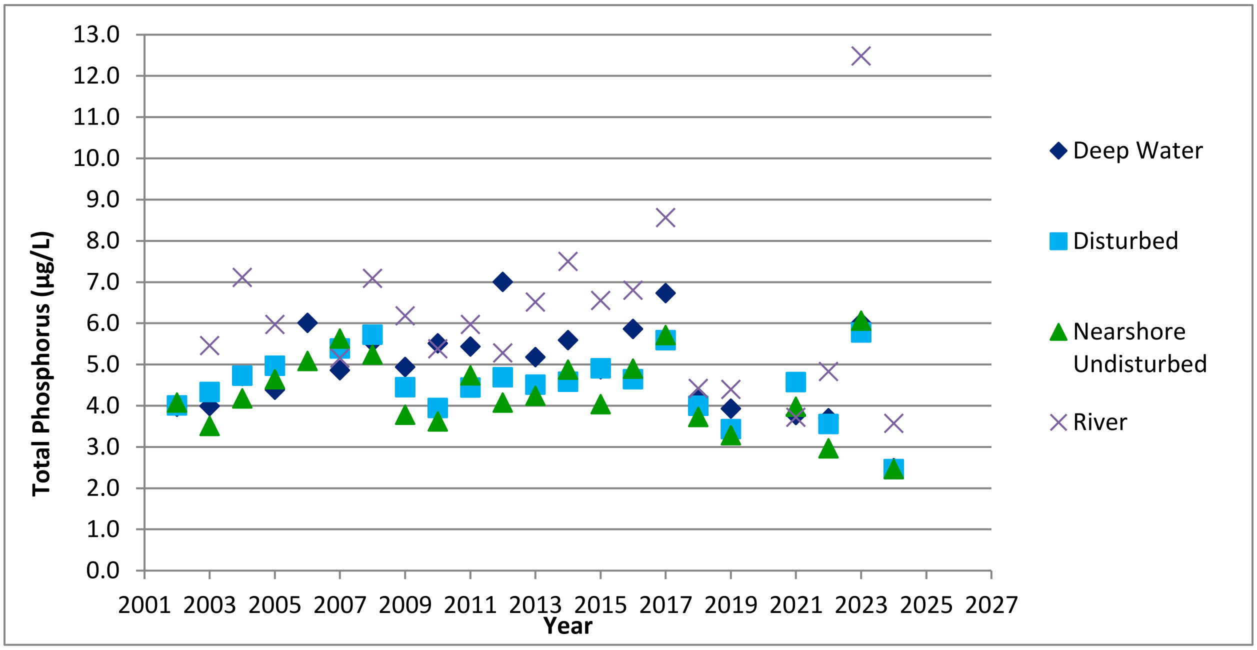
Table 7. Mean Summer Total Phosphorus Concentrations in Lake of Bays (2002-2024)

Site	Total Phosphorus (µg/L)																						
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2021	2022	2023	2024	AVG.
Deep Water	**4.0**	**4.0**	**4.7**	**4.4**	**6.0**	**4.9**	**5.6**	**4.9**	**5.5**	**5.4**	**5.7**	**5.2**	**5.6**	**4.9**	**5.9**	**6.7**	**4.2**	**3.9**	**3.8**	**4.2**	**6.0**	**2.5**	**5.1**
Bigwin East	4.2	4.2	4.2	4.0	5.5	4.5	6.4	4.1	5.7	4.9	5.0	4.9	6.2	4.5	4.4	6.6	4.1	3.1	3.2	2.8	5.7	2.0	4.7
Dwight Bay	4.6	3.6	6.1	4.7	6.4	5.9	6.1	4.9	6.2	5.3	6.5	5.3	6.1	5.0	8.9	8.3	3.7	3.4	3.0	10.1	5.6	2.0	5.5
Fairview	2.8	3.6	4.0	4.7	5.3	3.9	6.1	4.6	5.2	4.9	4.7	4.5	4.8	4.4	4.1	5.7	3.6	3.3	4.7	2.0	13.3	2.7	4.5
Gull Rock	4.0	4.2	5.1	4.4	5.6	4.7	5.0	4.4	5.5	5.8	5.1	3.9	5.0	4.1	5.2	5.7	3.9	3.7	4.3	2.9	4.2	2.0	4.7
Haystack Bay	4.2	4.4	4.6		6.8	5.5	5.3	6.4	5.9	6.2	4.7	7.3	6.2	4.1	5.7	8.2	3.5	4.4	4.4	3.6	7.2	2.3	5.4
Portage Bay											9.6	5.7	6.3	4.7	5.3	8.1	7.3	3.9	3.0	3.4	4.0	2.4	6.0
Price Point				3.4	6.0	4.5	4.7	5.7	5.2	5.5	4.5	5.8	4.5	4.0	5.7	5.3	3.9	4.2	4.7	2.6	2.0	4.1	5.5
Ten Mile Bay					6.9	5.0	5.5	4.8	5.2	5.1	6.8	5.7	7.3	5.1	7.3	6.4	3.8	3.5	3.3	4.6	8.3	2.1	5.4
Trading Bay	4.1	4.0	4.9	5.1	6.0	4.7	5.4	4.9	5.2	5.8	5.1	2.5	4.2	7.6	6.9	6.3	4.9	6.7	3.4	3.9	7.5	2.8	5.1
Disturbed	**4.0**	**4.3**	**4.7**	**5.0**		**5.4**	**5.7**	**4.5**	**3.9**	**4.4**	**4.7**	**4.5**	**4.6**	**4.9**	**4.6**	**5.6**	**4.0**	**3.4**	**4.6**	**3.6**	**6.5**	**2.6**	**4.6**
Bigwin Bay	3.6	4.7	4.9				5.5	4.2	3.6	4.5	4.5	4.5	4.3	4.8	4.3	5.4	3.4	3.9	3.7	3.6	5.0	2.1	4.4
Bigwin North	5.0	3.9	5.3	5.2		6.3	6.1	5.6	4.5	4.6	4.8	4.8	4.6	5.1	5.1	6.0	3.7	3.4	5.3	2.5	7.0	2.0	5.0
Britannia	3.3	4.4	4.0	4.6		4.7	5.5	3.6	3.8	4.2	4.8	4.1	4.8	4.9	4.5	5.5	4.7	3.1	4.7	4.5	5.0	3.2	4.4
Dwight Beach										6.3	4.5	6.8							4.3	8.8	8.9	3.7	5.5
Portage Bay docks																		3.3	3.1	3.2	5.4	2.1	3.2
Nearshore Undisturbed	**4.1**	**3.5**	**4.2**	**4.6**	**5.1**	**4.3**	**5.2**	**3.8**	**3.6**	**4.6**	**4.1**	**4.2**	**4.9**	**3.8**	**4.9**	**5.6**	**3.7**	**3.3**	**4.0**	**3.0**	**6.1**	**2.5**	**4.3**
Langmaid Island				4.8	4.7	3.3	4.5	2.9	2.8	4.2	3.9	4.0	4.2	3.5	4.3	4.8	3.7	3.0	4.5	2.3	4.4	2.0	4.0

Site	Total Phosphorus (µg/L)																					
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2021**	**2022**	**2023**	**2024**	**AVG.**
Boothby's				8.3	5.8	5.2	5.4	4.3	4.6	4.8	3.9	4.3	5.0	3.7	5.3	6.0	4.0	3.3	4.1	2.6	6.2	2.2	4.9
Menominee Bay				3.1	5.0	3.9	6.0	3.1	2.9	4.9	3.7	4.3	4.8	3.7	5.7	5.7	3.7	3.5	3.8	2.6	7.9	2.6	4.2
Hemlock Ridge Road	4.1	3.5	4.2	3.9	4.9	3.8	5.2	4.8	3.6	4.6	4.5	4.2	5.5	4.1	3.8	5.5	3.6	3.1	3.6	4.0	5.4	2.5	4.2
Narrows West						5.1	4.7		4.3	4.0	4.5	4.5	4.9	4.4	5.4	6.0	3.6	3.5	4.0	3.6		2.8	4.7
River		**5.5**	**7.1**	**5.3**		**5.2**	**6.7**	**6.2**	**5.4**	**6.0**	**5.3**	**6.5**	**7.5**	**6.6**	**6.8**	**9.1**	**4.4**	**4.4**	**3.7**	**4.3**	**12.2**	**3.5**	**6.0**
Hollow River Lagoon		7.2				5.3	6.3												3.9	2.5	11.8	3.3	5.7
Hollow River mouth		5.5	6.6	4.4		5.2	5.7		4.5	5.3	5.1	4.1	5.5	7.3	7.3	9.4	4.7	4.4	3.9		8.7	2.8	5.5
Oxtongue Delta							6.9	4.8	4.0	4.9	4.4	6.3	8.5	6.0	6.2	8.9	3.0	3.5	3.0		10.0	3.6	5.4
Oxtongue mouth			7.4	5.9			7.3	7.6	8.3	7.8	6.4	8.1	8.7	6.6	7.2	8.9	6.3	5.7	4.3		15.8	4.3	7.1

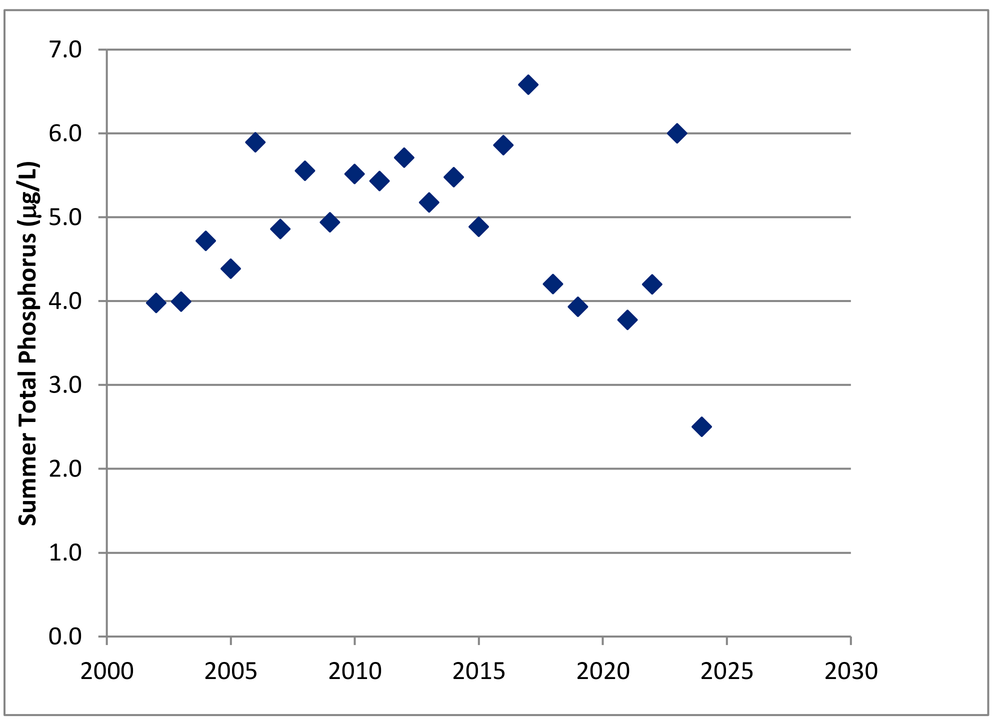
Note: Includes only those sites with at least two years of data collected within the last five years

Figure 9. Long-term (2002-2024) Mean Summer Euphotic Zone Total Phosphorus (TP) by Site Type.



Note: Only includes sites with at least five years of data.

Figure 10. Long-term Mean Summer Total Phosphorus in Deep Water areas of Lake of Bays.



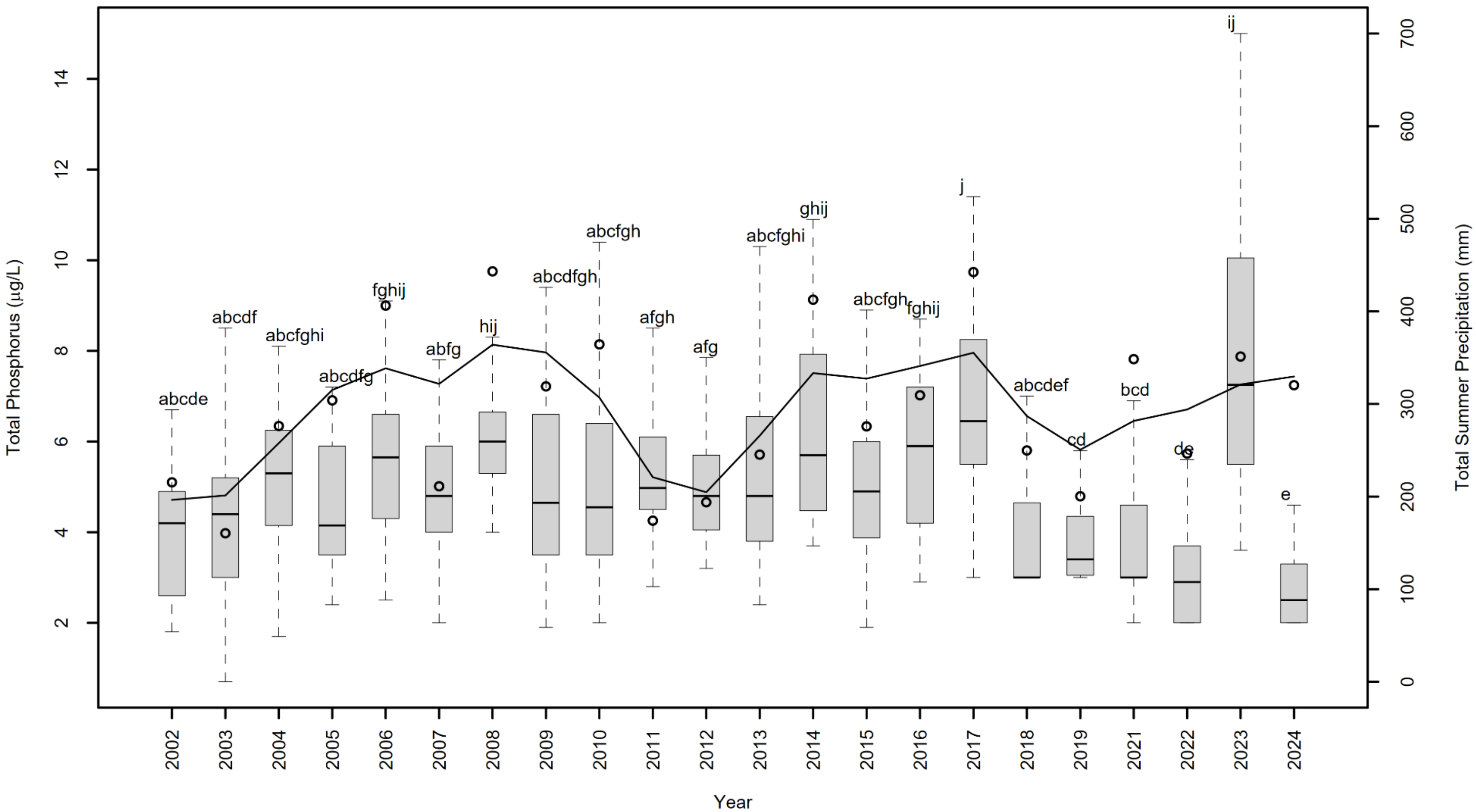
Note: LOBA sites exclude Little Trading Bay (2005-2008) and Portage Bay (Special Study).

Long-term monitoring has shown that increasing trends in total phosphorus have occurred in some Muskoka lakes monitored by the Dorset Environmental Science Centre (DESC), while other lakes exhibited decreasing or no trends (Andrew Paterson, MOECC lake scientist, pers. comm.). These lakes had little to no development in their watersheds and so regional (e.g., climate change, long range atmospheric deposition) and local factors other than development may be influencing lakes in the Muskoka area, including Lake of Bays. The District of Muskoka (DMM) has monitored spring total phosphorus at deep water sites in Lake of Bays since 2001 and has observed no increase which substantiates the findings presented herein.

Changes in annual precipitation patterns (amount of precipitation, frequency and duration of storm events) can strongly influence phosphorus loads from atmospheric deposition and also the mobilization and transport of phosphorus from the watershed. Long-term data collected in Lake of Bays, coupled with climate data from Beatrice Climate Station, suggests that inter-annual variability in precipitation may exert a significant influence on the total phosphorus concentration in the lake (Figure 11). In general, total phosphorus concentrations tended to decrease in drier years over the period of record. Total phosphorus concentrations in 2024 decreased slightly at nearshore stations, likely as a result of lower precipitation. Total phosphorus concentration across all sites excluding River stations were statistically similar to those with the lowest record phosphorus concentration since the programs inception (i.e., 2002, 2018, and 2022) and significantly lower than concentrations recorded during high precipitation years (i.e., 2008, 2014, 2016, and 2017; Figure 11, similarity indicated by the letters “a” “b”, “c”).

In summary, summer total phosphorus concentration in Lake of Bays exhibits inter-annual variability, which based on long-term TP and precipitation data appears to be driven by natural processes related to precipitation. The Lake of Bays Association water quality monitoring program experienced QA/QC issues in 2023 which resulted in a marked increase in the frequency of bad splits and outliers in the data set, these issues appear to have been resolved in 2024.

Figure 11. Annual Summary of Summer Total Phosphorus Concentrations at All Nearshore Disturbed, Undisturbed and Deep Water Sites and Precipitation (Beatrice Climate Station; 6110607) in Lake of Bays



Open Circles = Sum of Total Summer Precipitation; Line = Spline Smoothed Precipitation; Boxplots = Total Phosphorus Concentrations. Letters indicate years which are statistically similar

5. Summary

The total phosphorus and bacteria data collected by the LOBA in 2024 indicated increased nutrients, however data have been tainted by QA/QC issues. The main results of data analyses from 2024 are as follows:

1. The quantity of QA/QC sampling in 2024 was excellent. Ongoing QA/QC sampling for total phosphorus and bacteria in 2025 is recommended.
2. Data collected in 2023 were assessed against 2024 data and will need to be revisited in 2025 and beyond to determine if it should be removed entirely from future analyses and reporting. We recommend retaining the data for now.
3. Deep Water sites did not exhibit a significant increasing trend in total phosphorus concentration.
4. Significant long-term trends in total phosphorus previously detected in the lake at Trading Bay, no longer exhibited a positive trend with the addition of 2021-2024 data. As a result, no significant trends in phosphorus concentration were noted in the individual site data on Lake of Bays.
5. Bacteria levels collected by the Coliplate technique were below the PWQO for recreational use at all sites.
6. Total phosphorus concentrations (excluding River sites; mean TP = 2.7 μg/L) continue to be characteristic of lakes with low primary productivity and meet the highest Provincial standards for protection of nuisance aquatic plant growth due to phosphorus of <10 μg/L at all sites.
7. Mean summer total phosphorus concentration in Portage Bay has been consistently low since 2013, representing a decline from elevated concentrations observed in 2012 that coincided with construction activities. This remains true in 2024.
8. As in previous monitoring, no significant difference in phosphorus concentration between the Deep Water, Disturbed and Nearshore Undisturbed sites were found, suggesting that shoreline disturbance is having little impact on summer phosphorus concentrations.
9. Our analysis continues to demonstrate a correlation between changes in total phosphorus concentrations in the lake and regional precipitation with no evidence of increased nutrient concentrations due to development pressure.
10. We recommend LOBA consider the addition of total suspended solids sampling at River stations to help us better understand the influence of suspended solids on total phosphorus concentrations.

6. References

Clark, B.J., A.M. Paterson, A. Jeziorski and S. Kelsey. 2010.
Assessing variability in total phosphorus measurements in Ontario lakes. Lake and Reservoir Management 26: 63-72.

Gartner Lee Limited (GLL), 2005:
Recreational Water Quality Management in Muskoka. Prepared for District Municipality of Muskoka.

Hutchinson Environmental Sciences Limited (HESL), 2016a:
Lake of Bays Water Quality Report 2016. Prepared for the Lake of Bays Association, November, 2011.

Hutchinson Environmental Sciences Limited (HESL), 2016b:
Revised Water Quality Model and Lake System Health Program – Final Report. Prepared for District Municipality of Muskoka. April, 2016. 217 pp.

Hyatt, C.V., A.M. Paterson and E. Stainsby, 2012:
Lakeshore Capacity Model Users' Manual. Version 4.2. Prepared for the Province of Ontario, Fall 2012.

Millard, S.P. 2013.
EnvStats: Package for Environmental Statistics, Including US EPA Guidance.

Ontario Ministry of Environment and Energy (MOEE), 1994:
Water Management Policies Guidelines. Provincial Water Quality Objectives of the Ministry of Environment and Energy. July 1994.

Pohlert, T. 2017.
Trend: Non-Parametric Trend Tests and Change-Point Detection

Province of Ontario, 2010:
Lakeshore Capacity Assessment Handbook – Protecting Water Quality in Inland Lakes on Ontario's Precambrian Shield. Queen's Printer for Ontario. May 2010.

R Core Team, 2013:
R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Rosner, B. 1983.
Percentage Points for a Generalized ESD Many-Outlier Procedure. *Technometrics* **25**, 165–172.

Appendix A. Monitoring Protocols for the LOBA Water Quality Monitoring Program

Lake of Bays Association
Water Quality Testing Program Manual

Program Overview

The Lake of Bays Association (LOBA) has championed a volunteer-based water quality monitoring program in Lake of Bays since the 1970s. The aim of the program is to characterize phosphorus and bacteria level as an indication of general lake and watershed health and to compare different sites across the lake, while fostering community involvement and education. The program falls under the Environment Committee and is coordinated by a Program Manager who reports to the Chair of the Environment Committee.

LOBA has been monitoring spring turnover phosphorus levels as part of the Ministry of Environment, Conservation and Park's Lake Partner Program but the independent monitoring program began in 1970 to monitor bacteria levels in the lake during the ice-free season. In 1972, LOBA became a MoE Self-Help Program participant collecting Secchi depth measurements and water samples for Chlorophyll *a* analysis. In 1978 the program transitioned to analyzing Total Phosphorus. This project was successful, deemed valuable and LOBA expanded the area of study in the summer of 2001 to include near-shore sites adjacent to developed and undeveloped properties, and areas influenced by wetlands and rivers. In 2002, the program was again expanded to include monitoring of total phosphorus concentrations in near-shore areas and in the Hollow and Oxtongue rivers and river deltas (deep water sites were already being monitored). Site selection has changed as our understanding of water quality conditions in Lake of Bays has increased and, since 2009, sampling has focused on deep water sites, nearshore disturbed and undisturbed locations, and in-flowing rivers. In 2020, the Covid-19 pandemic suspended the data collection program, however the program was able to return to operation in 2021.

The LOBA monitoring program continues to focus on total phosphorus concentrations. For recreational lakes on the Precambrian Shield like Lake of Bays, water quality concerns are most often associated with nutrient enrichment due to increased human phosphorus sources. Phosphorus is a natural element in the environment and enters lakes from the atmosphere through precipitation, from streams and overland flow, and to a lesser degree through groundwater. Human sources to recreational lakes include storm water runoff and erosion from altered land uses, fertilizers on manicured lawns and faulty septic systems. Increases in phosphorus loads to lakes from human sources can result in increased growth of aquatic plants and algae, which in turn can lead to a deterioration of water clarity and cold-water fish habitat through a decrease in deep-water oxygen concentrations.

Previous monitoring reports have suggested that a reduction in bacteria sampling frequency was warranted; beginning in 2016, it was recommended that bacteria sampling be conducted only in the mid-summer each year at the nearshore sites. Every five years the collection of bacteria samples on all sampling dates was recommended. The reduced sampling frequency will continue to allow for the assessment of long-term trends while maintaining familiarity with bacteria sampling techniques.

As of 2024, water samples for bacteria and total phosphorus are collected at 23 sites in Lake of Bays including deep, open water locations (‘Deep Water’ sites, n=9), nearshore sites adjacent to developed areas (‘Disturbed’ sites, n=5), undeveloped shorelines (‘Nearshore Undisturbed’ sites, n=5), and both river (Oxtongue and Hollow rivers) and river-influenced (Oxtongue Delta) sites (‘River’ sites, n=4). See Appendix 1 for a list of all the sites and their GPS coordinates.

At each Deep Water site, a composite water sample is collected from the euphotic zone, at approximately two times the Secchi depth. At all other sites, the water sample is collected at a depth of ~30 cm (to the elbow of the sampling volunteer). Field duplicate samples are collected to assess the variability of results related to sampling and analytical procedures.

See Appendix 1 Sampling Procedures for precise details on how the samples are collected.

Program Manager Responsibilities

Procure Supplies

- In consultation with the LOBA Executive Coordinator (executivecoord@loba.ca) order sufficient phosphorus sampling kits for all sites for three testing dates, plus kits for one field duplicate at each site. With 23 sites, this is 23 sites x 3 testing dates + 23 field duplicate kits = 92 kits. We currently work with ALS Laboratories and the Account Manager is Costas Farassaglou (costas.farassoglou@alsglobal.com). Kits come in large coolers with ice packs.

From l to r: Cooler from ALS; Cooler Contents; Sampling Kit

- Inform the LOBA Executive Coordinator (executivecoord@loba.ca) as to how many coliplates are needed for coliform testing. Executive Coordinator orders these from Bluewater Biosciences (bluewaterbiosciences.com).

Coliplates

- Check quantity of 500ml mason jars for coliform testing and purchase more if needed.
- Check quantity of PET jugs, thermometers, binders and any other items needed for sampling kits and inform Executive Coordinator if items are needed.

Organize Sampling Kits for Volunteers

- Sampling kits include:
    - Binder with Sampling Procedure (Appendix 1), Map (Appendix 2), and Data Sheets (Appendix 3).
    - Thermometer
    - PET (plastic) container for collecting water for phosphorus testing. This container is reused and is not sterile.
    - Syringe, two 0.45-micron filters and brown water sample collection bottle for each collection site for phosphorus testing. The collection bottles are prelabelled for each collection site.

Syringe, filters and sample bottle for Phosphorus water sampling

    - If bacteria testing is being done, sterile mason jar for each collection site. See Prepping Coliform/E.coli Jars for Sampling section (page XX)

- Assign testing sites to available volunteers for each testing date.
- For phosphorus sampling kits, with a waterproof marker label each brown bottle for a specific site and date and tick the Total P box. Assign one field duplicate kit to each testing location and randomly assign one-third to each testing date. Field duplicates are labelled *Site Name FD*.
- For bacteria testing, provide each volunteer with a sterilized, labelled mason jar for each site. Provide one field duplicate mason jar for each volunteer for a random site.
- Once all kits are labelled, arrange them into groups that correspond to the sites that are going to be sampled by each volunteer.
- Add PET container, thermometer and binder to each sampling kit.
- LOBA has three deep-water testing devices. Determine with volunteers who will be deep-water testers and provide them with the testing equipment including Secchi disk.
- Arrange to drop off or have volunteers pick up all the required materials before the first testing date.

Prep E.coli/Coliform jars for sampling

Mason jars and lids need to be **sterilized** prior to them being used in the field to ensure no contamination occurs.

1. Bring a large pot of water to boil. Once boiling, use tongs to place the glass jars in the water, ensuring they are fully submerged and not floating. If they are floating, air is trapped in the jar and the hot water is unable to sterilize. Let jars sit in the boiling water for at least ten minutes.
   Safety note: Use oven mitts and tongs throughout this process. Water can easily splash onto skin and cause burns. Use tongs to put jars in and out of the pots and keep the tongs in the boiling water to ensure that they tongs are also sterilized.

Mason jars in boiling water

2. After at least 10 minutes, use the tongs to remove jars from the water onto clean kitchen towels and/or paper towel. Place them mouth down such that the opening is touching the clothes. Let the jars cool to a temperature so you can handle them comfortably. If there is some water left it is not a worry as the water is sterile and has not been in contact with the air.

Mason jars cooling/drying on clean kitchen towels and/or paper towel

3. Repeat steps 1 and 2 with the lids. They can be put in the pot at the same time as the jars.

Mason jar lids cooling/drying on clean kitchen towels and/or paper towel.

4. Once both jars and lids are cool, put the lids onto the jars. Don't put them on as tight as possible as this may cause a vacuum seal that will make it difficult to re-open the jar.

Special Notes:
It is critical that your hands do not touch the inside of the jar or the bottom side of the lids once they have been sterilized.
The jars cannot be opened until right before they are going to be used for sampling

Collection of Water Samples in the Field

- See procedures in Appendix 1 (page xx).

Collection of Water Samples After Testing

- Leave an ALS cooler on your dock to allow the testers to drop off their water samples.

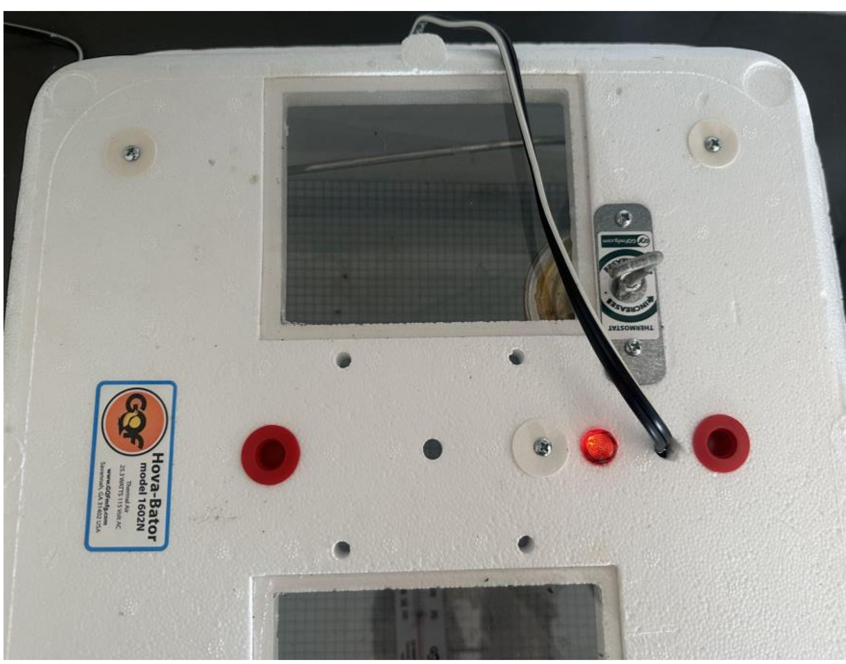
Return Samples for Phosphorus Testing to ALS

- Fill out chain of custody form given by ALS which includes the site names and the time the sample was collected. Field Duplicates are labelled FD. See Appendix 5 (page xx).
- Keep samples cool in a fridge until you are ready to ship them. Ensure two ice packs are in the freezer for each cooler.
- When ready to ship, put the samples into two coolers with two ALS ice packs in each. Put the completed Chain of Custody in a plastic bag in one of the coolers. Tape the cooler shut.
- Take the coolers to the closest Purolator and ship samples to:

  ALS Environmental
  60 Northland Road, Unit 1
  Waterloo ON
  N2V 2B8

Plating, Incubating and Reading Coliplates for Coliform/E. coli Levels
Set up incubator

- Plug in the incubator and let it warm up for an hour or so.
- After an hour, check on the thermometer inside the incubator. The goal is to have the incubator set at 36℃. To change the temperature, use the metal dial on top of the incubator to increase/decrease the temperature. This is done by either turning it clockwise or counterclockwise depending on if you want to increase or decrease the temperature. Loosen the nut on it to allow movement of the dial and tighten it once you've turned the dial the desired amount. It may take a couple tries of increasing and decreasing the temperature to get it right.



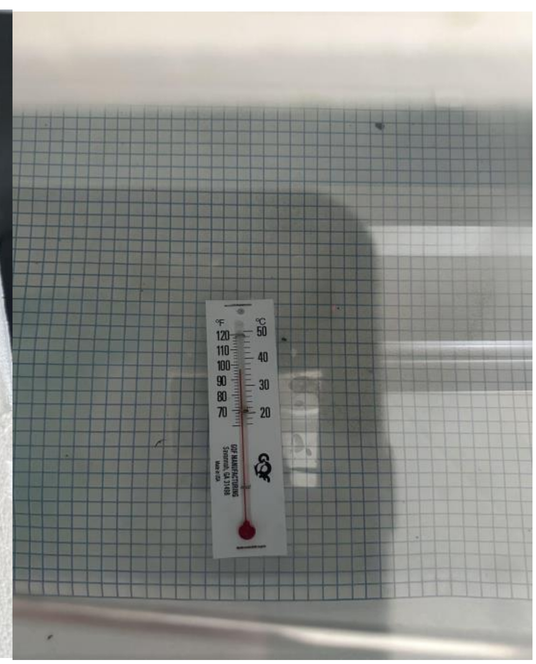
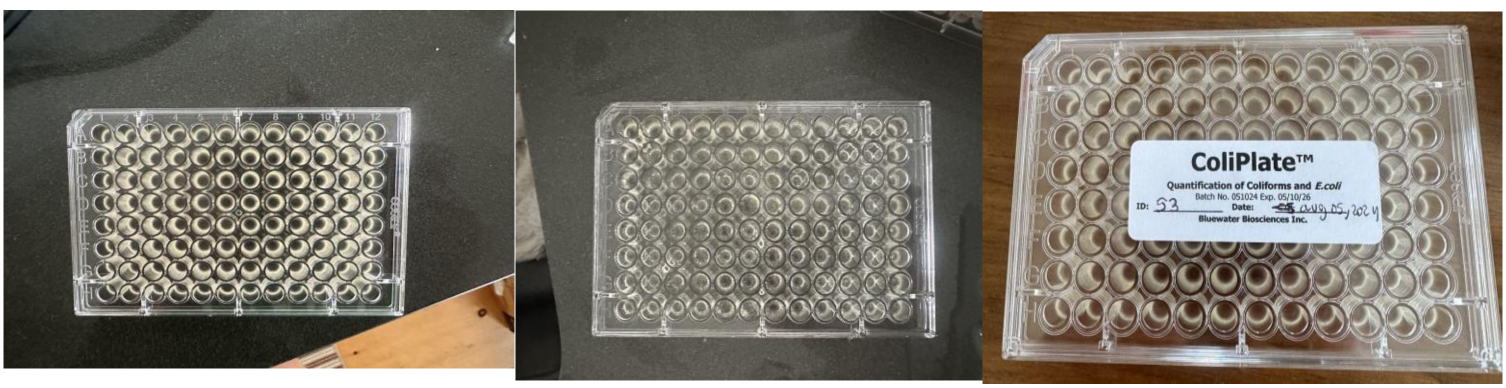


Plate samples

Once water samples have been collected, the ColiPlates must be filled for incubation.

- Remove the microplate lid. Using the sample bottle in which the water sample was collected, gently pour a small stream of water onto the plate, running the stream along each row of wells so that water enters each well. Using sample bottles with smaller necks makes the pouring easier. When all wells are full and excess sample water remains on the plate, gently tap the side of the microplate to dislodge any air bubbles which may remain in the bottom of some wells. To ensure that all wells are full, view the plate in a manner where light is reflected off the surface of the wells to your eye. Top up any wells which are not full.
- To remove excess water from the top of the plate, tilt the plate on a slight angle to one of the plate corners and drain off. Again, tap the plate while tilted to assist draining excess water off the top of the wells. Use a paper towel or tissue to wick away the last few drops of water at the low corner of the plate. Viewing the surface of the plate in reflected light should now reveal that all wells are full, that the surface water on each well has a slight concave shape, and that no excess water remains on the surface of the plate. If any wells remain unfilled, top up with a little more sample water and drain off excess.
- Once the plate is filled put the top back on and label the plate with site location and date.



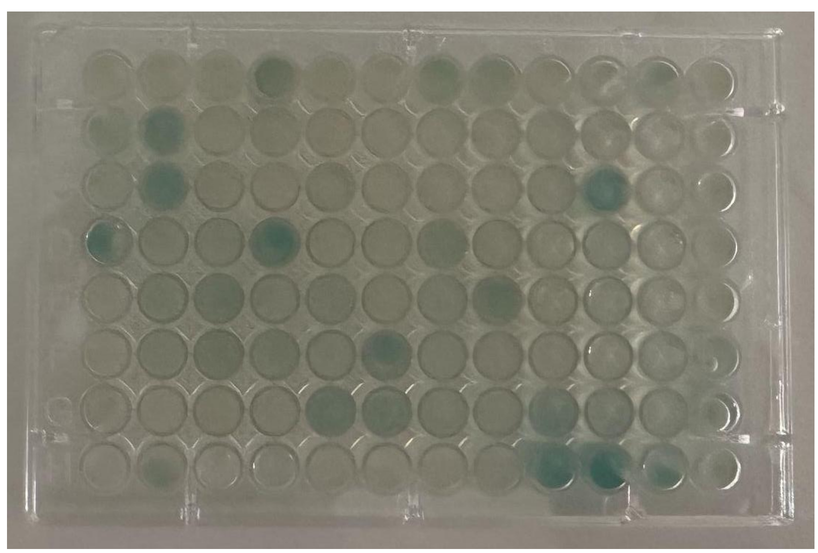
Left to right: empty coliplate, filled coliplate, coliplate with lid and label

Incubate Plates

- Once all plates have been filled and labelled, put them into the incubator set at 36 degrees. This will require you to stack them. Note on the picture the temperature is below 36 degrees. This will happen once you take the lid off of the incubator but will quickly go back to the desired temperature once the lid is put back on.
- Leave plates in incubator for 24 to 30 hours .

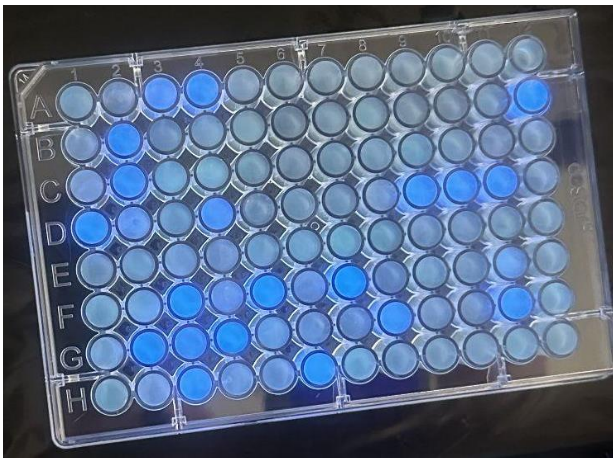
Counting ColiPlates for Coliform

- Place the incubated microplate on a white surface and count the number of wells which turned blue. This is the positive reaction for Total Coliforms. There will be different tones of blue depending on the strength of the bacterial colony in each well. Count ALL blue wells. Refer to the MPN Table (at Bluewater Biosciences website) to determine the Most Probable Number for Total Coliforms in 100 mL of sample water.



Counting ColiPlates for E.coli

- Place the incubated microplate on a black (dark) surface in reduced light and observe under long wavelength UV (366 nm) light. Count the number of wells that turned blue and were fluorescent under the UV light. This is the positive reaction for E. Coli. Do not count wells with fluorescence that are not also blue – they must be blue and fluorescent. Refer to the MPN Table (at Bluewater Biosciences website) to determine the Most Probable Number for E. Coli in 100 mL of sample water.



Bluewater Bioscience has a YouTube video that describes this technique in detail and is the best resource for understanding this process.
https://bluewaterbiosciences.com/coliplatea-direct-pour-method/

Data collation and submission

- Input the MPN per 100ml Sample for coliform and E.coli into the LOBA Master Data Sheet.
- When data are provided from ALS, enter the values for phosphorus into the LOBA Master Data Sheet.
- The excel file name is *LOBA_data-Sept2019 (2) .xlsx*.
- When all data for the summer has been entered into the spreadsheet, send a copy of the LOBA Master Data Sheet to Hutchinson Environmental Sciences (HES) for analysis and report generation. The current contact is Kristopher Hadley (Kris.Hadley@environmentalsciences.ca)

Results and Report Dissemination

- Once the report from HES is finalized, the Environment Committee chair will write a short synopsis for inclusion in a NewsFlash.
- The Executive Coordinator will post the report on the LOBA website and distribute it in a NewsFlash.
- The results will also be shared in the Environment report in the yearbook.

Appendix 1 - Water Quality Sampling Procedures

General

NOTE: Sampling is best done with two people in the boat

1. Check for equipment, including:
   - meter depth pole (if required)
   - thermometer
   - sterilized mason jars for coliform/E. coli sampling
   - sample kits for phosphorus sampling for each location, and field duplicates, which includes:
     a. plastic syringe,
     b. two yellow filters to attach to the end of the syringe,
     c. labelled brown bottle.
   - plastic jar for collecting phosphorus water samples (not sterile)
   - Secchi depth disc and jar (if required)
   - data sheets and pen
2. Verify that you have the appropriate boating safety equipment on board and that the weather is safe for sampling.
3. Record air temperature on data sheet as you leave the dock. Then attach the thermometer to a rope in preparation for taking water temperature at sampling sites.
4. At each site, complete the data sheet, recording any factors or conditions that may make the sampling trip unusual or that may have an influence on sample results (e.g. cloudy water, unusual activity in the area, presence of waterfowl)

Coliform and E. coli Water Sampling: All Locations

Near shore locations samples are collected 22–30 cm (to roughly your elbow) below the surface in water that is 1-metre in depth. Deep water location samples are also collected 22–30 cm below the surface of the water.
Coliform / E. Coli samples are collected and submitted in sterilized mason jars.

1. Carefully assemble the sterilized mason jar(s) required for the specific site (all should be named and number coded).
2. Remove the cap/lid from the jar without touching the inside of the lid or jar, and place carefully, upside down on a flat stable surface.
3. Grip the bottle at the base and plunge it into the water in a downward motion to a depth of 22–30 cm (to roughly your elbow). The bottle goes in upside down, that is with the open end to the lake bottom.
4. Adjust the bottle position in your hand so that the bottle is now parallel to lake surface and lake bottom, facing forward and collect sample by sweeping the bottle forward (forward, not up). This directional motion is important so that the water being collected in the jar does not pass over your hand. Collect the entire sample from that 22-30 cm depth and then bring bottle to surface.

5. Empty it slightly (if it is full to the brim) and then recap bottle.
6. Store safely in the boat in a cooler or other container.
7. If a Field Duplicate sample jar is supplied for the location, repeat steps 1 through 6 with the second sterilized jar.

Phosphorus Sampling: Near Shore Locations

Near shore locations samples are collected 22–30 cm (to roughly your elbow) below the surface in water that is 1-metre in depth.

For each testing site, you will have a sampling kit consisting of:

- plastic syringe,
- two yellow filters to attach to the end of the syringe,
- labelled brown bottle.

Phosphorus Sampling Kit

You will also have a plastic jar which is reused to collect samples at each site. This jar is not sterilized.

Once a summer you will be asked to do a Field Duplicate sample at each location for quality assurance. The second Field Duplicate sample is collected in exactly the same manner as the first.

1. Make sure you have the correct brown sample bottle for your current location. All the brown sample bottles should be labelled and number coded. Lay out the syringe and filters for the location.
2. While the plastic sample collection jar is not sterilized, avoid touching the inside and top edges of the jar. When not in use, place it upside down on a flat, level surface.
3. Rinse the plastic jar in surface water at the site.

4. Grip the jar at the base and plunge it into the water in a downward motion to a depth of 22–30 cm (to roughly your elbow). The jar goes in upside down, that is with the open end to the lake bottom.
5. Adjust the jar position in your hand so that the jar is now parallel to lake surface and lake bottom, facing forward and **collect sample by sweeping the jar forward** (forward, not up). This directional motion is important so that the water being collected in the jar does not pass over your hand. Collect the entire sample from that 22-30 cm depth and then bring jar to surface.
6. Extract water from the plastic jar into the syringe without a filter attached. Plunge out the water to rinse out the syringe.
7. With the rinsed-out syringe, extract water from the plastic jar. Attach the yellow (zooplankton) filter onto the tip of the syringe (yellow side should be facing up).
8. With the syringe filled with water and an attached zooplankton filter, plunge the water out of the syringe through the zooplankton filter into the brown sample bottle. One syringe of filtered water is enough for the sample so long as the brown bottle is over half full. If it is not over half full, repeat with another syringe of water filtered through the yellow filter. **NOTE:** It takes a fair bit of hand strength to push the water through the zooplankton filter.
9. Tightly cap the brown sample bottle and set aside the syringe and filter. Each syringe and filter is to only be used once for each site.

Phosphorus Sampling: Deep Water Locations

Deep water locations samples are collected 10 – 15 metres (meters, not centimeters) below the surface in deep water.

For each testing site, you will have a sampling kit exactly as described in the Near Shore Locations instructions (page 7).

Once a summer you will be asked to do a Field Duplicate sample at each location for quality assurance. The second Field Duplicate sample is collected in exactly the same manner as the first.

While the process of filtering the sample is the same as that for near shore phosphorus, the sample is collected from further down in the water column. The process is as follows:

1. Attach the rope to the Secchi disc and measure the Secchi depth by lowering the disc over the shady side of the boat until it disappears from view. Do not wear sunglasses. It may take a bit of playing with it to verify when it actually disappears. Haul it up until you see it again and then slowly lower it. As you pull the disc back to the surface, count the number of meters (the rope is calibrated in 0.5-metre intervals.) Record this number. Redo to double check.
2. Record the colour of the water (orangey brown, bluey-green, etc.)
3. Attach the calibrated rope to the container for the deep water collection jar.
4. Rinse the collection jar in surface site water.

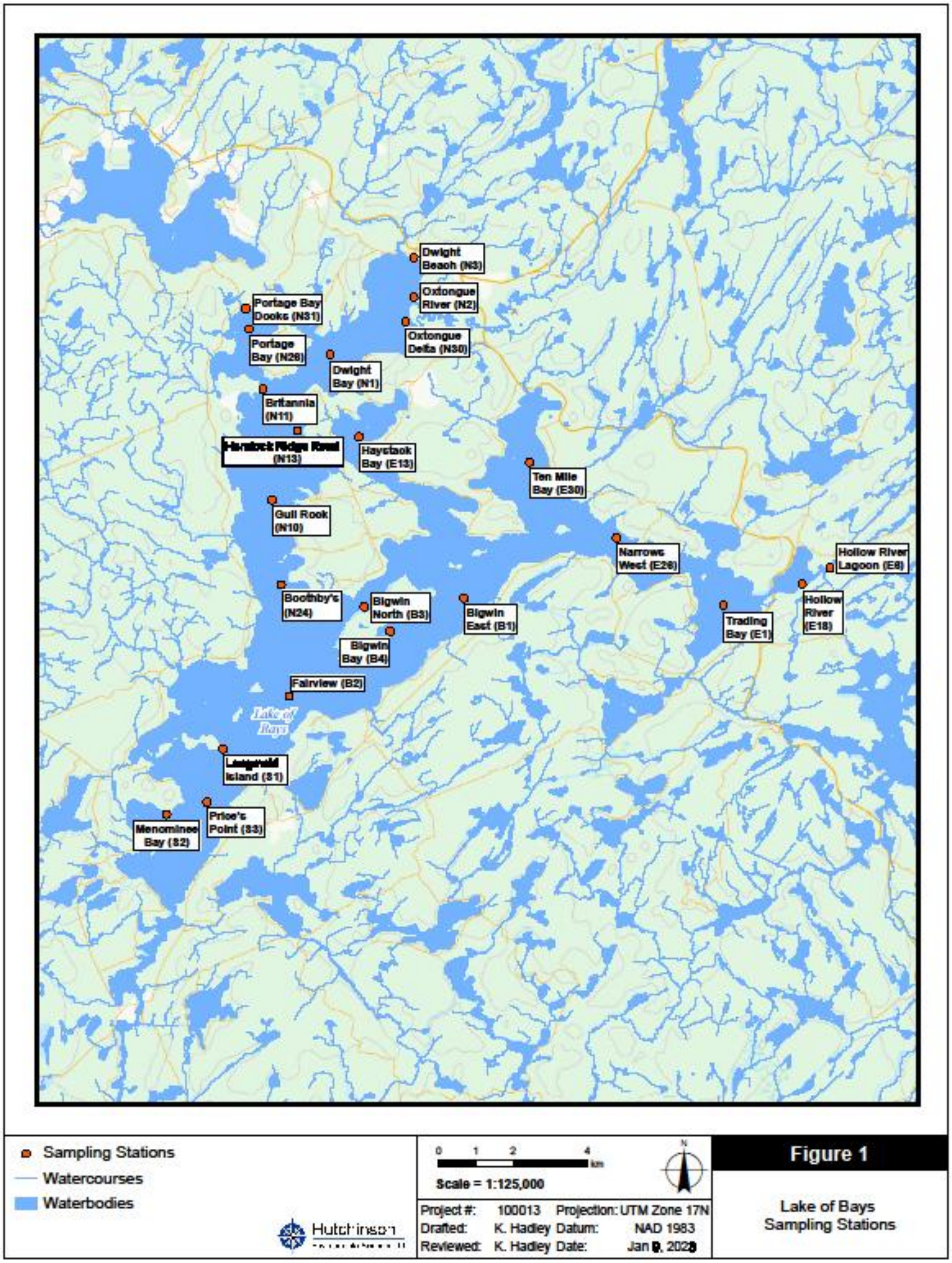
5. Lower the deep-water testing device to a distance that is **two-times (2 X)** the Secchi depth you observed and recorded above (the sample is being collected at a level to which light penetrates and given the refraction of light, that distance is two-times the depth at which you could last see the disc.) The device should be lowered in a quick, smooth, but controlled motion (Don't let it free fall.)
6. Collect the water at the given depth and pull the device back to the surface at a steady pace.
7. Use this water to rinse and fill the plastic jar.
8. Swirl the water in the plastic jar. Extract water from the plastic jar into the syringe without a filter attached. Plunge out the water to rinse out the syringe.
9. With the rinsed-out syringe, extract water from the plastic jar. Attach the yellow (zooplankton) filter onto the tip of the syringe (yellow side should be facing up).
10. With the syringe filled with water and an attached zooplankton filter, plunge the water out of the syringe through the zooplankton filter into the brown sample bottle. One syringe of filtered water is enough for the sample so long as the brown bottle is over half full. If it is not over half full, repeat with another syringe of water filtered through the yellow filter. NOTE: It takes a fair bit of hand strength to push the water through the zooplankton filter.
11. Tightly cap the brown sample bottle and set aside the syringe and filter. Each syringe and filter is to only be used once for each site.

Appendix 2 - Sampling Locations and GPS Coordinates

Location Name and Number	GPS Coordinates	Type of Location
Langmaid’s Island (S1) previously called Adamson’s Island	45°12’39” N 79°04’54”W	Near Shore Undisturbed
Menominee Bay (S2)	45°11’46” N 79°06’01” W	Near Shore Undisturbed
Price's Point (S3)	45°11’54” N 79°05’14” W	Deep Water
Bigwin East (B1)	45°14’48” N 78°59’53” W	Deep Water
Fairview (B2)	45°13’24” N 79°03’34” W	Deep Water
Bigwin North (B3)	45°14’42” N 79°01’57”W	Near Shore Disturbed
Bigwin Bay (B4)	45°14’22” N 79°01’33”W	Near Shore Disturbed
Dwight Bay (N1)	45°18’19” N 79°02’31”W	Deep Water
Oxtongue River (N2)	45°19’08” N 79°00’37”W	River
Dwight Beach (N3)	45°19’43” N 79°00’42”W	Near Shore Disturbed
Gull Rock (N10)	45°16’30” N 79°03’52”W	Deep Water
Britannia (N11)	45°17’51” N 79°03’57”W	Near Shore Disturbed
Hemlock Ridge Road (N13) previously called Moffat's	45°17’15” N 79°03’07”W	Near Shore Undisturbed
Boothby's (N24)	45°15’03” N 79°03’29”W	Near Shore Undisturbed
Portage Bay (N26)	45°18’43” N 79°04’09”W	Deep Water
Oxtongue Delta (N30)	45°18’33” N 79°00’45”W	River
Portage Bay Docks (N31)	45°19’04” N 79°04’16”W	Near Shore Disturbed
Trading Bay (E1)	45°14’38” N 78°54’35”W	Deep Water
Hollow River Lagoon (E6)	45°15’01” N 78°52’28”W	River
Haystack Bay (E13)	45°17’08” N 79°01’55”W	Deep Water

Hollow River (E18)	45°14’51” N 78°52’53”W	River
Narrows West (E26)	45°15’40” N 78°56’36”W	Near Shore Undisturbed
Ten Mile Bay (E30)	45°16’52” N 78°58’28”W	Deep Water

Appendix 3 - Map of Sampling Locations



Appendix 4 - Data Sheet

Lake of Bays Association

Water Quality monitoring sheet

Name: **Secchi depth (visibility):**

Site name and #: **Secchi depth (collection):**

Sampling Date: **Disk colour**

Sampling Time:

Temperature
Water:

Air:

Precipitation in last 24 hours: Heavy:______ Moderate:_____ Light:_______

Weather conditions:____

____

Wind strength: Strong_____ Moderate_____ Light______

Wave action: White caps_______ Big rollers___________ Small waves:________

calm_______ Other_________

Surface Conditions: Oil/gas_____ Leaves/pollen_____ white foam _____ Other___________

Wildlife: Ducks/waterfowl______ Beaver activity________ Other______________

Appendix 5 - Chain of Custody Sheet Sample

Chain of Custody (COC) / Analytical Request Form

ALS www.alsglobal.com

Canada Toll Free: 1 800 668 9878

COC Number: 22 -

Page 1 of 3

Report To	Contact and company name below will appear on the final report
Company:	Lake of Bays Association - LOBA100
Contact:	Lili-Davis Burchat
Phone:	647-834-0186
	Company address below will appear on the final report
Street:	P.O. Box 8
City/Province:	Baysville, ON
Postal Code:	P0B 1A0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	
Contact:	

Reports / Recipients	
Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	
Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A	
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Email 1 or Fax	executivecoord@loba.ca
Email 2	kieranmolony1@gmail.com
Email 3	
Invoice Recipients	
Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Email 1 or Fax	executivecoord@loba.ca
Email 2	

Turnaround Time (TAT) Requested

- ☑ Routine [R] if received by 3pm M-F - no surcharges apply
- ☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
- ☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
- ☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
- ☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
- ☐ Same day [E2] if received by 10am M-S - 200% rush surcharge.

AFFIX ALS BARCODE LABEL HERE (ALS use only)

Additional fees may apply to rush requests on weekends, statutory holidays and for non-routine tests.

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm am/pm

For all tests with rush TATs requested, please contact your AM to confirm availability.

Project Information	
ALS Account # / Quote #:	LOBA100/WT2022LOBA1000001
Job #:	
PO / AFE:	
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (ALS use only) | ALS Contact: Costas Farassoglou | Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Total P	SYRINGE FILTER KIT	SHIPPING-WT	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	Langmaid's/Adamson's Island (S1)	5-Aug-24		WATER	1	R	R	R			
	Menominee Bay (S2)	5-Aug-24		WATER	1	R	R				
	Price's Point (S3)	5-Aug-24		WATER	1	R	R				
	Bigwin East (B1)	5-Aug-24		WATER	1	R	R				
	Fairview (B2)	5-Aug-24		WATER	1	R	R				
	Bigwin North (B3)	5-Aug-24		WATER	1	R	R				
	Bigwin Bay (B4)	5-Aug-24		WATER	1	R	R				
	Dwight Bay (N1)	5-Aug-24		WATER	1	R	R				
	Oxtongue River (N2)	5-Aug-24		WATER	1	R	R				
	Dwight Beach (N3)	5-Aug-24		WATER	1	R	R				
	Gull Rock (N10)	5-Aug-24		WATER	1	R	R				
	Britannia (N11)	5-Aug-24		WATER	1	R	R				

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Appendix B. LOBA Total Phosphorus and Bacteria Data

Site Code	Site Name	Site Type	Year	Date	TP BDL	Total Phosphorus (ug/L)	*E. coli* (cfu/100 mL)	Total Coliform (cfu/100 mL)	Bad Splits	Outliers 2023
S1	Adamson's Island	Nearshore Undisturbed	2023	3-Jul-23		4.8				
S1	Adamson's Island	Nearshore Undisturbed	2023	7-Aug-23		28.2	2	6		x
S1	Adamson's Island	Nearshore Undisturbed	2023	27-Aug-23		4.0				
B4	Bigwin Bay	Disturbed	2023	3-Jul-23		6.7				
B4	Bigwin Bay	Disturbed	2023	7-Aug-23		3.3	1	27		
B4	Bigwin Bay	Disturbed	2023	27-Aug-23		10.3				x
B1 F/D	Bigwin East	Deep Water	2023	3-Jul-23		5.8				
B1	Bigwin East	Deep Water	2023	3-Jul-23		4.5				
B1	Bigwin East	Deep Water	2023	7-Aug-23		10.7	2	13		x
B1	Bigwin East	Deep Water	2023	27-Aug-23		6.3				
B3	Bigwin North	Disturbed	2023	3-Jul-23		64.9				x
B3	Bigwin North	Disturbed	2023	7-Aug-23		7.4	1	8		
B3	Bigwin North	Disturbed	2023	27-Aug-23		6.5				
N24	Boothby's	Nearshore Undisturbed	2023	3-Jul-23		6.8				
N24	Boothby's	Nearshore Undisturbed	2023	7-Aug-23		4.7	3	35		
N24	Boothby's	Nearshore Undisturbed	2023	27-Aug-23		7.0				
N24 F/D	Boothby's	Nearshore Undisturbed	2023	27-Aug-23		38.8			bs	
N11 F/D	Britannia	Disturbed	2023	3-Jul-23		11.5			bs	
N11	Britannia	Disturbed	2023	3-Jul-23		5.0				
N11	Britannia	Disturbed	2023	7-Aug-23		22.0	5	11		x
N11 F/D	Britannia	Disturbed	2023	27-Aug-23		39.4			bs	
N11	Britannia	Disturbed	2023	27-Aug-23		25.3				x
N1	Dwight Bay	Deep Water	2023	3-Jul-23		6.2				
N1	Dwight Bay	Deep Water	2023	7-Aug-23		5.9	5	14		
N1	Dwight Bay	Deep Water	2023	27-Aug-23		4.6				
N3	Dwight Beach	Disturbed	2023	3-Jul-23		7.0				
N3	Dwight Beach	Disturbed	2023	7-Aug-23		8.3	0	16		
N3	Dwight Beach	Disturbed	2023	27-Aug-23		11.3				
N3 F/D	Dwight Beach	Disturbed	2023	27-Aug-23		37.4			bs	

B2 F/D	Fairview	Deep Water	2023	3-Jul-23		14.5				
B2	Fairview	Deep Water	2023	3-Jul-23		12.1				
B2	Fairview	Deep Water	2023	7-Aug-23		36.3	1	15		x
B2	Fairview	Deep Water	2023	27-Aug-23		38.2				x
N10	Gull Rock	Deep Water	2023	3-Jul-23		10.9				x
N10	Gull Rock	Deep Water	2023	7-Aug-23		5.6	2	25		
N10	Gull Rock	Deep Water	2023	27-Aug-23		2.7				
E13	Haystack Bay	Deep Water	2023	3-Jul-23		15.5				x
E13	Haystack Bay	Deep Water	2023	7-Aug-23		5.0	0	4		
E13 F/D	Haystack Bay	Deep Water	2023	27-Aug-23		10.6				
E13	Haystack Bay	Deep Water	2023	27-Aug-23		8.1				
E6	Hollow River Lagoon	River	2023	3-Jul-23		5.3				
E6	Hollow River Lagoon	River	2023	7-Aug-23		22.8	9	36		
E6 F/D	Hollow River Lagoon	River	2023	7-Aug-23			4	26		
E6	Hollow River Lagoon	River	2023	27-Aug-23		7.2				
E6 F/D	Hollow River Lagoon	River	2023	27-Aug-23		31.6			bs	
E18 F/D	Hollow River mouth	River	2023	3-Jul-23		11.6				
E18	Hollow River mouth	River	2023	3-Jul-23		8.6				
E18	Hollow River mouth	River	2023	7-Aug-23		7.3	3	21		
E18	Hollow River mouth	River	2023	27-Aug-23		15.5				R
S2	Menominee Bay	Nearshore Undisturbed	2023	3-Jul-23		11.0				x
S2	Menominee Bay	Nearshore Undisturbed	2023	7-Aug-23		8.4	1	3		
S2	Menominee Bay	Nearshore Undisturbed	2023	27-Aug-23		7.6				
S2 F/D	Menominee Bay	Nearshore Undisturbed	2023	27-Aug-23		7.3				
N13	Moffat's	Nearshore Undisturbed	2023	3-Jul-23		5.4				
N13	Moffat's	Nearshore Undisturbed	2023	7-Aug-23		11.6	0	6		x
N13	Moffat's	Nearshore Undisturbed	2023	27-Aug-23		15.6				x
E26	Narrows West	Nearshore Undisturbed	2023	3-Jul-23		45.7				x
E26	Narrows West	Nearshore Undisturbed	2023	7-Aug-23		34.1	2	30	bs	
E26 F/D	Narrows West	Nearshore Undisturbed	2023	7-Aug-23		24.2				x
E26 F/D	Narrows West	Nearshore Undisturbed	2023	7-Aug-23			5	37		
E26	Narrows West	Nearshore Undisturbed	2023	27-Aug-23		10.6				x
N30	Oxtongue Delta	River	2023	3-Jul-23		10.0				
N30	Oxtongue Delta	River	2023	7-Aug-23		14.1	0	2		R
N30	Oxtongue Delta	River	2023	27-Aug-23		16.0				R

N2	Oxtongue mouth	River	2023	3-Jul-23		15.0				
N2 F/D	Oxtongue mouth	River	2023	7-Aug-23		30.9			bs	
N2	Oxtongue mouth	River	2023	7-Aug-23		17.7	7	18		
N2	Oxtongue mouth	River	2023	27-Aug-23		14.8				
N26	Portage Bay	Deep Water	2023	3-Jul-23		5.8				
N26	Portage Bay	Deep Water	2023	7-Aug-23		7.6	2	36	bs	
N26 F/D	Portage Bay	Deep Water	2023	7-Aug-23		3.6				
N26	Portage Bay	Deep Water	2023	27-Aug-23	y	2.0				
N26 F/D	Portage Bay	Deep Water	2023	27-Aug-23		3.1				
N31	Portage Bay docks	Disturbed	2023	3-Jul-23		10.3				
N31	Portage Bay docks	Disturbed	2023	7-Aug-23		3.1	10	21		
N31	Portage Bay docks	Disturbed	2023	27-Aug-23	y	2.0				
N31 F/D	Portage Bay docks	Disturbed	2023	27-Aug-23		3.3				
S3	Price's Point	Deep Water	2023	3-Jul-23		30.2				x
S3	Price's Point	Deep Water	2023	7-Aug-23		11.9	0	2		x
S3	Price's Point	Deep Water	2023	27-Aug-23	y	2.0				
E30	Ten Mile Bay	Deep Water	2023	3-Jul-23		12.1				x
E30 F/D	Ten Mile Bay	Deep Water	2023	7-Aug-23		8.0				
E30	Ten Mile Bay	Deep Water	2023	7-Aug-23		6.8	3	6		
E30	Ten Mile Bay	Deep Water	2023	27-Aug-23		9.2				
E1	Trading Bay	Deep Water	2023	3-Jul-23		30.2				x
E1	Trading Bay	Deep Water	2023	7-Aug-23		34.5	0	3	bs	
E1 F/D	Trading Bay	Deep Water	2023	7-Aug-23		7.5				
E1 F/D	Trading Bay	Deep Water	2023	7-Aug-23			2	10		
E1	Trading Bay	Deep Water	2023	27-Aug-23		27.2				x