Lyall Harbour/Boot Cove Water Service

2024 Annual Report

CRD | Drinking Water

Introduction

This report provides a summary of the Lyall Harbour/Boot Cove Water Service for 2024 and includes a description of the service, summary of the water supply, demand and production, drinking water quality, operations highlights, capital project updates and financial report.

Service Description

The community of Lyall Harbour/Boot Cove is primarily a rural residential development with community and commercial properties located on Saturna Island in the Southern Gulf Islands Electoral Area which was originally serviced by a private water utility and in 1978 the service converted to the Capital Regional District (CRD). The Lyall Harbour/Boot Cove water service is made up of 174 parcels (Figure 1) encompassing a total area of approximately 100 hectares. Of the 174 parcels, 158 properties (170 Single Family Equivalent's) are connected to the water system.

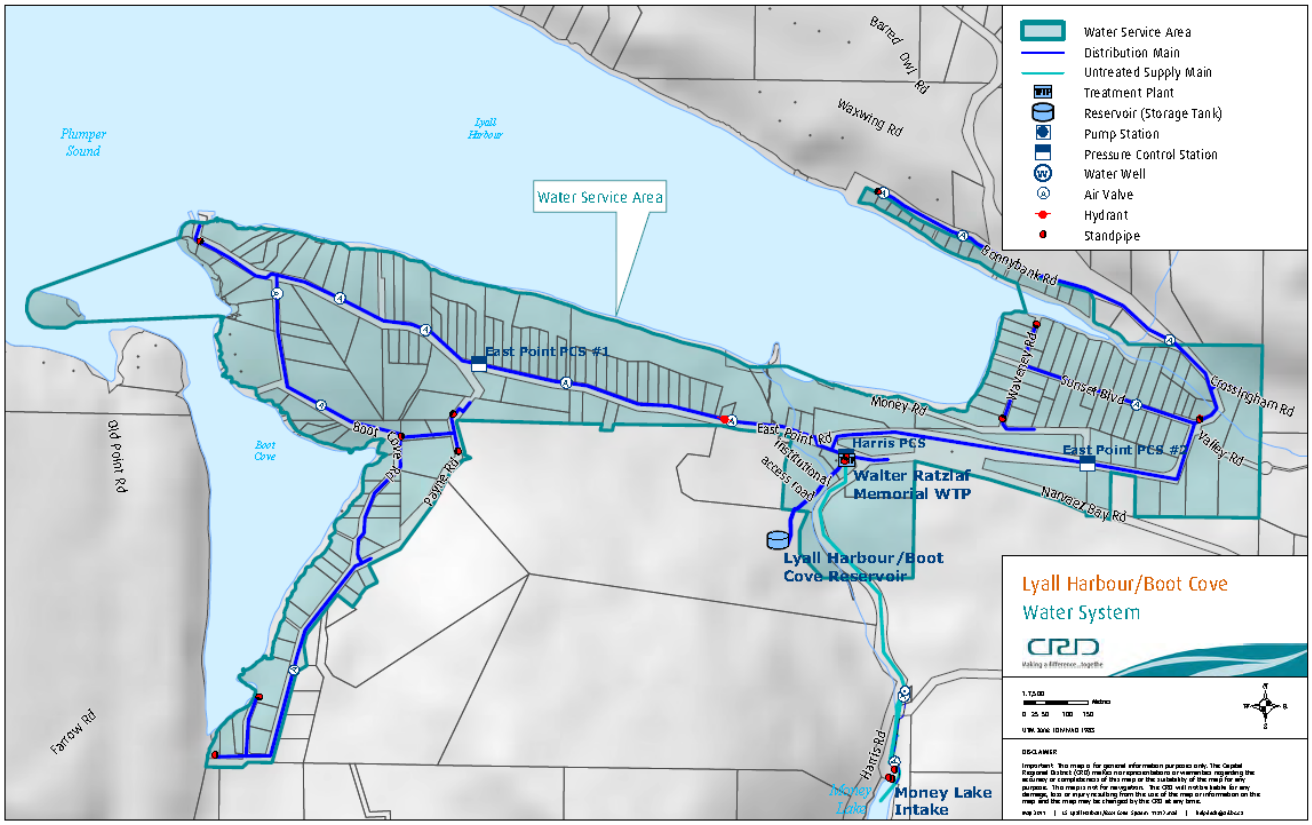

Figure 1: Map of Lyall Harbour/Boot Cove Water System

The Lyall Harbour/Boot Cove water system is primarily comprised of:

- Two raw water sources:
  - Money Lake, a small, impounded, surface water body that lies within a 94-hectare (230 acre) watershed on private and public lands.
  - Ground water spring (seepage pit) located near the base of Money Lake Dam.
- One earthen dam structure, Money Lake Dam No. 1.
- Treatment equipment including ozonation (currently offline), two stages of filtration (granular and absorption), ultraviolet light disinfection and chlorine disinfection.
- One steel storage tank (total volume 136 cubic meters or 36,000 US gallons).
- Supervisory Control and Data Acquisition (SCADA) system.
- Distribution system and supply pipe network (8,390 meters of water mains).
- Other water system assets: water service connections and meters, three pressure reducing valve stations, 50 gate valves, 12 standpipes and a small auxiliary generator.

Water Supply

Referring to Figure 2 below, Money Lake monthly water levels are highlighted for 2024. It is important to note that water supply levels in Money Lake, prior to 2008, were historically lower during the summer period. An upgrade to mitigate the low water levels involved the installation of a groundwater seepage spring recirculation pumping system. Excess water from the seepage spring is pumped back to Money Lake to keep the Lake as full as possible. The groundwater seepage spring water level is not monitored; however, the seepage spring weekly flow rate is monitored to confirm production rate. The seepage spring typically provides 100% of the winter water system demand for the community. Money Lake water is used periodically to supplement seepage spring flows, typically during the summer dry period.

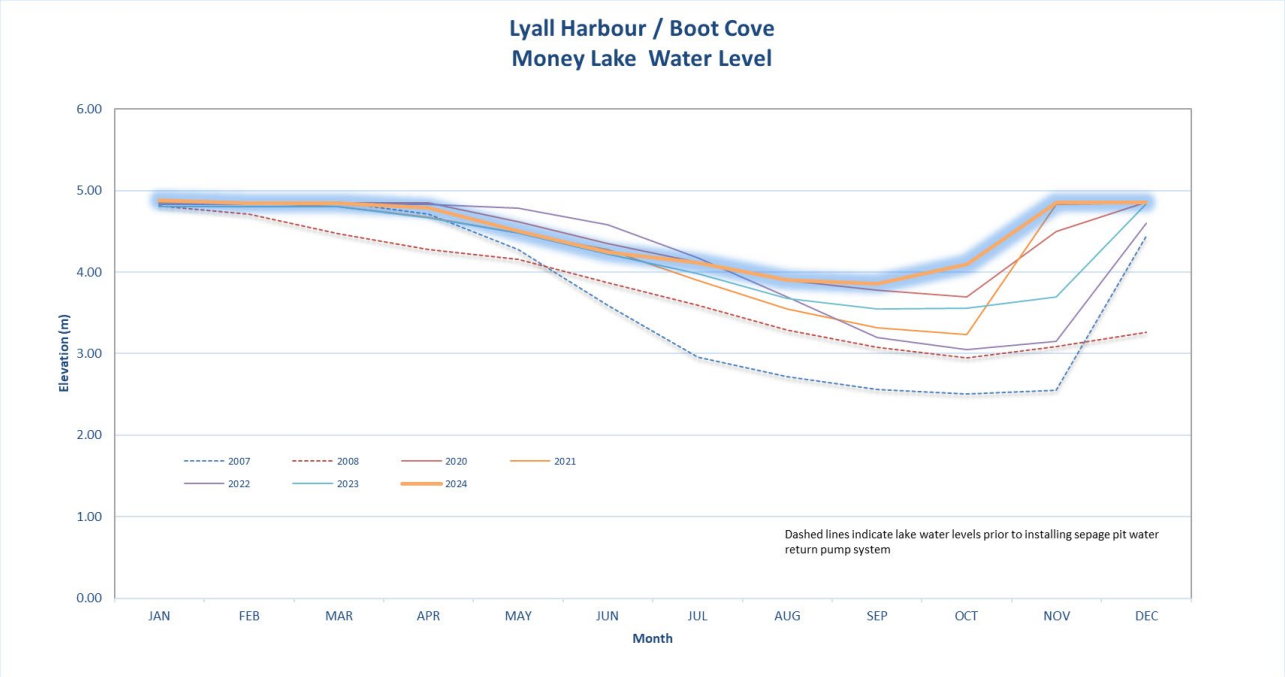

Figure 2: Money Lake Monthly Water Level

Water Production and Demand

Referring to Figure 3, 25,331 cubic meters of water was extracted (water production) from the seepage spring and Money Lake Reservoir in 2024; a 9% increase from the previous year and a 4% increase from the five-year average. Water demand (customer water billing) for the service totaled 17,833 cubic meters of water; 9% decrease from the previous year and an 10% decrease from the five-year average.

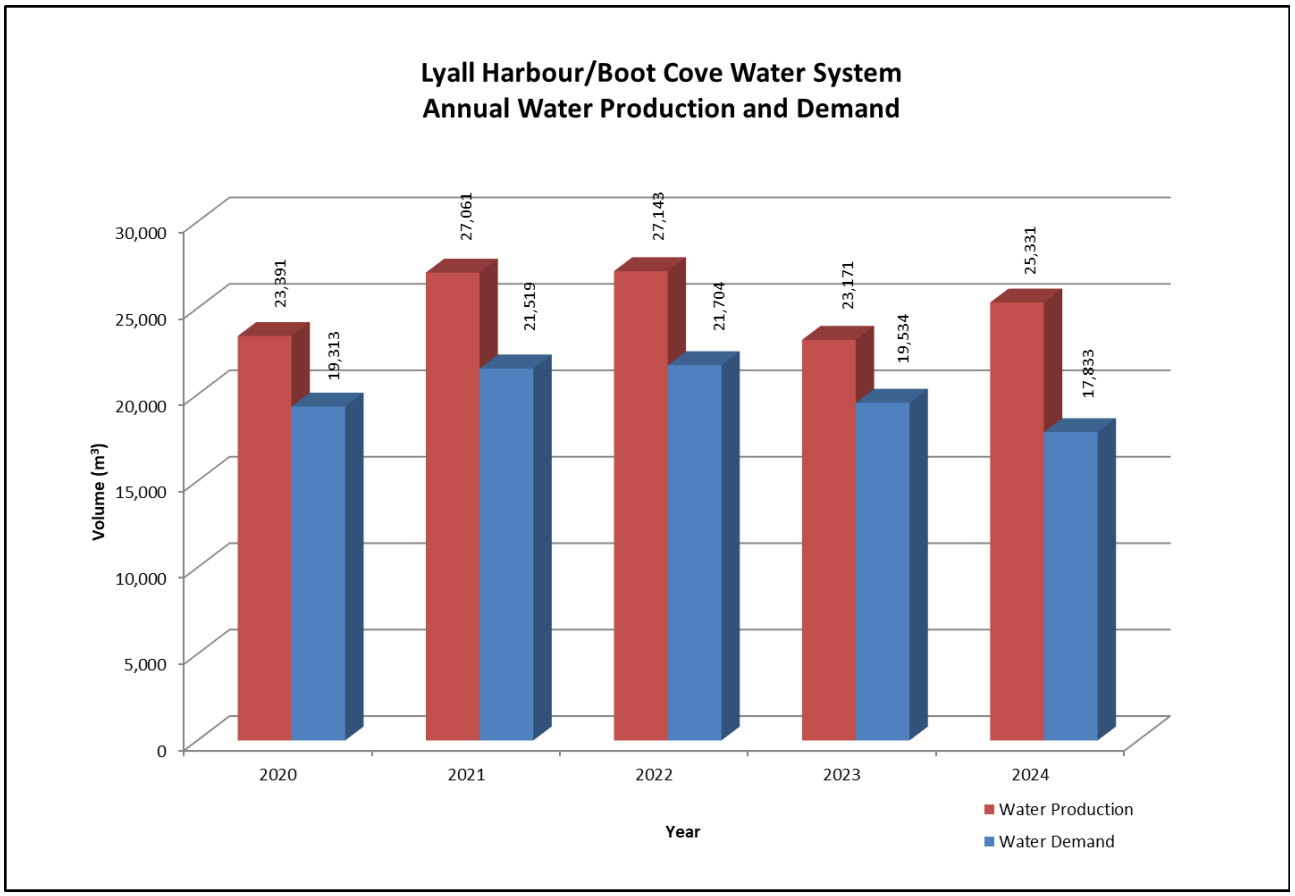

Figure 3: Lyall Harbour/Boot Cove Water System Annual Water Production and Demand

The difference between annual water production and annual customer demand is referred to as non-revenue water and can include water system leaks, water system maintenance and operational use (e.g. water main flushing, filter system backwashing), potential unauthorized use and fire-fighting use.

The 2024 non-revenue water (7,498 cubic meters) represents about 30% of the total water production for the service area. However, almost 13% of the total water can be attributed to operational use which includes water main flushing to keep chlorine residuals at acceptable levels at the extremities of the water system and water treatment filtration system backwashing activities. Therefore, the non-revenue water associated with system losses is approximately 17%. Although this is considered acceptable for small water systems, this is an increase from previous years and is likely the result of water system leaks that require further investigation.

Figure 4 illustrates the monthly water production for 2024 along with the historical water production information. The monthly water production trends are typical for small water systems such as the Lyall Harbour/Boot Cove water system.

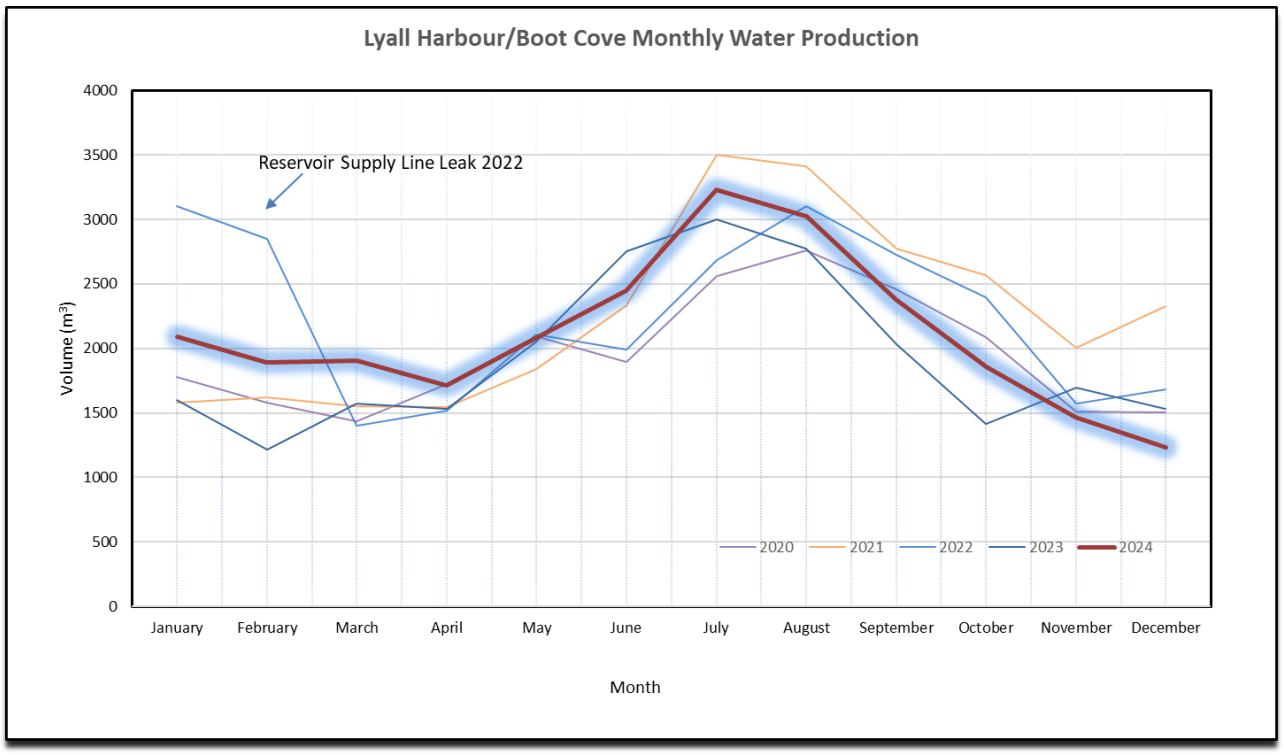

Figure 4: Lyall Harbour/Boot Cove Water Service Monthly Water Production

Drinking Water Quality

The Lyall Harbour/Boot Cove Water System uses predominantly seepage water collected from below the Money Lake dam as the primary raw water source. During the summer months this source is supplemented or completely replaced with flows directly from Money Lake. During summer and early fall 2024, all source water was supplied by Money Lake only, as the seepage water collection system ran dry. There is sufficient evidence to conclude that the seepage water is hydraulically connected to the lake source.

The Lyall Harbour/Boot Cove Water System experienced some of the usual water quality challenges at the beginning of 2024. Due to the typical winter season turbidity issues, the system was under a boil water advisory (BWA) until March 15, 2024. This BWA was a continuation since October 25, 2023, when an annual pattern reappeared which sees the treated water turbidity begin to exceed one Nephelometric Turbidity Unit (NTU) in late fall and remain above this threshold until the spring, typically until March. Interestingly, this typical annual pattern did not return in the fall of 2024 and the water system was, for the first time in years, not under a BWA during a winter season. The reasons for this positive change are still unknown.

Between late July and early November, Money Lake experienced a strong cyanobacteria bloom. The peak occurred in mid-September. Multiple cyanotoxin tests did not detect microcystin toxins in the raw water during this bloom.

This bloom did not pose a public health risk through the drinking water supplied. The annual average concentration for both regulated disinfection by-products, total Trihalomethanes (TTHM) and Haloacetic Acids (HAA), remained below the maximum acceptable concentration (MAC) in the Guidelines for Canadian Drinking Water Quality (GCDWQ).

The data below provides a summary of the water quality characteristics in 2024:

Raw Water:

- The raw water exhibited low concentrations of total coliform bacteria during the cool seasons but orders of magnitude higher concentrations during the summer and early fall months when lake water was the primary water source and water temperatures were high. Throughout most of the year, the raw water entering the treatment plant contained either none or only low concentrations of *E. coli* bacteria.
- The raw water turbidity ranged from 0.7 to 50.8 NTU. The highest raw water turbidity period was recorded during a strong cyanobacteria bloom from late July to November. The median annual raw water turbidity was 1.9 NTU.
- Low concentrations of both *Giardia* cysts and *Cryptosporidium* oocysts were detected in one of two sample sets in 2024 (in May 2024).
- The raw water had naturally high concentrations of iron and manganese especially during the fall season. Elevated iron and manganese concentrations are typically released during the fall turnover event in Money Lake and can be compounded by the ground passage of the seepage water. Typically, October and November see the highest iron and manganese concentrations.
- The raw water was slightly hard (median hardness 44.3 mg/L $CaCO_3$).
- The natural total organic carbon (TOC) in the source water was moderately high (median 5.2 mg/L).
- All year, the water had a high colour rating, above the aesthetic objective in the GCDWQ. The water was particularly coloured in the fall coinciding with the highest iron and manganese concentrations in the source water.

Treated Water:

- Outside the period with a BWA, the treated water was safe to drink. No treated water sample from the distribution system tested positive for E. coli bacteria. One distribution sample from August tested positive for total coliform bacteria. An immediate resample from the same location did not confirm an actual drinking water contamination.
- The treated water turbidity was regularly > 1 NTU from January to March and caused the BWA. For investigations into possible turbidity measurement inference by dissolved organic matter (coloured water), a secondary turbidity analyzer with less interference from colour was installed in November 2023. Unfortunately, the results were not conclusive to allow for a modified turbidity risk assessment in this water system. The industry typical threshold of 1 NTU for unfiltered surface water supplies remains the benchmark.
- The treated water TOC was regularly high within a range from 4.0 to 5.0 mg/L. The annual median was 4.4 mg/L. There is currently no guideline in the GCDWQ for TOC levels, however TOC levels > 2 mg/L indicate a potential for disinfection by-product exceedances. TOC levels > 4 mg/L are usually a precursor for high disinfection by-product concentrations.
- As a result of a chlorination optimization process, the disinfection by-product (DBP) concentrations remained below the GCDWQ health limits. One individual result on February 7 slightly exceeded the TTHM MAC of 100 µg/L (110 µg/L). But the annual average TTHM and HAA concentrations were 91.5 µg/L and 49.0 µg/L respectively and therefore below the MAC (100 µg/L and 80 µg/L respectively).

- Iron concentrations in exceedance of the aesthetic objective were found in distribution system samples from October and February. It is assumed that this exceedance typical lasts throughout the fall and winter season each year. These exceedances are a result of high iron concentrations in the raw water and the lack of adequate treatment for metals. Manganese concentrations, while elevated in the raw water, were consistently low in the treated water. Elevated iron concentrations are not a health concern but can lead to discolouration of the drinking water which can be a nuisance for the customers.
- The treated water had colour concentrations above the aesthetic objective throughout the fall and winter season.
- The annual median pH of the treated water was 6.3. This is well below the Health Canada recommended range of 7 - 10.5. Drinking water with low pH can cause corrosion issues on metallic pipes and fittings and potentially leach toxic metals such as lead into the drinking water. Lead in drinking water is typically not found in samples from distribution systems but in samples from building taps and faucets.

Table 1 and 2 below provide a summary of the 2024 raw and treated water test results.

Water quality data collected from this drinking water system can be also reviewed on the CRD website:

https://www.crd.bc.ca/about/data/drinking-water-quality-reports

Operational Highlights

The following is a summary of the major operational issues that were addressed by CRD Infrastructure and Water Services staff:

- Water Treatment Plant (WTP) plant occupational health and safety investigation and corrective actions. Corrective actions included replacement and rerouting of the sodium hypochlorite chemical feed lines. Operations office relocated from the WTP to remote site for operator to perform administrative duties. Implement chlorine gas monitoring procedure for operator. Other corrective actions are pending that include facility extraction fan improvement and implementation of additional emergency tempered shower system.
- Emergency response to water treatment plant SCADA communications failure event.
- Several emergency responses throughout the year related to leak detection due to high daily water production. Most leaks were identified on private property resulting in water being turned off and residents notified.
- Water main leak emergency response at 134 Payne Road. Standpipe flush connection was found to be corroded which resulted in the watermain failure.
- Water main leak 101 Payne Road. Standpipe flush connection was found to be corroded which resulted in the watermain failure.
- WTP emergency response to chlorine chemical feed pump process failure.
- Earthquake response on September 26 was initiated for Money Lake Dam. Given the magnitude and proximity of this quake, our Dam Emergency Plans were activated which requires a rapid inspection of the Money Lake Dam structure for any signs of disturbance. Inspection reports were submitted as part of the response. Nothing of concern was noted, however this is the first time a response has been initiated for this type of event.

- Planning and preparation for the replacement of the water treatment plant filtration media continued. Filtration media sourcing challenges has resulted in procurement and expenses to be completed in the first quarter of 2025.
- The bolted steel water storage tank is leaking. A low-cost repair process is planned for 2025 to determine if the leaking can be mitigated. If not, further assessment, repair details and repair work will be required.

Capital Project Updates

The Capital Projects that were in progress or completed in 2024 included:

1. Dam Improvements – CRD Action Plan document finalized in response to Thurber's Dam Safety Report (DSR). Action plan was presented to committee with intent to proceed to petition process or AAP in 2025.

Financial Report

Please refer to the attached 2024 Statement of Operations and Reserve Balances.

Revenue includes parcel taxes (Transfers from Government), fixed user fees (User Charges), interest on savings Interest earnings), transfer from Operating Reserve Fund and miscellaneous revenue such as late payment charges (Other revenue).

Expenses include all costs of providing the service. General Government Services include budget preparation, financial management, utility billing and risk management services. CRD Labour and Operating Costs include CRD staff time as well as the cost of equipment, tools, and vehicles. Debt servicing costs are interest and principal payments on long term debt. Other Expenses include all other costs to administer and operate the water system, including insurance, water testing and electricity.

The difference between Revenue and Expenses is reported as Net revenue (expenses). Any transfers to or from capital or reserve funds for the service (Transfers to own funds) are deducted from this amount and it is then added to any surplus or deficit carry forward from the prior year, yielding an Accumulated Surplus (or deficit). In alignment with Local Government Act Section 374 (11), any deficit must be carried forward and included in next year's financial plan.

For questions related to this Annual Report please email IWSAdministration@crd.bc.ca

Table 1

Table 1: 2024 Summary of Raw Water Test Results, Lyall Harbour / Boot Cove Water System										
PARAMETER		**2024 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2014-2023 ANALYTICAL RESULTS**			
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Minimum	Range Maximum	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum	Range Maximum
ND means Not Detected by analytical method used										
Physical/Biological Parameters										
Carbon, Total Organic	mg/L as C	**5.2**	11	4.1	7.8		5.08	124	3.2	18
Colour, True	TCU	**21.5**	12	15	52		21	77	9	88
Hardness as $CaCO_3$	mg/L	**44.25**	4	40.7	45.5	No Guideline Required	43	73	35.2	50.2
pH	pH units	**6.55**	4	6.5	6.7	7.0 - 10.5 AO	6.8	27	5.7	7.4
Turbidity, Field Tests	NTU	**1.95**	101	0.8	50.8		2.99	420	0.67	36.1
Turbidity, Grab Samples	NTU	**1.9**	13	0.7	11		1.9	133	0.2	20.3
Water Temperature	Degrees C	**11.6**	124	4.2	23.3	15°C AO	11	573	-0.1	25.5
Metals										
Aluminum	ug/L as Al	**30.2**	4	19.1	85	2900 MAC / 100 OG	73.1	73	8.7	739
Antimony	ug/L as Sb	**< 0.5**	4	< 0.5	< 0.5	6 MAC	< 0.5	73	0.042	< 0.5
Arsenic	ug/L as As	**0.39**	4	0.27	0.5	10 MAC	0.4	73	0.22	1.06
Barium	ug/L as Ba	**2.8**	4	2.2	4.6	1000 MAC	3.2	73	1.47	40.4
Beryllium	ug/L as Be	**< 0.1**	4	< 0.1	< 0.1		< 0.1	73	< 0.01	< 3
Bismuth	ug/L as Bi	**< 1**	4	< 1	< 1		< 1	71	0.017	< 1
Boron	ug/L as B	**< 50**	4	< 50	< 50	5000 MAC	< 50	73	11	< 50
Cadmium	ug/L as Cd	**< 0.01**	4	< 0.01	< 0.01	7 MAC	< 0.01	73	< 0.01	< 0.1
Calcium	mg/L as Ca	**11.4**	4	10.3	11.7	No Guideline Required	10.7	73	9.17	13
Chromium	ug/L as Cr	**< 1**	4	< 1	< 1	50 MAC	< 1	73	0.15	< 10
Cobalt	ug/L as Co	**< 0.2**	4	< 0.2	< 0.2		< 0.2	73	0.022	< 20
Copper	ug/L as Cu	**2.885**	4	2.34	12.6	2000 MAC / ≤ 1000 AO	3.34	73	1.34	285
Iron	ug/L as Fe	**247**	4	83	750	≤ 100 AO	273	75	25.6	1960
Lead	ug/L as Pb	**0.305**	4	0.2	1.79	5 MAC	0.38	73	< 0.2	105
Lithium	ug/L as Li	**< 2**	4	< 2	< 2		< 2	43	< 2	20.1
Magnesium	mg/L as Mg	**3.84**	4	3.65	3.94	No Guideline Required	3.8	73	2.98	4.6
Manganese	ug/L as Mn	**55.75**	4	11.4	146	120 MAC / ≤ 20 AO	28.95	74	< 1	1370
Molybdenum	ug/L as Mo	**< 1**	4	< 1	< 1		< 1	73	0.065	< 20
Nickel	ug/L as Ni	**< 1**	4	< 1	< 1		< 1	73	0.353	< 50
Potassium	mg/L as K	**0.6865**	4	0.536	0.847		0.658	73	0.387	1.36
Selenium	ug/L as Se	**< 0.1**	4	< 0.1	< 0.1	50 MAC	< 0.1	73	< 0.04	< 0.5
Silicon	mg/L as Si	**7575**	4	4370	8970		7330	73	2750	10100
Silver	ug/L as Ag	**< 0.02**	4	< 0.02	< 0.02	No Guideline Required	< 0.02	73	< 0.005	< 40
Sodium	mg/L as Na	**8.83**	4	8.54	8.99	≤ 200 AO	9.09	73	7.03	13.2
Strontium	ug/L as Sr	**96.25**	4	91.7	102	7000 MAC	95.8	73	79.8	120
Sulfur	mg/L as S	**< 3**	4	< 3	< 3		< 3	71	< 3	6.1
Tin	ug/L as Sn	**< 5**	4	< 5	< 5		< 5	73	0.46	65
Titanium	ug/L as Ti	**< 5**	4	< 5	< 5		< 5	73	1.44	65
Thallium	ug/L as Tl	**< 0.01**	4	< 0.01	< 0.01		< 0.01	71	0.008	< 0.05
Uranium	ug/L as U	**< 0.1**	4	< 0.1	< 0.1	20 MAC	< 0.1	71	0.007	< 0.1
Vanadium	ug/L as V	**< 5**	4	< 5	< 5		< 5	73	0.5	< 10
Zinc	ug/L as Zn	**8.95**	4	5.6	14.4	≤ 5000 AO	8.7	73	< 1	258
Zirconium	ug/L as Zr	**0.145**	4	< 0.1	0.21		0.16	71	< 0.1	0.57
Microbial Parameters										
Indicator Bacteria										
Coliform, Total	CFU/100 mL	**15**	13	< 1	7800		108	125	1	9200
E. coli	CFU/100 mL	**< 1**	13	< 1	12		< 1	127	<1	29
Hetero. Plate Count, 35C (2 day)	CFU/1 mL	Not tested in 2024					2200	2	1100	3300
Parasites										
Cryptosporidium, Total oocysts	oocysts/100 L	**0.445**	2	0	0.89	Zero detection desirable	< 1	27	< 1	2.8
Giardia, Total cysts	cysts/100 L	**0.445**	2	0	0.89	Zero detection desirable	< 1	27	< 1	< 1
Algal Toxins										
Microcystin	ug/L	Not tested in 2024				1.5 ug/L MAC	<1	27	<1	<1

Table 2

Table 2: 2024 Summary of Treated Water Test Results, Lyall Harbour / Boot Cove Water System										
PARAMETER		**2024 ANALYTICAL RESULTS**				**CANADIAN GUIDELINES**	**2014-2023 ANALYTICAL RESULTS**			
Parameter Name	Units of Measure	Annual Median	Samples Analyzed	Range Min.	Range Max.	≤ = Less than or equal to	Median	Samples Analyzed	Range Minimum	Range Maximum
ND means Not Detected by analytical method used										
Physical Parameters										
Carbon, Total Organic	mg/L as C	**4.40**	15	4	5		4.50	166	1.1	66.9
Colour, True	TCU	**8.50**	24	4	19		9.00	84	< 2	> 50
pH	No units	**6.30**	4	6.2	6.6	7.0 - 10.5 AO	6.76	22	5.9	8
Hardness	mg/L as CaCO3	**43.05**	8	37.5	46.8		43.00	71	37.2	50.1
Turbidity	NTU	**0.73**	28	0.15	1.2	1 MAC and ≤ 5 AO	0.95	216	0.18	5.3
Turbidity, Field Tests	NTU	**0.99**	92	0.06	1.8		0.81	379	0.09	4
Water Temperature	Degrees C	**9.70**	224	5.2	18.6	≤ 15 AO	11.00	1916	0	20.8
Microbial Parameters										
Indicator Bacteria										
Coliform, Total	CFU/100 mL	**< 1**	106	< 1	6	0 MAC	< 1	830	<1	460
E. coli	CFU/100 mL	**< 1**	106	< 1	< 1	0 MAC	< 1	832	<1	1
Hetero. Plate Count, 7 day	CFU/1 mL	**1635**	18	10	17,000	No Guideline Required	1000	159	< 10	33000
Algal Toxins										
Algal Toxins										
Microcystin	ug/L	Not tested in 2024				1.5 ug/L MAC	<1	3	<1	<1
Disinfectants										
Disinfectants										
Chlorine, Free Residual	mg/L as Cl2	**0.53**	203	0.04	7.20	No Guideline Required	0.34	1918	0.01	8.8
Chlorine, Total Residual	mg/L as Cl_2	Not tested in 2024				No Guideline Required	0.52	1318	0.01	8.8
Disinfection By-Products										
Haloacetic Acids										
HAA5	ug/L	**48.5**	4	26	73	80 MAC	56.00	32	< 0.1	160
Trihalomethanes (THMs)										
Bromodichloromethane	ug/L	**16.5**	4	13.0	18.0		15	44	0.643	400.6
Bromoform	ug/L	**< 1**	4	< 1	< 1		< 1	44	< 0.1	< 1
Chloroform	ug/L	**69.0**	4	65.0	94.0		80	44	7.26	250
Chlorodibromomethane	ug/L	**1.9**	4	1.5	2.1		1.6	44	<0.1	31
Total Trihalomethanes	ug/L	**88.0**	4	80.0	110.0	100 MAC	97	44	7.9	280
Metals										
Aluminum	ug/L as Al	**15**	8	4.2	54.3	2900 MAC / 100 OG	18.1	71	6.7	138
Antimony	ug/L as Sb	**< 0.5**	8	< 0.5	< 0.5	6 MAC	< 0.5	71	0.035	< 50
Arsenic	ug/L as As	**0.25**	8	0.24	0.36	10 MAC	0.35	71	0.2	0.8
Barium	ug/L as Ba	**2.75**	8	2.2	3.6	1000 MAC	2.6	71	1.5	16.1
Beryllium	ug/L as Be	**< 0.1**	8	< 0.1	< 0.1		< 0.1	71	< 0.01	< 0.1
Bismuth	ug/L as Bi	**< 1**	8	< 1	< 1		< 1	71	0.005	< 1
Boron	ug/L as B	**< 50**	8	< 50	53	5000 MAC	< 50	71	13	< 50
Cadmium	ug/L as Cd	**< 0.01**	8	< 0.01	< 0.01	7 MAC	< 0.01	71	< 0.005	0.087
Calcium	mg/L as Ca	**11.05**	8	9.48	12.1	No Guideline Required	10.8	71	9.44	13.2
Chromium	ug/L as Cr	**< 1**	8	< 1	< 1	50 MAC	< 1	71	< 0.1	< 10
Cobalt	ug/L as Co	**< 0.2**	8	< 0.2	< 0.2		< 0.2	71	0.01	< 0.5
Copper	ug/L as Cu	**33.65**	8	13	69.9	2000 MAC / ≤ 1000 AO	31.7	71	2.14	595
Iron	ug/L as Fe	**81.5**	8	37.5	318	≤ 100 AO	132	73	28.8	EXG 1670
Lead	ug/L as Pb	**0.965**	8	0.4	1.96	5 MAC	1.35	71	< 0.2	25.8
Lithium	ug/L as Li	**< 2**	8	< 2	< 2		< 2	42	1.74	< 5
Magnesium	mg/L as Mg	**3.765**	8	3.36	3.99	No Guideline Required	3.76	71	3.2	4.53
Manganese	ug/L as Mn	**1.6**	8	1.1	18.3	120 MAC / ≤ 20 AO	2.1	73	< 1	26.3
Molybdenum	ug/L as Mo	**< 1**	8	< 1	< 1		< 1	71	0.076	< 1
Nickel	ug/L as Ni	**< 1**	8	< 1	< 1		1.3	71	0.288	80.9
Potassium	mg/L as K	**0.6455**	8	0.562	0.888		0.677	71	0.479	0.956
Selenium	ug/L as Se	**< 0.1**	8	< 0.1	< 0.1	50 MAC	< 0.1	71	< 0.04	0.12
Silicon	mg/L as Si	**7400**	8	4150	9090		7220	71	2970	8850
Silver	ug/L as Ag	**< 0.02**	8	< 0.02	< 0.02	No Guideline Required	< 0.02	71	< 0.005	< 0.02
Sodium	mg/L as Na	**11.25**	8	10.4	12.2	≤ 200 AO	11.5	71	9.26	15.6
Strontium	ug/L as Sr	**96.7**	8	83	109	7000 MAC	96.2	71	80.5	121
Sulfur	mg/L as S	**< 3**	8	< 3	< 3		< 3	71	< 3	5.6
Tin	ug/L as Sn	**< 5**	8	< 5	< 5		< 5	71	< 0.2	47.8
Titanium	ug/L as Ti	**< 5**	8	< 5	< 5		< 5	71	0.79	9.3
Thallium	ug/L as Tl	**< 0.01**	8	< 0.01	< 0.01		< 0.01	71	< 0.002	< 0.05
Uranium	ug/L as U	**< 0.1**	8	< 0.1	< 0.1	20 MAC	< 0.1	71	0.008	< 0.1
Vanadium	ug/L as V	**< 5**	8	< 5	< 5		< 5	71	0.48	< 5
Zinc	ug/L as Zn	**30.1**	8	14.4	43.6	≤ 5000 AO	26.6	71	< 5	102
Zirconium	ug/L as Zr	**0.115**	8	< 0.1	0.25		0.12	71	< 0.1	0.66