







2025 Annual Report

Vernon Water Reclamation Centre

Reporting period: January 1, 2025 – December 31, 2025









The City of Vernon recognizes that it is located in the traditional territory of the Syilx people of the Okanagan Nation.













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List of Acronyms and Measurement Units

BOD_5	5-day Biochemical Oxygen Demand (mg/L)
FC	Fecal Coliform (MPN/100ml)
L	litres
mg	milligrams
m^3	cubic meters
MPN	most probable number
OC	Operating Certificate
OP	Ortho Phosphate (mg/L)
TN	Total Nitrogen (mg/L)
TP	Total Phosphorus (mg/L)
TSS	Total Suspended Solids (mg/L)
VWRC	Vernon Water Reclamation Centre
Fasl	Feet above sea level
EMS	Environmental Monitoring System
HRAD	High Rate Anaerobic Digestion



Introduction

This report is submitted as per Section 9.3.1 of the Ministry of Environment and Climate Change Strategy Operational Certificate ME 12215 (OC) for the City of Vernon Water Reclamation Centre (VWRC).

The Vernon Water Reclamation Centre (VWRC) is designated as a Class IV Wastewater Treatment Center. The current plant was commissioned in 2004 as a Modified Johannesburg Biological Nutrient Removal (BNR) process.

There are four major treatment stages that complete the VWRC process. First, pretreatment of the influent at the fine screen and grit removal. Second, primary settling where solids are further settled out and removed. Third, nutrients and BOD are removed by the organisms in the bioreactors and settled out in the secondary clarifiers. Lastly, sand filters and ultraviolet lights are utilized for disinfection, and the fully treated reclaimed water is ready for discharge.

Under the provisions of the Operational Certificate, the Corporation of the City of Vernon is authorized to discharge reclaimed wastewater from the VWRC located at 2100 43rd Street, Vernon, B.C., to a water storage reservoir (MacKay Reservoir) and then to the ground by irrigation. The discharge of treated reclaimed water to Okanagan Lake via the deep lake outfall is only authorized when:

a) Unforeseen conditions or circumstances beyond the City's control prevent the City from pumping treated reclaimed water from the Vernon Water Reclamation Centre to MacKay Reservoir. Such conditions would include but not be limited to power outages, pump station or pipeline failures, or,

b) The elevation in MacKay Reservoir exceeds 1935 feet above mean sea level and it is projected that the level of MacKay Reservoir will exceed 1939 feet above mean sea level prior to the start of the next irrigation season.

VWRC is further authorized to discharge biosolids. Biosolids from the VWRC are processed by the Regional Compost Facility located at 551 Commonage Road, Vernon, B.C., into Class A soil compost.

Reclaimed Water Quality Requirements

Reclaimed water discharged from the VWRC to MacKay Reservoir to be used for irrigation may not exceed the following limits:

- 26 mg/L 5-day Biochemical Oxygen Demand (BOD5) and
- 25 mg/L Total Suspended Solids (TSS)

Reclaimed water may be discharged from the VWRC to Okanagan Lake via the deep lake outfall if the quality is better than or equivalent to the following parameters:

- 10 mg/L 5-day Biochemical Oxygen Demand (BOD5)
- 10 mg/L Total Suspended Solids (TSS)
- Not to exceed 2.0 mg/L of Total Phosphorus (TP) (as P)
- Annual average of 0.25 mg/L of Total Phosphorus (TP) (as P)
- 6.0 mg/L Total Nitrogen (TN) (as N)
- 50 MPN /100ml Fecal Coliform (FC)

The analytical requirements stipulated by the OC and reported in this annual report were conducted by Caro Analytical Services in Kelowna, BC, and Nautilus Environmental in Burnaby, BC. The lab reports are attached in the appendices. Analysis data stipulated by the OC is uploaded annually to the Ministry of Environment and Climate Change Strategy Environmental Monitoring System (EMS) site.



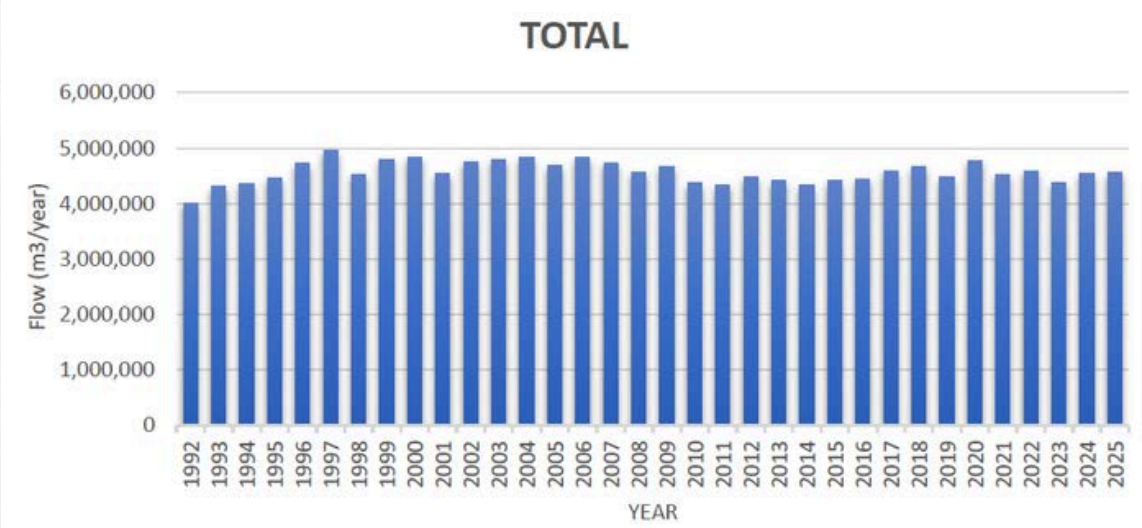
VWRC Influent

The VWRC continuously monitors influent flow at the headworks parshall flume. Table 1 shows the average daily flow of 12,480m^3/day with a maximum daily flow of 14,676m^3/day occurring in January. The VWRC influent flow is below the maximum authorized daily volume to discharge at 28,100 m^3/day, as per section 2.1 of the OC. Figure 1 shows the total influent flows from 1992 to 2025.

Table 1: Summary of Influent Flows

2025	Average Daily flow (m^3/day)	Min (m^3/day)	Max (m^3/day)	Monthly (m^3)
January	12,268	11,778	12,773	380,311
February	12,424	11,716	13,510	347,864
March	12,847	12,051	15,166	398,672
April	13,102	12,373	14,676	393,057
May	12,576	12,038	12,927	389,864
June	12,420	11,890	12,819	372,599
July	12,637	12,084	14,432	391,758
August	12,479	11,905	12,980	386,841
September	12,082	11,637	12,568	362,464
October	12,065	11,660	12,763	374,025
November	12,131	11,704	12,814	363,937
December	12,711	11,521	14,074	394,052
	12,479	11,521	15,166	4,555,444

Figure 1: Annual Influent Flow 1992 - 2025



VWRC Influent

Figure 2 shows the flow changes each year from 2020 to 2025. Table 2 summarizes the influent quality treated a tthe VWRC. A monthly 24-hour composite sample is sent to CARO Analytical services for analysis (Appendix A –I nfluent Results).

Figure 2: Monthly Influent Flows 2020 - 2025

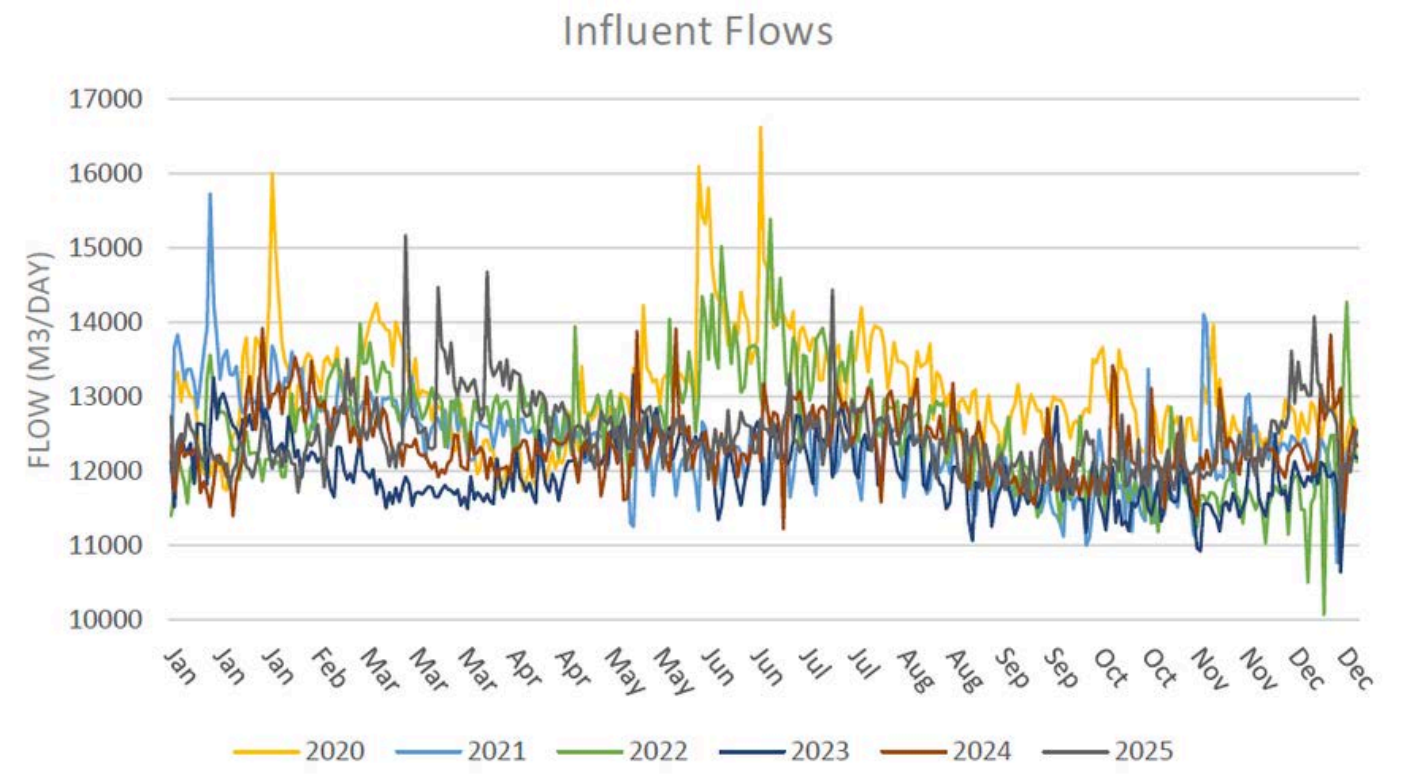


Table 2: 2025 Sampling of Influent Quality - EMS #E228537

2025	BOD_5 (mg/L)	TSS (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	pH pH units
January	302	238	8.30	58.8	7.67
February	697	300	12.40	87.7	7.51
March	337	260	7.06	47.0	7.68
April	285	260	8.29	57.7	7.46
May	421	315	10.40	64.0	7.50
June	412	548	10.30	59.6	7.54
July	321	276	8.73	58.6	7.58
August	281	240	9.13	55.6	7.65
September	344	252	10.00	61.8	7.21
October	537	647	10.70	72.3	7.58
November	302	213	7.84	61.0	7.48
December	300	214	9.15	60.6	7.68
Average	385	314	9.36	62.1	7.5

VWRC Reclaimed Water

The VWRC has three distribution options for reclaimed water. One option, the VWRC delivers reclaimed water to MacKay Reservoir throughout the year. Second option, during irrigation season the sand filters, Ultra-Violet (UV) lights, and chlorination are utilized for disinfection of reclaimed water used for direct Irrigation. Lastly, under certain conditions the VWRC can discharge to Okanagan Lake following tertiary treatment. Table 3 summarizes the monthly distribution of the VWRC reclaimed water in 2025.

The quantity of reclaimed water discharged to MacKay Reservoir is measured at the VWRC headworks parshall flume as per section 2 and 3 of the OC at EMS #E229537. Table 4 summarizes the reclaimed water quality to MacKay Reservoir (Appendix B – Reclaimed Water Quality Results). Monthly, 24hr composite samples are submitted to CARO Analytical Services. The VWRC reclaimed water met the permit requirements in 2025 as per section 2.2 for discharge to MacKay Reservoir.

Table 3: 2025 Reclaimed Water Distribution

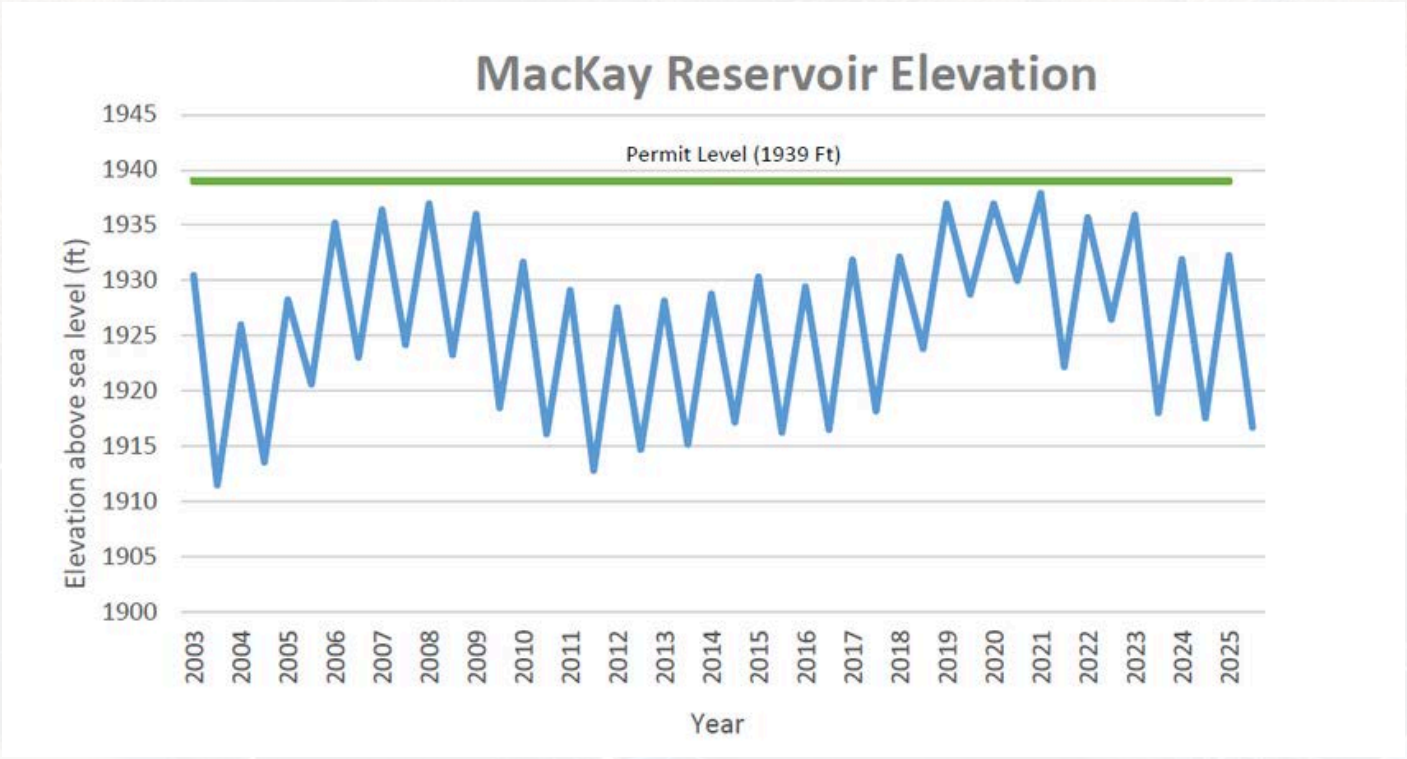
2025	Plant Influent (m^3/month)	Lake Discharge (m^3)	Irrigation		
			MacKay Reservoir		Direct to Irrigation (m^3)
			Inflow (m^3)	Outflow (m^3)	
January	380,311		372,272		
February	347,864		356,258		
March	398,672		397,758		
April	393,057		396,542		
May	389,864		387,190	279,610.0	17,199
June	372,599		369,083	810,620	25,924
July	391,758		403,862	1,144,870	26,764
August	386,841		437,169	1,022,110	28,412
September	362,464		423,576	1,064,950	25,952
October	374,025		416,942		
November	363,937		403,562		
December	394,052		424,926		
Total (m^3/year)	**4,555,444**	**0**	**4,789,140**	**4,322,160**	**124,251**
Daily Average (m^3/day)	**12,481**	**0**	**13,193**	**28,814**	**828**

VWRC Reclaimed Water

Table 4: Quality of Reclaimed Water to MacKay Reservoir in 2025 - EMS #E105004

VWRC Treated Effluent to MacKay Reservoir														
2025		OC Limit	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
BOD_5	(mg/L)	26	16.8	19.8	10.5	3.6	9.6	9.0	<8.0	<8.0	<8.0	<8.0	<8.0	9.7
TSS	(mg/L)	25	6.6	7.6	7.6	6.0	6.0	5.4	2.4	2.4	2.6	6.2	0.3	0.1
pH	ph units		7.6	7.6	7.8	7.9	7.8	7.9	7.8	7.9	7.6	7.7	7.7	7.3
Total Phosphorus	(mg/L)		0.365	0.330	0.666	0.362	0.245	0.277	0.300	0.251	0.632	0.381	2.810	2.440
Total Dissolved Phosphorus	(mg/L)		0.0810	0.0830	0.3810	0.1880	0.1490	0.1150	0.1300	0.0951	0.4010	0.1780	0.4950	0.4040
Orthophosphorus	(mg/L)		<0.0050	<0.0050	0.270	0.0	0.046	0.030	0.040	0.0489	0.322	0.0835	0.3410	0.1630
Total Nitrogen	(mg/L)		8.59	9.37	7.07	6.68	6.83	5.87	5.86	5.94	6.72	7.60	8.84	6.51
Organic Nitrogen	(mg/L)		2.22	2.11	2.16	2.20	1.96	1.97	2.14	2.23	2.14	2.25	2.04	1.86
Ammonia Nitrogen	(mg/L)		1.040	4.270	2.100	0.659	0.106	0.140	0.130	0.554	0.286	0.634	0.768	0.580
Nitrate Nitrogen	(mg/L)		3.89	0.89	0.90	3.18	4.77	3.76	3.53	3.07	4.25	4.68	5.86	3.60
Nitrite Nitrogen	(mg/L)		1.4400	2.1000	1.9200	0.6440	<0.010	<0.010	0.0510	0.0800	0.0370	0.0360	0.1680	0.4830
Sodium	(mg/L)		90.1	89.3	96.3	87.8	82.8	85.6	84.4	84.7	100.0	83.7	2.4	2.4
Chloride	(mg/L)		87.5	91.0	80.2	80.9	75.6	88.0	81.8	81.6	87.8	95.8	77.9	81.0
Specific Conductivity	(µS/cm)		873	871	905	763	872	863	863	857	869	871	896	823

Figure 3: MacKay Reservoir Minimum and Maximum Elevations 2003 - 2025



Lake Monitoring

A report by Larratt Aquatic Consulting was done for the 2020-2024 lake discharge and is in the appendices (Appendix K).

Spray Irrigation Program

MacKay Reservoir

Since 1977 the VWRC has been utilizing MacKay Reservoir as a reclaimed water storage basin for the Spray Irrigation Program. The Spray Irrigation Program is operational from May to October, as per section 7.2 of the OC. MacKay Reservoir level and irrigation distribution use are dependent on the weather. Currently, beneficial reuse of reclaimed water is provided to four seed orchards, three golf courses, grazing lands, pastures, soccer fields, baseball diamonds, regional compost facility, and residential landscape irrigation (Appendix G – Spray Irrigation Areas).

The City of Vernon continues to seek feasibility for the expansion of the Reclaimed Water Irrigation Program. With the assistance of environmental consultants, the expansion, cost and challenges to irrigate new land parcels are being perused. Through various correspondences, ongoing conversations with staff members of the OKIB and community have occurred. An assessment report on these findings is appendix G 2025 Reclaimed Water Irrigation Groundwater Monitoring Report states that we have met Section 8.6 of OC 12215 for the 2025 irrigation season. The City of Vernon has been updating its infrastructure and equipment for the Spray Irrigation Program. By making these upgrades, Spray Irrigation Operators can provide more efficient irrigation usage.

MacKay Reservoir level is measured weekly at EMS site # E228540. Figure 4 shows the annual supply of reclaimed water and irrigation demand at MacKay Reservoir for the last 10 years. Figure 5 shows the MacKay Reservoir elevation trend from 2003 – 2025. In conclusion, the Spray Irrigation Program was able to utilize 4,353,453m^3 of reclaimed water from MacKay Reservoir during the 2025 irrigation season.

Figure 4: VWRC Influent Flow and Irrigation Usage 2016 - 2025

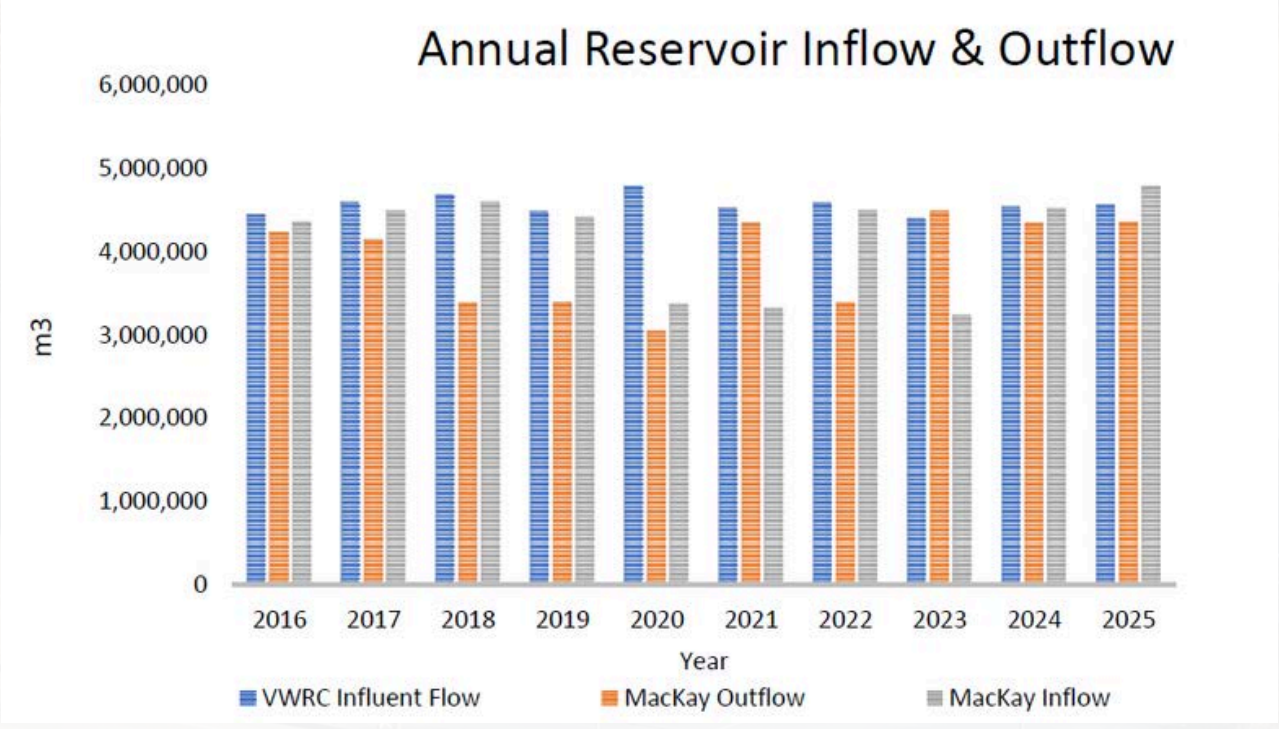
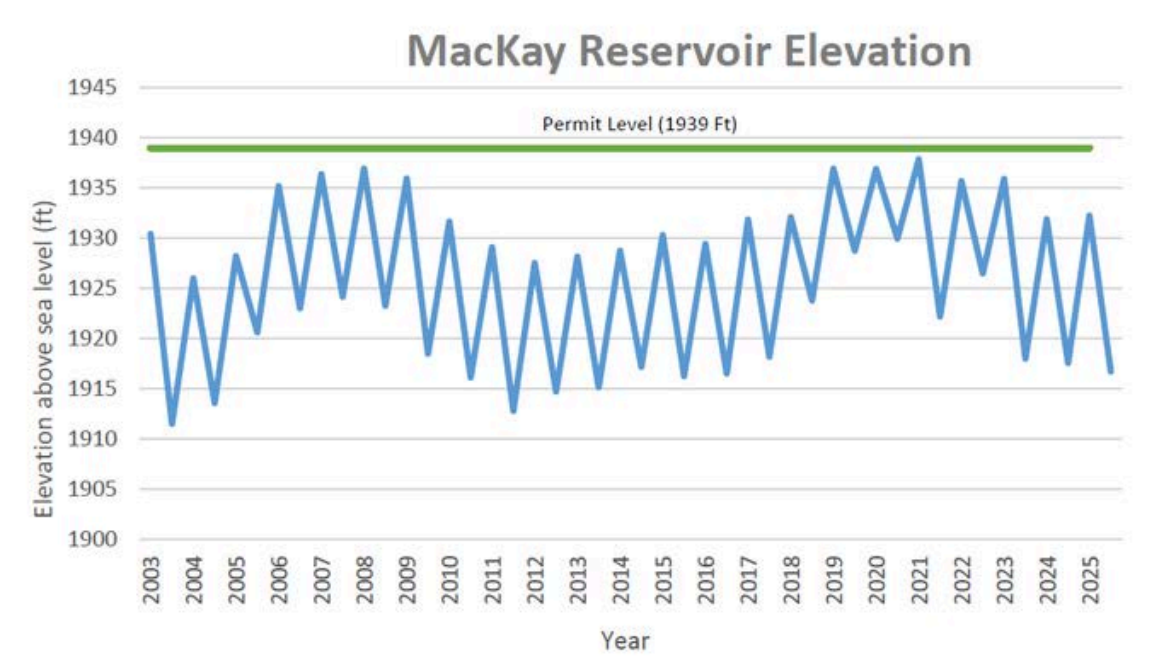


Figure 5: MacKay Reservoir Elevation Trend 2003 - 2025 - EMS E228540



Irrigation

Water is withdrawn from MacKay Reservoir and distributed to users during the irrigation season. It is chlorinated prior to use. Chlorine residuals are tested weekly at Clay Valve #4 throughout the irrigation season, and the chlorine residual was above 0.5mg/L. As per section 2.2 of the OC, Table 5 displays the monthly water quality results from the distribution system at Clay Valve #4 - EMS #228539 (Appendix I– Irrigation Water Quality Results).

Table 5: 2025 Irrigation Quality at Clay Valve #4

Irrigation from MacKay Reservoir

2025		OC Permit	May	June	July	Aug	Sept	Oct
BOD_5	mg/L	10	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0
TSS	mg/L	10	2.4	<2.0	<2.0	3.6	2.2	2.5
pH	pH units	6 to 9	7.95	7.92	8.00	8.01	8.07	7.80
Total Phosphorus	mg/L		0.855	0.9	1.19	1.33	1.37	1.37
Total Dissolved Phosphorus	mg/L		0.84	0.89	1.16	1.33	1.32	1.38
Ortho Phosphate	mg/L		0.701	0.823	1.03	1.13	1.15	1.2
Total Nitrogen	mg/L		2.98	3.68	3.13	3.39	2.88	3.28
Organic Nitrogen	mg/L		1.17	1.22	1.2	1.42	1.04	1.4
Ammonia N	mg/L		0.424	0.64	0.896	1.04	1.2	1.24
Nitrate N	mg/L		1.38	1.82	0.975	0.897	0.572	0.561
Nitrite N	mg/L		<0.010	<0.010	0.063	0.035	0.068	0.083
Total Coliform	(MPN/100mL)		28	8	<1	<1	1	2
Fecal Coliform	(MPN/100mL)	2.2	<1	<1	<1	<1	1	<1
Turbidity	NTU	2	0.86	0.98	0.87	1.65	1.31	0.72

Spray Irrigation Program

Table 6 summarizes the reclaimed water quality for direct irrigation. Reclaimed water is supplied to the Rise Golf Course from VWRC following sand filtration, UV disinfection and chlorination. The turbidity samples were less than 2 NTU. As per section 2.2 of the OC, the reclaimed water quality used for direct irrigation meets the OC requirements (Appendix J).

Table 6: 2025 Irrigation Quality to The Rise Golf Course - EMS site #229578

		Direct to Irrigation					
2025		OC Limits	May	June	July	Aug	Sep
BOD_5	(mg/L)	10	<2.0	<8.0	<8.0	<8.0	<8.0
TSS	(mg/L)	10	<2.2	<2.0	<2.0	<2.0	2.6
pH	pH units	6 to 9	7.81	7.64	7.66	7.15	6.92
Fecal Coliforms	(MPN/100mL)	2.2	<1	<1	<1	11	<1
Turbidity	NTU	2	0.79	0.76	0.47	0.48	0.63

Groundwater Monitoring Program

Monthly grab samples of Bailey Springs, EMS #0500578, are analyzed at CARO Analytical Services. Table 7 summarizes the results of the grab samples (Appendix K – Bailey Spring Water Quality Results). The annual groundwater monitoring program was completed by Associated Environmental and attached as Appendix L – Reclaimed Water Irrigation Groundwater Monitoring Program.

Table 7: 2025 Bailey Spring Results - EMS Site E0500578

Bailey Springs														
2025		AVG	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH		8.399	8.42	8.38	8.33	8.37	8.44	8.41	8.49	8.45	8.47	8.39	8.31	8.33
Total Phosphorus	(mg/L)	0.137	0.112	0.150	0.160	0.102	0.140	0.148	0.169	0.174	0.159	0.120	0.104	0.107
Total Dissolved Phosphorus	(mg/L)	0.120	0.107	0.126	0.106	0.089	0.140	0.126	0.143	0.174	0.128	0.108	0.097	0.098
Ortho Phosphorus	(mg/L)	0.105	0.105	0.122	0.083	0.084	0.108	0.120	0.120	0.128	0.118	0.090	0.090	0.092
Total Nitrogen	(mg/L)	0.721	0.692	1.210	0.950	0.740	0.719	0.604	0.643	0.670	0.710	0.595	0.574	0.544
Organic Nitrogen	(mg/L)	0.576	0.447	0.579	0.632	0.512	0.719	0.604	0.421	0.628	0.691	0.595	0.574	0.515
Ammonia Nitrogen	(mg/L)	0.137	0.051	<0.050	<0.050	<0.050	<0.050	<0.050	0.222	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate Nitrogen	(mg/L)	0.209	0.194	0.630	0.318	0.228	<0.010	<0.010	<0.010	0.042	0.019	<0.010	<0.010	0.029
Nitrite Nitrogen	(mg/L)	#DIV/0!	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Sodium	(mg/L)	144	153	132	143	147	147	139	143	155	143	137	145	145
Chloride	*(mg/L)*	167	163	174	181	180	184	182	169	152	153	149	157	165
Specific Conductivity	(uS/cm)	1379	1430	1390	1410	1420	1430	1350	1360	1350	1340	1350	1360	1360
Total Coliform	(MPN/100 mL)	7940	344	645	363	2420	3090	38700	16200	12600	13800	4410	1300	1410
Fecal Coliform	(MPN/100 mL)	285.75	75	11	30	1	727	261	548	980	435	326	23	12

Sanitary Sewer Use Bylaw

The City of Vernon Sanitary Use Bylaw (#4863) is attached as Appendix M – Sanitary Use Bylaw.

Contingency Plan

An Emergency Response Manual is available for the Staff of the VWRC to refer to in such case of emergency.

Authorized Works

Attached in Appendix N & O are updated schematic of the VWRC's process.

Biosolids Management

Biosolids from the Vernon Water Reclamation Centre are made up of thickened primary sludge and secondary sludge. Regional Compost Facility processes the biosolids into nutrient rich Ogogrow Compost. The VWRC samples monthly for Biosolids from the Vernon Water Reclamation Centre.

New Works

No new works to report in 2025.

Operation and Maintenance

The staff at the Vernon Water Reclamation Centre perform routine preventive and corrective maintenance. Throughout the year 2025, numerous upgrades, pump replacements and upgrades were accomplished. Maintenance records are kept daily, and software programs are used for tracking purposes.

Table 8: Facility Staffing

Position	Name	EOCP Designation
Manager	Serge Kozin	MWWT IV
Operator III	Mark Hawthorne	MWWT III
Operator II	Kevin Holman	MWWT III
Operator II	Nick Morrison	MWWT III
Operator II	Ryan Powell	MWWT IV
Operator II	Kevin Walters	MWWT III
Operator I	Rob Morris	MWWT III
Operator I	John Gardener	MWWT I
Reclaimed Operator	Derek Anderson	MWWT I
Reclaimed Operator	David McGean	WD II
VWRC Laborer		
Lab Technician	Tyler Steele	MWWT II
Instrumentation Tech/electrician	Trevor Schikowski	
Instrumentation Tech/electrician	Kenny Simms	



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Appendix A

Influent Results

Caro Analytical Services

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25A0815
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-01-15 13:11

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25A0815-01) | Matrix: Water | Sampled: 2025-01-09						FILT, PRES
Anions						
Chloride	**91.1**	± 2.6	0.10	mg/L	2025-01-10	
Nitrate (as N)	**0.015**	± 0.002	0.010	mg/L	2025-01-10	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-01-10	
Calculated Parameters						
Nitrate+Nitrite (as N)	**0.0153**		0.0100	mg/L	N/A	
Nitrogen, Total	**58.8**		2.00	mg/L	N/A	
Nitrogen, Organic	**17.4**		2.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**41.3**	± 6.9	0.050	mg/L	2025-01-14	
BOD, 5-day	**302**	± 51	2.0	mg/L	2025-01-15	
Conductivity (EC)	**1190**	± 44	2.0	µS/cm	2025-01-10	
Nitrogen, Total Kjeldahl	**58.8**	± 6.7	0.050	mg/L	2025-01-14	
pH	**7.67**	± 0.03	0.10	pH units	2025-01-10	HT2
Phosphorus, Total (as P)	**8.30**	± 0.82	0.0050	mg/L	2025-01-14	
Phosphorus, Total Dissolved	**5.54**	± 0.54	0.0050	mg/L	2025-01-14	
Phosphorus, Dissolved Reactive	**4.65**	± 0.37	0.0050	mg/L	2025-01-11	
Solids, Total Suspended	**238**	± 51	2.0	mg/L	2025-01-11	
Total Metals						
Sodium, total	**109**	± 20	0.10	mg/L	2025-01-13	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25B1274
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-02-19 10:15

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25B1274-01) | Matrix: Water | Sampled: 2025-02-12						FILT, PRES
Anions						
Chloride	**61.0**	± 1.7	0.10	mg/L	2025-02-13	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-02-13	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-02-13	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**87.7**		1.00	mg/L	N/A	
Nitrogen, Organic	**38.2**		1.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**49.5**	± 8.3	0.050	mg/L	2025-02-18	
BOD, 5-day	**697**	± 113	2.0	mg/L	2025-02-18	
Conductivity (EC)	**1200**	± 44	2.0	µS/cm	2025-02-13	
Nitrogen, Total Kjeldahl	**87.7**	± 9.9	0.050	mg/L	2025-02-14	
pH	**7.51**	± 0.03	0.10	pH units	2025-02-13	HT2
Phosphorus, Total (as P)	**12.4**	± 1.2	0.0050	mg/L	2025-02-14	
Phosphorus, Total Dissolved	**7.09**	± 0.70	0.0050	mg/L	2025-02-14	
Phosphorus, Dissolved Reactive	**6.81**	± 0.54	0.0050	mg/L	2025-02-15	
Solids, Total Suspended	**300**	± 65	2.0	mg/L	2025-02-15	
Total Metals						
Sodium, total	**85.9**	± 15.7	0.10	mg/L	2025-02-15	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25C1768
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-03-20 15:02

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25C1768-01) | Matrix: Water | Sampled: 2025-03-14						FILT, PRES
Anions						
Chloride	**100**	± 3	0.10	mg/L	2025-03-15	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-03-15	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-03-15	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**47.0**		1.00	mg/L	N/A	
Nitrogen, Organic	**16.7**		1.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**30.3**	± 5.1	0.050	mg/L	2025-03-20	
BOD, 5-day	**337**	± 54	8.0	mg/L	2025-03-20	
Conductivity (EC)	**1110**	± 41	2.0	µS/cm	2025-03-15	
Nitrogen, Total Kjeldahl	**47.0**	± 5.3	0.050	mg/L	2025-03-20	
pH	**7.68**	± 0.03	0.10	pH units	2025-03-15	HT2
Phosphorus, Total (as P)	**7.06**	± 0.69	0.0050	mg/L	2025-03-18	
Phosphorus, Total Dissolved	**3.76**	± 0.37	0.0050	mg/L	2025-03-18	
Phosphorus, Dissolved Reactive	**3.64**	± 0.29	0.0050	mg/L	2025-03-15	
Solids, Total Suspended	**260**	± 56	2.0	mg/L	2025-03-20	
Total Metals						
Sodium, total	**93.3**	± 17.1	0.10	mg/L	2025-03-19	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25D1621
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-04-17 11:50

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25D1621-01) | Matrix: Water | Sampled: 2025-04-09 00:00 To 2025-04-10 00:00						FILT, PRES
Anions						
Chloride	**76.4**	± 2.2	0.10	mg/L	2025-04-12	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-04-12	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-04-12	
Calculated Parameters						
Hardness, Total (as CaCO3)	**210**		0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**57.7**		1.00	mg/L	N/A	
Nitrogen, Organic	**23.6**		1.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**34.1**	± 5.7	0.050	mg/L	2025-04-14	
BOD, 5-day	**285**	± 46	8.0	mg/L	2025-04-17	
Conductivity (EC)	**1040**	± 38	2.0	µS/cm	2025-04-14	
Nitrogen, Total Kjeldahl	**57.7**	± 6.5	0.050	mg/L	2025-04-16	
pH	**7.46**	± 0.03	0.10	pH units	2025-04-14	HT2
Phosphorus, Total (as P)	**8.29**	± 0.82	0.0050	mg/L	2025-04-15	
Phosphorus, Total Dissolved	**4.29**	± 0.42	0.0050	mg/L	2025-04-15	
Phosphorus, Dissolved Reactive	**3.87**	± 0.31	0.0050	mg/L	2025-04-12	
Solids, Total Suspended	**266**	± 57	2.0	mg/L	2025-04-12	
Total Metals						
Aluminum, total	**0.821**	± 0.161	0.0050	mg/L	2025-04-14	
Antimony, total	**0.00062**	± 0.00012	0.00020	mg/L	2025-04-14	
Arsenic, total	**0.00101**	± 0.00012	0.00050	mg/L	2025-04-14	
Barium, total	**0.0779**	± 0.0101	0.0050	mg/L	2025-04-14	
Beryllium, total	< 0.00010		0.00010	mg/L	2025-04-14	
Bismuth, total	**0.00565**	± 0.00107	0.00010	mg/L	2025-04-14	
Boron, total	**0.106**	± 0.032	0.0500	mg/L	2025-04-14	
Cadmium, total	**0.000242**	± 0.000066	0.000010	mg/L	2025-04-14	
Calcium, total	**52.2**	± 7.4	0.20	mg/L	2025-04-14	
Chromium, total	**0.00318**	± 0.00064	0.00050	mg/L	2025-04-14	
Cobalt, total	**0.00085**	± 0.00009	0.00010	mg/L	2025-04-14	
Copper, total	**0.0990**	± 0.0154	0.00040	mg/L	2025-04-14	
Iron, total	**1.02**	± 0.19	0.010	mg/L	2025-04-14	
Lead, total	**0.00230**	± 0.00050	0.00020	mg/L	2025-04-14	
Lithium, total	**0.00762**	± 0.00136	0.00010	mg/L	2025-04-14	
Magnesium, total	**19.4**	± 2.7	0.010	mg/L	2025-04-14	
Manganese, total	**0.0567**	± 0.0503	0.00020	mg/L	2025-04-14	
Molybdenum, total	**0.00520**	± 0.00074	0.00010	mg/L	2025-04-14	
Nickel, total	**0.00390**	± 0.00074	0.00040	mg/L	2025-04-14	
Phosphorus, total	**7.85**	± 1.59	0.050	mg/L	2025-04-14	
Potassium, total	**17.9**	± 2.8	0.10	mg/L	2025-04-14	

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25E1181
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-05-15 16:07

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25E1181-01) | Matrix: Water | Sampled: 2025-05-08						FILT, PRES
Anions						
Chloride	**74.2**	± 2.1	0.10	mg/L	2025-05-10	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-05-10	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-05-10	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**64.0**		1.00	mg/L	N/A	
Nitrogen, Organic	**23.4**		1.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**40.6**	± 6.8	0.050	mg/L	2025-05-09	
BOD, 5-day	**421**	± 68	8.0	mg/L	2025-05-15	
Conductivity (EC)	**1170**	± 43	2.0	µS/cm	2025-05-10	
Nitrogen, Total Kjeldahl	**64.0**	± 7.2	0.050	mg/L	2025-05-13	
pH	**7.50**	± 0.03	0.10	pH units	2025-05-10	HT2
Phosphorus, Total (as P)	**10.4**	± 1.0	0.0050	mg/L	2025-05-15	
Phosphorus, Total Dissolved	**4.37**	± 0.43	0.0050	mg/L	2025-05-15	
Phosphorus, Dissolved Reactive	**3.80**	± 0.30	0.0050	mg/L	2025-05-10	
Solids, Total Suspended	**315**	± 68	2.0	mg/L	2025-05-15	
Total Metals						
Sodium, total	**96.8**	± 17.7	0.10	mg/L	2025-05-14	

Sample Qualifiers:

FILT	The sample has been filtered for Dissolved Phosphorus in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for Dissolved Phosphorus in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25F0599
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-06-19 15:41

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25F0599-01) | Matrix: Water | Sampled: 2025-06-04						FILT, PRES
Anions						
Chloride	**78.5**	± 2.2	0.10	mg/L	2025-06-05	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-06-05	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-06-05	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**59.6**		2.00	mg/L	N/A	
Nitrogen, Organic	**13.8**		2.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**45.8**	± 7.7	0.050	mg/L	2025-06-09	
BOD, 5-day	**412**	± 72	8.0	mg/L	2025-06-11	
Conductivity (EC)	**1190**	± 44	2.0	µS/cm	2025-06-06	
Nitrogen, Total Kjeldahl	**59.6**	± 6.8	0.050	mg/L	2025-06-10	
pH	**7.54**	± 0.03	0.10	pH units	2025-06-06	HT2
Phosphorus, Total (as P)	**10.3**	± 1.0	0.0050	mg/L	2025-06-19	
Phosphorus, Total Dissolved	**5.60**	± 0.55	0.0050	mg/L	2025-06-19	
Phosphorus, Dissolved Reactive	**5.05**	± 0.40	0.0050	mg/L	2025-06-05	
Solids, Total Suspended	**548**	± 118	2.0	mg/L	2025-06-09	
Total Metals						
Sodium, total	**94.3**	± 17.2	0.10	mg/L	2025-06-10	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25G1559
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-07-22 15:35

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25G1559-01) | Matrix: Water | Sampled: 2025-07-09 00:00 To 2025-07-10 00:00						FILT, PRES
Anions						
Chloride	**67.5**	± 1.9	0.10	mg/L	2025-07-12	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-07-12	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-07-12	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**58.6**		1.00	mg/L	N/A	
Nitrogen, Organic	**20.0**		1.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**38.6**	± 6.5	0.050	mg/L	2025-07-14	
BOD, 5-day	**321**	± 55	8.0	mg/L	2025-07-16	
Conductivity (EC)	**1180**	± 43	2.0	µS/cm	2025-07-16	
Nitrogen, Total Kjeldahl	**58.6**	± 6.6	0.050	mg/L	2025-07-16	
pH	**7.58**	± 0.03	0.10	pH units	2025-07-16	HT2
Phosphorus, Total (as P)	**8.73**	± 0.86	0.0050	mg/L	2025-07-22	
Phosphorus, Total Dissolved	**5.17**	± 0.51	0.0050	mg/L	2025-07-22	
Phosphorus, Dissolved Reactive	**4.14**	± 0.33	0.0050	mg/L	2025-07-11	
Solids, Total Suspended	**276**	± 59	2.0	mg/L	2025-07-15	
Total Metals						
Sodium, total	**95.6**	± 17.5	0.10	mg/L	2025-07-15	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25H1588
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-08-19 15:31

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25H1588-01) | Matrix: Water | Sampled: 2025-08-11 00:00 To 2025-08-12 00:00						FILT, PRES
Anions						
Chloride	**75.8**	± 2.2	0.10	mg/L	2025-08-14	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-08-14	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-08-14	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**55.6**		2.00	mg/L	N/A	
Nitrogen, Organic	**16.5**		2.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**39.1**	± 6.3	0.050	mg/L	2025-08-13	
BOD, 5-day	**281**	± 48	8.0	mg/L	2025-08-19	
Conductivity (EC)	**1090**	± 40	2.0	µS/cm	2025-08-13	
Nitrogen, Total Kjeldahl	**55.6**	± 6.3	0.050	mg/L	2025-08-19	
pH	**7.65**	± 0.03	0.10	pH units	2025-08-13	HT2
Phosphorus, Total (as P)	**9.13**	± 0.90	0.0050	mg/L	2025-08-18	
Phosphorus, Total Dissolved	**5.05**	± 0.50	0.0050	mg/L	2025-08-18	
Phosphorus, Dissolved Reactive	**4.78**	± 0.38	0.0050	mg/L	2025-08-13	
Solids, Total Suspended	**240**	± 54	2.0	mg/L	2025-08-15	
Total Metals						
Sodium, total	**79.0**	± 14.4	0.10	mg/L	2025-08-16	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25I2700
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-09-25 17:09

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25I2700-01) | Matrix: Water | Sampled: 2025-09-18						FILT, PRES
Anions						
Chloride	**92.5**	± 2.6	0.10	mg/L	2025-09-22	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-09-22	HT1
Nitrite (as N)	< 0.010		0.010	mg/L	2025-09-22	HT1
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**61.8**		2.00	mg/L	N/A	
Nitrogen, Organic	**21.1**		2.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**40.7**	± 6.6	0.050	mg/L	2025-09-25	
BOD, 5-day	**344**	± 58	8.0	mg/L	2025-09-25	
Conductivity (EC)	**1150**	± 42	2.0	µS/cm	2025-09-19	
Nitrogen, Total Kjeldahl	**61.8**	± 6.9	0.050	mg/L	2025-09-24	
pH	**7.21**	± 0.03	0.10	pH units	2025-09-19	HT2
Phosphorus, Total (as P)	**10.0**	± 1.0	0.0050	mg/L	2025-09-23	
Phosphorus, Total Dissolved	**5.34**	± 0.53	0.0050	mg/L	2025-09-23	
Phosphorus, Dissolved Reactive	**4.63**	± 0.37	0.0050	mg/L	2025-09-20	
Solids, Total Suspended	**252**	± 54	1.8	mg/L	2025-09-24	
Total Metals						
Sodium, total	**103**	± 10	0.10	mg/L	2025-09-24	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25J1589
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-10-17 16:13

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25J1589-01) | Matrix: Water | Sampled: 2025-10-08 00:00 To 2025-10-09 00:00						FILT, PRES
Anions						
Chloride	**97.2**	± 2.8	0.10	mg/L	2025-10-10	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-10-10	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-10-10	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**72.3**		2.00	mg/L	N/A	
Nitrogen, Organic	**31.0**		2.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**41.2**	± 6.7	0.050	mg/L	2025-10-17	
BOD, 5-day	**537**	± 92	8.0	mg/L	2025-10-16	
Conductivity (EC)	**1230**	± 45	2.0	µS/cm	2025-10-11	
Nitrogen, Total Kjeldahl	**72.3**	± 8.1	0.050	mg/L	2025-10-17	
pH	**7.58**	± 0.03	0.10	pH units	2025-10-11	HT2
Phosphorus, Total (as P)	**10.7**	± 1.0	0.0050	mg/L	2025-10-16	
Phosphorus, Total Dissolved	**5.59**	± 0.55	0.0050	mg/L	2025-10-16	
Phosphorus, Dissolved Reactive	**4.59**	± 0.36	0.0050	mg/L	2025-10-12	
Solids, Total Suspended	**647**	± 139	1.8	mg/L	2025-10-16	
Total Metals						
Sodium, total	**95.0**	± 9.0	0.10	mg/L	2025-10-17	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25K1723
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-11-24 16:56

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25K1723-01) | Matrix: Water | Sampled: 2025-11-13 00:00 To 2025-11-14 00:00						FILT, PRES
Anions						
Chloride	**66.1**	± 1.9	0.10	mg/L	2025-11-15	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-11-15	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-11-15	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**61.0**		2.00	mg/L	N/A	
Nitrogen, Organic	**17.2**		2.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**43.8**	± 7.1	0.050	mg/L	2025-11-17	
BOD, 5-day	**302**	± 51	8.0	mg/L	2025-11-20	
Conductivity (EC)	**1220**	± 45	2.0	µS/cm	2025-11-17	
Nitrogen, Total Kjeldahl	**61.0**	± 6.9	0.050	mg/L	2025-11-21	
pH	**7.48**	± 0.03	0.10	pH units	2025-11-17	HT2
Phosphorus, Total (as P)	**7.84**	± 0.77	0.0050	mg/L	2025-11-21	
Phosphorus, Total Dissolved	**5.34**	± 0.53	0.0050	mg/L	2025-11-21	
Phosphorus, Dissolved Reactive	**4.26**	± 0.34	0.0050	mg/L	2025-11-15	
Solids, Total Suspended	**213**	± 46	1.8	mg/L	2025-11-17	RE2
Total Metals						
Sodium, total	**99.3**	± 9.4	0.10	mg/L	2025-11-19	

Sample Qualifiers:

FILT	The sample has been filtered for PDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for PDP in the laboratory and the holding time has been extended.
RE2	Result was confirmed by re-analysis prior to reporting.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25L0612
PROJECT	Influent (ME12215) - EMS	**REPORTED**	2025-12-10 13:35

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Influent E228537 (25L0612-01) | Matrix: Water | Sampled: 2025-12-02 00:00 To 2025-12-03 00:00						FILT, PRES
Anions						
Chloride	**110**	± 3	0.10	mg/L	2025-12-05	
Nitrate (as N)	< 0.010		0.010	mg/L	2025-12-05	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-12-05	
Calculated Parameters						
Nitrate+Nitrite (as N)	< 0.0100		0.0100	mg/L	N/A	
Nitrogen, Total	**60.6**		2.00	mg/L	N/A	
Nitrogen, Organic	**19.2**		2.00	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**41.4**	± 6.7	0.050	mg/L	2025-12-08	
BOD, 5-day	**300**	± 51	8.0	mg/L	2025-12-10	
Conductivity (EC)	**1360**	± 50	2.0	µS/cm	2025-12-05	
Nitrogen, Total Kjeldahl	**60.6**	± 6.8	0.050	mg/L	2025-12-09	
pH	**7.68**	± 0.03	0.10	pH units	2025-12-05	HT2
Phosphorus, Total (as P)	**9.15**	± 0.90	0.0050	mg/L	2025-12-08	
Phosphorus, Total Dissolved	**6.02**	± 0.59	0.0050	mg/L	2025-12-08	
Phosphorus, Dissolved Reactive	**4.99**	± 0.40	0.0050	mg/L	2025-12-05	
Solids, Total Suspended	**214**	± 46	1.8	mg/L	2025-12-06	
Total Metals						
Sodium, total	**137**	± 13	0.10	mg/L	2025-12-06	

Sample Qualifiers:

FILT	The sample has been filtered for PDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for PDP in the laboratory and the holding time has been extended.

Appendix B

Reclaimed Water Quality Results

Caro Analytical Services

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25A1624
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-01-22 15:32

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 - 24 hr composite (25A1624-01) | Matrix: Water | Sampled: 2025-01-16						FILT, PRES
Anions						
Chloride	**87.5**	± 2.5	0.10	mg/L	2025-01-17	
Nitrate (as N)	**3.89**	± 0.21	0.010	mg/L	2025-01-17	
Nitrite (as N)	**1.44**	± 0.12	0.010	mg/L	2025-01-17	
Calculated Parameters						
Nitrate+Nitrite (as N)	**5.33**		0.0100	mg/L	N/A	
Nitrogen, Total	**8.59**		0.100	mg/L	N/A	
Nitrogen, Organic	**2.22**		0.100	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**1.04**	± 0.17	0.050	mg/L	2025-01-17	
BOD, 5-day	**16.8**	± 3.3	2.0	mg/L	2025-01-22	
Conductivity (EC)	**873**	± 32	2.0	µS/cm	2025-01-17	
Nitrogen, Total Kjeldahl	**3.26**	± 0.37	0.050	mg/L	2025-01-20	
pH	**7.64**	± 0.03	0.10	pH units	2025-01-17	HT2
Phosphorus, Total (as P)	**0.365**	± 0.036	0.0050	mg/L	2025-01-20	
Phosphorus, Total Dissolved	**0.0810**	± 0.0080	0.0050	mg/L	2025-01-20	
Phosphorus, Dissolved Reactive	< 0.0050		0.0050	mg/L	2025-01-18	
Solids, Total Suspended	**6.6**	± 1.5	2.0	mg/L	2025-01-21	
Total Metals						
Sodium, total	**90.1**	± 16.5	0.10	mg/L	2025-01-18	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25B2145
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-02-27 13:23

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 - 24 hr composite (25B2145-01) | Matrix: Water | Sampled: 2025-02-20						FILT, PRES
Anions						
Chloride	**91.0**	± 2.6	0.10	mg/L	2025-02-21	
Nitrate (as N)	**0.886**	± 0.049	0.010	mg/L	2025-02-21	
Nitrite (as N)	**2.10**	± 0.17	0.010	mg/L	2025-02-21	
Calculated Parameters						
Nitrate+Nitrite (as N)	**2.99**		0.0100	mg/L	N/A	
Nitrogen, Total	**9.37**		0.100	mg/L	N/A	
Nitrogen, Organic	**2.11**		0.100	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**4.27**	± 0.72	0.050	mg/L	2025-02-27	
BOD, 5-day	**19.8**	± 4.1	2.0	mg/L	2025-02-27	
Conductivity (EC)	**871**	± 32	2.0	µS/cm	2025-02-25	
Nitrogen, Total Kjeldahl	**6.38**	± 0.72	0.050	mg/L	2025-02-27	
pH	**7.62**	± 0.03	0.10	pH units	2025-02-25	HT2
Phosphorus, Total (as P)	**0.330**	± 0.033	0.0050	mg/L	2025-02-24	
Phosphorus, Total Dissolved	**0.0830**	± 0.0082	0.0050	mg/L	2025-02-24	
Phosphorus, Dissolved Reactive	< 0.0050		0.0050	mg/L	2025-02-22	
Solids, Total Suspended	**7.6**	± 1.8	2.0	mg/L	2025-02-26	
Total Metals						
Sodium, total	**89.3**	± 16.3	0.10	mg/L	2025-02-24	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25C1625
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-03-19 15:16

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25C1625-01) | Matrix: Water | Sampled: 2025-03-13						FILT, PRES
Anions						
Chloride	**80.2**	± 2.3	0.10	mg/L	2025-03-14	
Nitrate (as N)	**0.897**	± 0.050	0.010	mg/L	2025-03-14	
Nitrite (as N)	**1.92**	± 0.16	0.010	mg/L	2025-03-14	
Calculated Parameters						
Nitrate+Nitrite (as N)	**2.81**		0.0100	mg/L	N/A	
Nitrogen, Total	**7.07**		0.0500	mg/L	N/A	
Nitrogen, Organic	**2.16**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**2.10**	± 0.35	0.050	mg/L	2025-03-18	
BOD, 5-day	**10.5**	± 1.8	8.0	mg/L	2025-03-19	
Chemical Oxygen Demand	**99**	± 9	20	mg/L	2025-03-18	
Conductivity (EC)	**905**	± 33	2.0	µS/cm	2025-03-14	
Nitrogen, Total Kjeldahl	**4.25**	± 0.48	0.050	mg/L	2025-03-18	
pH	**7.80**	± 0.03	0.10	pH units	2025-03-14	HT2
Phosphorus, Total (as P)	**0.666**	± 0.066	0.0050	mg/L	2025-03-14	
Phosphorus, Total Dissolved	**0.381**	± 0.037	0.0050	mg/L	2025-03-14	
Phosphorus, Dissolved Reactive	**0.270**	± 0.021	0.0050	mg/L	2025-03-14	
Solids, Total Suspended	**7.6**	± 1.7	2.0	mg/L	2025-03-19	
Total Metals						
Sodium, total	**96.3**	± 17.6	0.10	mg/L	2025-03-17	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25D2479
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-04-25 11:18

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25D2479-01) | Matrix: Water | Sampled: 2025-04-17						FILT, PRES
Anions						
Chloride	**80.9**	± 2.3	0.10	mg/L	2025-04-19	
Nitrate (as N)	**3.18**	± 0.18	0.010	mg/L	2025-04-19	
Nitrite (as N)	**0.644**	± 0.053	0.010	mg/L	2025-04-19	
Calculated Parameters						
Nitrate+Nitrite (as N)	**3.82**		0.0100	mg/L	N/A	
Nitrogen, Total	**6.68**		0.0500	mg/L	N/A	
Nitrogen, Organic	**2.20**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.659**	± 0.111	0.050	mg/L	2025-04-22	
BOD, 5-day	**3.6**	± 0.6	8.0	mg/L	2025-04-24	
Conductivity (EC)	**763**	± 28	2.0	µS/cm	2025-04-19	
Nitrogen, Total Kjeldahl	**2.86**	± 0.32	0.050	mg/L	2025-04-25	
pH	**7.91**	± 0.03	0.10	pH units	2025-04-19	HT2
Phosphorus, Total (as P)	**0.362**	± 0.036	0.0050	mg/L	2025-04-23	
Phosphorus, Total Dissolved	**0.188**	± 0.019	0.0050	mg/L	2025-04-23	
Phosphorus, Dissolved Reactive	**0.0428**	± 0.0035	0.0050	mg/L	2025-04-18	
Solids, Total Suspended	**6.0**	± 1.4	2.0	mg/L	2025-04-24	
Total Metals						
Sodium, total	**87.8**	± 16.0	0.10	mg/L	2025-04-24	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25E2888
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-06-02 09:41

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25E2888-01) | Matrix: Water | Sampled: 2025-05-21						FILT, PRES
Anions						
Chloride	**75.6**	± 2.2	0.10	mg/L	2025-05-22	
Nitrate (as N)	**4.77**	± 0.26	0.010	mg/L	2025-05-22	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-05-22	
Calculated Parameters						
Nitrate+Nitrite (as N)	**4.77**		0.0100	mg/L	N/A	
Nitrogen, Total	**6.83**		0.0500	mg/L	N/A	
Nitrogen, Organic	**1.96**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.106**	± 0.019	0.050	mg/L	2025-05-26	
BOD, 5-day	**9.6**	± 1.7	8.0	mg/L	2025-05-28	
Conductivity (EC)	**872**	± 32	2.0	µS/cm	2025-05-24	
Nitrogen, Total Kjeldahl	**2.06**	± 0.23	0.050	mg/L	2025-05-27	
pH	**7.80**	± 0.03	0.10	pH units	2025-05-24	HT2
Phosphorus, Total (as P)	**0.245**	± 0.024	0.0050	mg/L	2025-05-31	
Phosphorus, Total Dissolved	**0.149**	± 0.015	0.0050	mg/L	2025-05-31	
Phosphorus, Dissolved Reactive	**0.0457**	± 0.0056	0.0050	mg/L	2025-05-23	
Solids, Total Suspended	**6.0**	± 1.3	2.0	mg/L	2025-05-28	
Total Metals						
Sodium, total	**82.8**	± 15.1	0.10	mg/L	2025-05-25	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25F3608
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-07-02 10:32

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25F3608-01) | Matrix: Water | Sampled: 2025-06-24						FILT, PRES
Anions						
Chloride	**88.0**	± 2.5	0.10	mg/L	2025-06-25	
Nitrate (as N)	**3.76**	± 0.21	0.010	mg/L	2025-06-25	
Nitrite (as N)	< 0.010		0.010	mg/L	2025-06-25	
Calculated Parameters						
Nitrate+Nitrite (as N)	**3.76**		0.0100	mg/L	N/A	
Nitrogen, Total	**5.87**		0.0500	mg/L	N/A	
Nitrogen, Organic	**1.97**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.140**	± 0.025	0.050	mg/L	2025-06-28	
BOD, 5-day	**9.0**	± 1.7	8.0	mg/L	2025-06-30	
Conductivity (EC)	**863**	± 32	2.0	µS/cm	2025-06-27	
Nitrogen, Total Kjeldahl	**2.11**	± 0.24	0.050	mg/L	2025-06-30	
pH	**7.87**	± 0.03	0.10	pH units	2025-06-27	HT2
Phosphorus, Total (as P)	**0.277**	± 0.027	0.0050	mg/L	2025-07-01	
Phosphorus, Total Dissolved	**0.115**	± 0.011	0.0050	mg/L	2025-07-01	
Phosphorus, Dissolved Reactive	**0.0296**	± 0.0025	0.0050	mg/L	2025-06-26	
Solids, Total Suspended	**5.4**	± 1.2	2.0	mg/L	2025-06-28	
Total Metals						
Sodium, total	**85.6**	± 15.6	0.10	mg/L	2025-06-27	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25G0406
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-07-10 12:49

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25G0406-01) | Matrix: Water | Sampled: 2025-07-02 00:00 To 2025-07-03 00:00						FILT, PRES
Anions						
Chloride	**81.8**	± 2.3	0.10	mg/L	2025-07-04	
Nitrate (as N)	**3.53**	± 0.19	0.010	mg/L	2025-07-04	
Nitrite (as N)	**0.051**	± 0.004	0.010	mg/L	2025-07-04	
Calculated Parameters						
Nitrate+Nitrite (as N)	**3.58**		0.0100	mg/L	N/A	
Nitrogen, Total	**5.86**		0.0500	mg/L	N/A	
Nitrogen, Organic	**2.14**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.130**	± 0.023	0.050	mg/L	2025-07-04	
BOD, 5-day	< 8.0		8.0	mg/L	2025-07-10	
Conductivity (EC)	**863**	± 32	2.0	µS/cm	2025-07-05	
Nitrogen, Total Kjeldahl	**2.27**	± 0.26	0.050	mg/L	2025-07-08	
pH	**7.79**	± 0.03	0.10	pH units	2025-07-05	HT2
Phosphorus, Total (as P)	**0.300**	± 0.030	0.0050	mg/L	2025-07-04	
Phosphorus, Total Dissolved	**0.130**	± 0.013	0.0050	mg/L	2025-07-04	
Phosphorus, Dissolved Reactive	**0.0401**	± 0.0033	0.0050	mg/L	2025-07-04	
Solids, Total Suspended	**2.4**	± 0.6	2.0	mg/L	2025-07-04	
Total Metals						
Sodium, total	**84.4**	± 15.4	0.10	mg/L	2025-07-06	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25H1589
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-08-19 15:29

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25H1589-01) | Matrix: Water | Sampled: 2025-08-11 00:00 To 2025-08-12 00:00						FILT, PRES
Anions						
Chloride	**81.6**	± 2.3	0.10	mg/L	2025-08-14	
Nitrate (as N)	**3.07**	± 0.17	0.010	mg/L	2025-08-14	
Nitrite (as N)	**0.080**	± 0.007	0.010	mg/L	2025-08-14	
Calculated Parameters						
Nitrate+Nitrite (as N)	**3.15**		0.0100	mg/L	N/A	
Nitrogen, Total	**5.94**		0.0500	mg/L	N/A	
Nitrogen, Organic	**2.23**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.554**	± 0.090	0.050	mg/L	2025-08-13	
BOD, 5-day	< 8.0		8.0	mg/L	2025-08-19	
Chemical Oxygen Demand	**50**	± 7	20	mg/L	2025-08-14	
Conductivity (EC)	**857**	± 32	2.0	µS/cm	2025-08-13	
Nitrogen, Total Kjeldahl	**2.79**	± 0.31	0.050	mg/L	2025-08-15	
pH	**7.88**	± 0.03	0.10	pH units	2025-08-13	HT2
Phosphorus, Total (as P)	**0.251**	± 0.025	0.0050	mg/L	2025-08-18	
Phosphorus, Total Dissolved	**0.0951**	± 0.0094	0.0050	mg/L	2025-08-18	
Phosphorus, Dissolved Reactive	**0.0489**	± 0.0040	0.0050	mg/L	2025-08-13	
Solids, Total Suspended	**2.4**	± 0.6	2.0	mg/L	2025-08-15	
Total Metals						
Sodium, total	**84.7**	± 15.5	0.10	mg/L	2025-08-16	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25I2905
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-09-26 15:36

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25I2905-01) | Matrix: Water | Sampled: 2025-09-18 00:00 To 2025-09-19 00:00						FILT, PRES
Anions						
Chloride	**87.8**	± 2.5	0.10	mg/L	2025-09-22	
Nitrate (as N)	**4.25**	± 0.23	0.010	mg/L	2025-09-22	
Nitrite (as N)	**0.037**	± 0.003	0.010	mg/L	2025-09-22	
Calculated Parameters						
Nitrate+Nitrite (as N)	**4.29**		0.0100	mg/L	N/A	
Nitrogen, Total	**6.72**		0.0500	mg/L	N/A	
Nitrogen, Organic	**2.14**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.286**	± 0.047	0.050	mg/L	2025-09-26	
BOD, 5-day	< 8.0		8.0	mg/L	2025-09-25	
Chemical Oxygen Demand	**36**	± 7	20	mg/L	2025-09-26	
Conductivity (EC)	**869**	± 32	2.0	µS/cm	2025-09-25	
Nitrogen, Total Kjeldahl	**2.43**	± 0.27	0.050	mg/L	2025-09-26	
pH	**7.57**	± 0.03	0.10	pH units	2025-09-25	HT2
Phosphorus, Total (as P)	**0.632**	± 0.062	0.0050	mg/L	2025-09-24	
Phosphorus, Total Dissolved	**0.401**	± 0.039	0.0050	mg/L	2025-09-24	
Phosphorus, Dissolved Reactive	**0.322**	± 0.026	0.0050	mg/L	2025-09-22	
Solids, Total Suspended	**2.6**	± 0.6	1.8	mg/L	2025-09-25	
Total Metals						
Sodium, total	**100**	± 9	0.10	mg/L	2025-09-25	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25J0611
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-10-10 08:08

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25J0611-01) | Matrix: Water | Sampled: 2025-10-02 00:00 To 2025-10-03 00:00						FILT, PRES
Anions						
Chloride	**95.8**	± 2.7	0.10	mg/L	2025-10-04	
Nitrate (as N)	**4.68**	± 0.26	0.010	mg/L	2025-10-04	
Nitrite (as N)	**0.036**	± 0.003	0.010	mg/L	2025-10-04	
Calculated Parameters						
Nitrate+Nitrite (as N)	**4.72**		0.0100	mg/L	N/A	
Nitrogen, Total	**7.60**		0.0500	mg/L	N/A	
Nitrogen, Organic	**2.25**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.634**	± 0.103	0.050	mg/L	2025-10-08	
BOD, 5-day	< 8.0		8.0	mg/L	2025-10-09	
Chemical Oxygen Demand	**84**	± 8	20	mg/L	2025-10-09	
Conductivity (EC)	**871**	± 32	2.0	µS/cm	2025-10-06	
Nitrogen, Total Kjeldahl	**2.88**	± 0.32	0.050	mg/L	2025-10-08	
pH	**7.66**	± 0.03	0.10	pH units	2025-10-06	HT2
Phosphorus, Total (as P)	**0.381**	± 0.038	0.0050	mg/L	2025-10-07	
Phosphorus, Total Dissolved	**0.178**	± 0.017	0.0050	mg/L	2025-10-07	
Phosphorus, Dissolved Reactive	**0.0835**	± 0.0067	0.0050	mg/L	2025-10-04	
Solids, Total Suspended	**6.2**	± 1.4	1.8	mg/L	2025-10-09	
Total Metals						
Sodium, total	**83.7**	± 7.9	0.10	mg/L	2025-10-07	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25K1726
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-11-21 12:33

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25K1726-01) | Matrix: Water | Sampled: 2025-11-13 00:00 To 2025-11-14 00:00						FILT, PRES
Anions						
Chloride	**77.9**	± 2.2	0.10	mg/L	2025-11-15	
Nitrate (as N)	**5.86**	± 0.32	0.010	mg/L	2025-11-15	
Nitrite (as N)	**0.168**	± 0.014	0.010	mg/L	2025-11-15	
Calculated Parameters						
Nitrate+Nitrite (as N)	**6.03**		0.0100	mg/L	N/A	
Nitrogen, Total	**8.84**		0.0500	mg/L	N/A	
Nitrogen, Organic	**2.04**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.768**	± 0.124	0.050	mg/L	2025-11-17	
BOD, 5-day	< 8.0		8.0	mg/L	2025-11-20	
Chemical Oxygen Demand	**47**	± 7	20	mg/L	2025-11-16	
Conductivity (EC)	**896**	± 33	2.0	µS/cm	2025-11-17	
Nitrogen, Total Kjeldahl	**2.81**	± 0.31	0.050	mg/L	2025-11-21	
pH	**7.74**	± 0.03	0.10	pH units	2025-11-17	HT2
Phosphorus, Total (as P)	**0.495**	± 0.049	0.0050	mg/L	2025-11-20	
Phosphorus, Total Dissolved	**0.341**	± 0.034	0.0050	mg/L	2025-11-20	
Phosphorus, Dissolved Reactive	**0.252**	± 0.020	0.0050	mg/L	2025-11-15	
Solids, Total Suspended	**2.4**	± 0.6	1.8	mg/L	2025-11-17	
Total Metals						
Sodium, total	**89.5**	± 8.4	0.10	mg/L	2025-11-19	

Sample Qualifiers:

FILT	The sample has been filtered for PDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for PDP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25L1792
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-12-18 12:41

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent (FTE) E105004 (25L1792-01) | Matrix: Water | Sampled: 2025-12-11 00:00 To 2025-12-12 00:00						FILT, PRES
Anions						
Chloride	**81.0**	± 2.3	0.10	mg/L	2025-12-14	
Nitrate (as N)	**3.60**	± 0.20	0.010	mg/L	2025-12-14	
Nitrite (as N)	**0.483**	± 0.040	0.010	mg/L	2025-12-14	
Calculated Parameters						
Nitrate+Nitrite (as N)	**4.08**		0.0100	mg/L	N/A	
Nitrogen, Total	**6.51**		0.0500	mg/L	N/A	
Nitrogen, Organic	**1.86**		0.0500	mg/L	N/A	
General Parameters						
Ammonia, Total (as N)	**0.580**	± 0.094	0.050	mg/L	2025-12-15	
BOD, 5-day	**9.7**	± 1.8	8.0	mg/L	2025-12-18	
Chemical Oxygen Demand	**35**	± 7	20	mg/L	2025-12-14	
Conductivity (EC)	**823**	± 30	2.0	µS/cm	2025-12-15	
Nitrogen, Total Kjeldahl	**2.44**	± 0.27	0.050	mg/L	2025-12-17	
pH	**7.28**	± 0.03	0.10	pH units	2025-12-15	HT2
Phosphorus, Total (as P)	**0.404**	± 0.040	0.0050	mg/L	2025-12-17	
Phosphorus, Total Dissolved	**0.163**	± 0.016	0.0050	mg/L	2025-12-17	
Phosphorus, Dissolved Reactive	**0.0984**	± 0.0079	0.0050	mg/L	2025-12-14	
Solids, Total Suspended	**2.4**	± 0.6	1.8	mg/L	2025-12-14	
Total Metals						
Sodium, total	**81.2**	± 7.7	0.10	mg/L	2025-12-17	

Sample Qualifiers:

FILT	The sample has been filtered for PDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for PDP in the laboratory and the holding time has been extended.

Appendix C

Spray Irrigation Areas

Spray Irrigation area

Okanagan Lake

Kalamalka Lake

CITY OF Vernon

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U:\Projects_KEL\1985\0052\0120-Drafting-Design-Analysis\GIS\Projects\MXD\Current\Figure 1 - Spray Irrigation Area 2017 - North.mxd Last updated by bpuda on January 18, 2018 at 11:42:28 AM

Spray Irrigation area

Okanagan Lake

MacKay Reservoir

Kalamalka Lake

N

SMITH RD
KOKANEE CR
SUNSET RD
EASTSIDE RD
CHINOOK RD
KOKANEE RD
PETERS RD
OKANAGAN LANDING RD
COMMONAGE RD
DARKWING DR
BORDER LAKE PL
BORDER LAKE DR
LOONEY POINT
HOOKBILL PL
HOOKBILL DR
LONGSPOON DR
MACKENZIE PRIEST CR
MACKENZIE RIDGE DR

CITY OF Vernon

U:\Projects_KEL\1065\0052\0110-Drafting-Design-Analysis\GIS\Projects\MXD\Current\Figure 2 - Spray Irrigation Area 2017 - South.mxd Last updated by spaulk on January 18, 2018 at 11:43:02 AM

Appendix D

Irrigation Water Quality Results for Clay Valve 4

Caro Analytical Services

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25E2282
PROJECT	MacKay Reservoir Effluent (ME 12215) - EMS	**REPORTED**	2025-05-26 17:00

Analyte	Result	RL	Units	Analyzed	Qualifier
Mackay Reservoir Effluent to Irrigation (Clay Valve 4) E228539 (25E2282-01) | Matrix: Water | Sampled: 2025-05-15					FILT, PRES
Anions					
Chloride	**90.0**	0.10	mg/L	2025-05-16	
Nitrate (as N)	**1.38**	0.010	mg/L	2025-05-16	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-05-16	
Sulfate	**96.0**	1.0	mg/L	2025-05-16	
Calculated Parameters					
Hardness, Dissolved (as CaCO3)	**237**	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**1.38**	0.0100	mg/L	N/A	
Nitrogen, Total	**2.98**	0.0500	mg/L	N/A	
Nitrogen, Organic	**1.17**	0.0500	mg/L	N/A	
Dissolved Metals					
Aluminum, dissolved	**0.0052**	0.0050	mg/L	2025-05-23	
Antimony, dissolved	**0.00033**	0.00020	mg/L	2025-05-23	
Arsenic, dissolved	**0.00088**	0.00050	mg/L	2025-05-23	
Barium, dissolved	**0.0315**	0.0050	mg/L	2025-05-23	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2025-05-23	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2025-05-23	
Boron, dissolved	**0.191**	0.0500	mg/L	2025-05-23	
Cadmium, dissolved	< 0.000010	0.000010	mg/L	2025-05-23	
Calcium, dissolved	**53.5**	0.20	mg/L	2025-05-23	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2025-05-23	
Cobalt, dissolved	**0.00029**	0.00010	mg/L	2025-05-23	
Copper, dissolved	**0.00505**	0.00040	mg/L	2025-05-23	
Iron, dissolved	**0.033**	0.010	mg/L	2025-05-23	
Lead, dissolved	< 0.00020	0.00020	mg/L	2025-05-23	
Lithium, dissolved	**0.0104**	0.00010	mg/L	2025-05-23	
Magnesium, dissolved	**25.2**	0.010	mg/L	2025-05-23	
Manganese, dissolved	**0.0507**	0.00020	mg/L	2025-05-23	
Molybdenum, dissolved	**0.00375**	0.00010	mg/L	2025-05-23	
Nickel, dissolved	**0.00167**	0.00040	mg/L	2025-05-23	
Phosphorus, dissolved	**0.865**	0.050	mg/L	2025-05-23	
Potassium, dissolved	**22.1**	0.10	mg/L	2025-05-23	
Selenium, dissolved	**0.00069**	0.00050	mg/L	2025-05-23	
Silicon, dissolved	**3.1**	1.0	mg/L	2025-05-23	
Silver, dissolved	< 0.000050	0.000050	mg/L	2025-05-23	
Sodium, dissolved	**108**	0.10	mg/L	2025-05-23	
Strontium, dissolved	**0.582**	0.0010	mg/L	2025-05-23	
Sulfur, dissolved	**41.6**	3.0	mg/L	2025-05-23	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2025-05-23	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2025-05-23	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2025-05-23	
Tin, dissolved	< 0.00020	0.00020	mg/L	2025-05-23	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25F3564
PROJECT	MacKay Reservoir Effluent (ME 12215) - EMS	**REPORTED**	2025-07-02 13:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Mackay Reservoir Effluent to Irrigation (Clay Valve 4) E228539 (25F3564-01) | Matrix: Water | Sampled: 2025-06-24 09:30					
Anions					
Chloride	**102**	0.10	mg/L	2025-06-25	
Nitrate (as N)	**1.82**	0.010	mg/L	2025-06-25	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-06-25	
Sulfate	**96.8**	1.0	mg/L	2025-06-25	
Calculated Parameters					
Hardness, Dissolved (as CaCO3)	**230**	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**1.82**	0.0100	mg/L	N/A	
Nitrogen, Total	**3.68**	0.0500	mg/L	N/A	
Nitrogen, Organic	**1.22**	0.0500	mg/L	N/A	
Dissolved Metals					
Aluminum, dissolved	**0.0056**	0.0050	mg/L	2025-06-27	
Antimony, dissolved	**0.00032**	0.00020	mg/L	2025-06-27	
Arsenic, dissolved	**0.00091**	0.00050	mg/L	2025-06-27	
Barium, dissolved	**0.0307**	0.0050	mg/L	2025-06-27	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2025-06-27	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2025-06-27	
Boron, dissolved	**0.173**	0.0500	mg/L	2025-06-27	
Cadmium, dissolved	**0.000034**	0.000010	mg/L	2025-06-27	
Calcium, dissolved	**52.0**	0.20	mg/L	2025-06-27	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2025-06-27	
Cobalt, dissolved	**0.00029**	0.00010	mg/L	2025-06-27	
Copper, dissolved	**0.0135**	0.00040	mg/L	2025-06-27	
Iron, dissolved	**0.044**	0.010	mg/L	2025-06-27	
Lead, dissolved	< 0.00020	0.00020	mg/L	2025-06-27	
Lithium, dissolved	**0.00992**	0.00010	mg/L	2025-06-27	
Magnesium, dissolved	**24.4**	0.010	mg/L	2025-06-27	
Manganese, dissolved	**0.0721**	0.00020	mg/L	2025-06-27	
Molybdenum, dissolved	**0.00327**	0.00010	mg/L	2025-06-27	
Nickel, dissolved	**0.00182**	0.00040	mg/L	2025-06-27	
Phosphorus, dissolved	**0.937**	0.050	mg/L	2025-06-27	
Potassium, dissolved	**20.9**	0.10	mg/L	2025-06-27	
Selenium, dissolved	**0.00082**	0.00050	mg/L	2025-06-27	
Silicon, dissolved	**3.0**	1.0	mg/L	2025-06-27	
Silver, dissolved	< 0.000050	0.000050	mg/L	2025-06-27	
Sodium, dissolved	**102**	0.10	mg/L	2025-06-27	
Strontium, dissolved	**0.576**	0.0010	mg/L	2025-06-27	
Sulfur, dissolved	**37.4**	3.0	mg/L	2025-06-27	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2025-06-27	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2025-06-27	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2025-06-27	
Tin, dissolved	< 0.00020	0.00020	mg/L	2025-06-27	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25G2995
PROJECT	MacKay Reservoir Effluent (ME 12215) - EMS	**REPORTED**	2025-07-28 15:59

Analyte	Result	RL	Units	Analyzed	Qualifier
Mackay Reservoir Effluent to Irrigation (Clay Valve 4) E228539 (25G2995-01) | Matrix: Water | Sampled: 2025-07-21 09:10					
Anions					
Chloride	**93.1**	0.10	mg/L	2025-07-23	
Nitrate (as N)	**0.988**	0.010	mg/L	2025-07-23	
Nitrite (as N)	**0.060**	0.010	mg/L	2025-07-23	
Sulfate	**96.0**	1.0	mg/L	2025-07-23	
Calculated Parameters					
Hardness, Dissolved (as CaCO3)	**253**	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**1.05**	0.0100	mg/L	N/A	
Nitrogen, Total	**3.15**	0.0500	mg/L	N/A	
Nitrogen, Organic	**1.22**	0.0500	mg/L	N/A	
Dissolved Metals					
Aluminum, dissolved	**0.0083**	0.0050	mg/L	2025-07-23	
Antimony, dissolved	**0.00033**	0.00020	mg/L	2025-07-23	
Arsenic, dissolved	**0.00091**	0.00050	mg/L	2025-07-23	
Barium, dissolved	**0.0332**	0.0050	mg/L	2025-07-23	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2025-07-23	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2025-07-23	
Boron, dissolved	**0.195**	0.0500	mg/L	2025-07-23	
Cadmium, dissolved	**0.000010**	0.000010	mg/L	2025-07-23	
Calcium, dissolved	**55.9**	0.20	mg/L	2025-07-23	
Chromium, dissolved	**0.00051**	0.00050	mg/L	2025-07-23	
Cobalt, dissolved	**0.00031**	0.00010	mg/L	2025-07-23	
Copper, dissolved	**0.00450**	0.00040	mg/L	2025-07-23	
Iron, dissolved	**0.060**	0.010	mg/L	2025-07-23	
Lead, dissolved	< 0.00020	0.00020	mg/L	2025-07-23	
Lithium, dissolved	**0.0114**	0.00010	mg/L	2025-07-23	
Magnesium, dissolved	**27.5**	0.010	mg/L	2025-07-23	
Manganese, dissolved	**0.115**	0.00020	mg/L	2025-07-23	
Molybdenum, dissolved	**0.00364**	0.00010	mg/L	2025-07-23	
Nickel, dissolved	**0.00166**	0.00040	mg/L	2025-07-23	
Phosphorus, dissolved	**1.29**	0.050	mg/L	2025-07-23	
Potassium, dissolved	**24.2**	0.10	mg/L	2025-07-23	
Selenium, dissolved	**0.00075**	0.00050	mg/L	2025-07-23	
Silicon, dissolved	**3.5**	1.0	mg/L	2025-07-23	
Silver, dissolved	< 0.000050	0.000050	mg/L	2025-07-23	
Sodium, dissolved	**112**	0.10	mg/L	2025-07-23	
Strontium, dissolved	**0.538**	0.0010	mg/L	2025-07-23	
Sulfur, dissolved	**44.4**	3.0	mg/L	2025-07-23	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2025-07-23	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2025-07-23	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2025-07-23	
Tin, dissolved	< 0.00020	0.00020	mg/L	2025-07-23	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25H3811
PROJECT	MacKay Reservoir Effluent (ME 12215) - EMS	**REPORTED**	2025-09-04 11:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Mackay Reservoir Effluent to Irrigation (Clay Valve 4) E228539 (25H3811-01) | Matrix: Water | Sampled: 2025-08-26 09:10					
Anions					
Chloride	**92.1**	0.10	mg/L	2025-08-29	
Nitrate (as N)	**0.897**	0.010	mg/L	2025-08-29	
Nitrite (as N)	**0.035**	0.010	mg/L	2025-08-29	
Sulfate	**91.3**	1.0	mg/L	2025-08-29	
Calculated Parameters					
Hardness, Dissolved (as CaCO3)	**239**	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**0.932**	0.0100	mg/L	N/A	
Nitrogen, Total	**3.39**	0.0500	mg/L	N/A	
Nitrogen, Organic	**1.42**	0.0500	mg/L	N/A	
Dissolved Metals					
Aluminum, dissolved	< 0.0050	0.0050	mg/L	2025-08-30	
Antimony, dissolved	**0.00036**	0.00020	mg/L	2025-08-30	
Arsenic, dissolved	**0.00095**	0.00050	mg/L	2025-08-30	
Barium, dissolved	**0.0322**	0.0050	mg/L	2025-08-30	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2025-08-30	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2025-08-30	
Boron, dissolved	**0.163**	0.0500	mg/L	2025-08-30	
Cadmium, dissolved	< 0.000010	0.000010	mg/L	2025-08-30	
Calcium, dissolved	**53.2**	0.20	mg/L	2025-08-30	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2025-08-30	
Cobalt, dissolved	**0.00029**	0.00010	mg/L	2025-08-30	
Copper, dissolved	**0.00366**	0.00040	mg/L	2025-08-30	
Iron, dissolved	**0.055**	0.010	mg/L	2025-08-30	
Lead, dissolved	< 0.00020	0.00020	mg/L	2025-08-30	
Lithium, dissolved	**0.00940**	0.00010	mg/L	2025-08-30	
Magnesium, dissolved	**25.8**	0.010	mg/L	2025-08-30	
Manganese, dissolved	**0.136**	0.00020	mg/L	2025-08-30	
Molybdenum, dissolved	**0.00314**	0.00010	mg/L	2025-08-30	
Nickel, dissolved	**0.00171**	0.00040	mg/L	2025-08-30	
Phosphorus, dissolved	**1.34**	0.050	mg/L	2025-08-30	
Potassium, dissolved	**23.9**	0.10	mg/L	2025-08-30	
Selenium, dissolved	**0.00070**	0.00050	mg/L	2025-08-30	
Silicon, dissolved	**3.2**	1.0	mg/L	2025-08-30	
Silver, dissolved	< 0.000050	0.000050	mg/L	2025-08-30	
Sodium, dissolved	**104**	0.10	mg/L	2025-08-30	
Strontium, dissolved	**0.531**	0.0010	mg/L	2025-08-30	
Sulfur, dissolved	**35.6**	3.0	mg/L	2025-08-30	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2025-08-30	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2025-08-30	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2025-08-30	
Tin, dissolved	< 0.00020	0.00020	mg/L	2025-08-30	

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25I3671
PROJECT	MacKay Reservoir Effluent (ME 12215) - EMS	**REPORTED**	2025-10-03 12:11

Analyte	Result	RL	Units	Analyzed	Qualifier
Mackay Reservoir Effluent to Irrigation (Clay Valve 4) E228539 (25I3671-01) | Matrix: Water | Sampled: 2025-09-25 08:10					
Anions					
Chloride	**91.7**	0.10	mg/L	2025-09-26	
Nitrate (as N)	**0.572**	0.010	mg/L	2025-09-26	
Nitrite (as N)	**0.068**	0.010	mg/L	2025-09-26	
Sulfate	**96.6**	1.0	mg/L	2025-09-26	
Calculated Parameters					
Hardness, Dissolved (as CaCO3)	**238**	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**0.640**	0.0100	mg/L	N/A	
Nitrogen, Total	**2.88**	0.0500	mg/L	N/A	
Nitrogen, Organic	**1.04**	0.0500	mg/L	N/A	
Dissolved Metals					
Aluminum, dissolved	< 0.0050	0.0050	mg/L	2025-10-02	
Antimony, dissolved	**0.00030**	0.00020	mg/L	2025-10-02	
Arsenic, dissolved	**0.00090**	0.00050	mg/L	2025-10-02	
Barium, dissolved	**0.0296**	0.0050	mg/L	2025-10-02	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2025-10-02	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2025-10-02	
Boron, dissolved	**0.157**	0.0500	mg/L	2025-10-02	
Cadmium, dissolved	< 0.000010	0.000010	mg/L	2025-10-02	
Calcium, dissolved	**53.2**	0.20	mg/L	2025-10-02	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2025-10-02	
Cobalt, dissolved	**0.00029**	0.00010	mg/L	2025-10-02	
Copper, dissolved	**0.00315**	0.00040	mg/L	2025-10-02	
Iron, dissolved	**0.059**	0.010	mg/L	2025-10-02	
Lead, dissolved	< 0.00020	0.00020	mg/L	2025-10-02	
Lithium, dissolved	**0.00943**	0.00010	mg/L	2025-10-02	
Magnesium, dissolved	**25.6**	0.010	mg/L	2025-10-02	
Manganese, dissolved	**0.152**	0.00020	mg/L	2025-10-02	
Molybdenum, dissolved	**0.00314**	0.00010	mg/L	2025-10-02	
Nickel, dissolved	**0.00178**	0.00040	mg/L	2025-10-02	
Phosphorus, dissolved	**1.43**	0.050	mg/L	2025-10-02	
Potassium, dissolved	**23.9**	0.10	mg/L	2025-10-02	
Selenium, dissolved	**0.00073**	0.00050	mg/L	2025-10-02	
Silicon, dissolved	**3.2**	1.0	mg/L	2025-10-02	
Silver, dissolved	< 0.000050	0.000050	mg/L	2025-10-02	
Sodium, dissolved	**106**	0.10	mg/L	2025-10-02	
Strontium, dissolved	**0.550**	0.0010	mg/L	2025-10-02	
Sulfur, dissolved	**35.0**	3.0	mg/L	2025-10-02	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2025-10-02	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2025-10-02	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2025-10-02	
Tin, dissolved	< 0.00020	0.00020	mg/L	2025-10-02	

Appendix E

Direct to Rise Golf Course Water Quality Results

Caro Analytical Services

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25E2280
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-05-23 12:19

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent to Direct Irrigation (FFE) E229578 (25E2280-01) | Matrix: Water | Sampled: 2025-05-15						
General Parameters						
BOD, 5-day	< 2.0		8.0	mg/L	2025-05-22	
pH	**7.81**	± 0.03	0.10	pH units	2025-05-22	HT2
Solids, Total Suspended	< 2.2		2.0	mg/L	2025-05-23	
Turbidity	**0.79**	± 0.06	0.10	NTU	2025-05-16	
Microbiological Parameters						
Coliforms, Total (Q-Tray)	< 1		1	MPN/100 mL	2025-05-16	HT4
Coliforms, Fecal (Q-Tray)	< 1		1	MPN/100 mL	2025-05-16	HT4

Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

HT4 The collection date and/or time was not provided. Therefore holding time exceedances cannot be properly identified.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25F0382
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-06-10 12:23

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent to Direct Irrigation (FFE) E229578 (25F0382-01) | Matrix: Water | Sampled: 2025-06-03						
General Parameters						
BOD, 5-day	< 8.0		8.0	mg/L	2025-06-09	
pH	**7.64**	± 0.03	0.10	pH units	2025-06-05	HT2
Solids, Total Suspended	< 2.0		2.0	mg/L	2025-06-09	
Turbidity	**0.76**	± 0.05	0.10	NTU	2025-06-04	
Microbiological Parameters						
Coliforms, Total (Q-Tray)	**1**		1	MPN/100 mL	2025-06-04	HT4
Coliforms, Fecal (Q-Tray)	< 1		1	MPN/100 mL	2025-06-04	HT4

Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

HT4 The collection date and/or time was not provided. Therefore holding time exceedances cannot be properly identified.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25G1149
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-07-15 14:02

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent to Direct Irrigation (FFE) E229578 (25G1149-01) | Matrix: Water | Sampled: 2025-07-08 08:30						
General Parameters						
BOD, 5-day	< 8.0		8.0	mg/L	2025-07-15	
pH	**7.66**	± 0.03	0.10	pH units	2025-07-12	HT2
Solids, Total Suspended	< 2.0		2.0	mg/L	2025-07-11	
Turbidity	**0.47**	± 0.04	0.10	NTU	2025-07-09	
Microbiological Parameters						
Coliforms, Total (Q-Tray)	< 1		1	MPN/100 mL	2025-07-09	
Coliforms, Fecal (Q-Tray)	< 1		1	MPN/100 mL	2025-07-09	

Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25H1199
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-08-18 11:35

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent to Direct Irrigation (FFE) E229578 (25H1199-01) | Matrix: Water | Sampled: 2025-08-08 08:30						
General Parameters						
BOD, 5-day	< 8.0		8.0	mg/L	2025-08-14	
pH	**7.15**	± 0.03	0.10	pH units	2025-08-13	HT2
Solids, Total Suspended	< 2.0		2.0	mg/L	2025-08-15	
Turbidity	**0.48**	± 0.04	0.10	NTU	2025-08-10	
Microbiological Parameters						
Coliforms, Total (Q-Tray)	**11**		1	MPN/100 mL	2025-08-09	
Coliforms, Fecal (Q-Tray)	**11**		1	MPN/100 mL	2025-08-09	

Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25I2701
PROJECT	Final Treated Effluent (ME12215) - EMS	**REPORTED**	2025-09-25 15:08

Analyte	Result	Uncertainty	RL	Units	Analyzed	Qualifier
VWRC Treated Effluent to Direct Irrigation (FFE) E229578 (25I2701-01) | Matrix: Water | Sampled: 2025-09-18 08:30						
General Parameters						
BOD, 5-day	< 8.0		8.0	mg/L	2025-09-25	
pH	**6.92**	± 0.03	0.10	pH units	2025-09-19	HT2
Solids, Total Suspended	**2.6**	± 0.6	1.8	mg/L	2025-09-24	
Turbidity	**0.63**	± 0.05	0.10	NTU	2025-09-21	
Microbiological Parameters						
Coliforms, Total (Q-Tray)	< 1		1	MPN/100 mL	2025-09-19	
Coliforms, Fecal (Q-Tray)	< 1		1	MPN/100 mL	2025-09-19	
VWRC Treated Effluent to Direct Irrigation (FFE) E229578 (25I2701-02) | Matrix: Water | Sampled: 2025-09-18 08:30						
General Parameters						
BOD, 5-day	< 8.0		8.0	mg/L	2025-09-25	
pH	**6.95**	± 0.03	0.10	pH units	2025-09-19	HT2
Solids, Total Suspended	**2.6**	± 0.6	1.8	mg/L	2025-09-24	
Turbidity	**0.79**	± 0.06	0.10	NTU	2025-09-21	
Microbiological Parameters						
Coliforms, Total (Q-Tray)	**6**		1	MPN/100 mL	2025-09-19	
Coliforms, Fecal (Q-Tray)	**2**		1	MPN/100 mL	2025-09-19	

Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

Appendix F

Bailey Springs Water Quality Results

Caro Analytical Services

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25A3025
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-02-06 08:51

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25A3025-01) | Matrix: Water | Sampled: 2025-01-30					FILT, PRES
Anions					
Chloride	**163**	0.10	mg/L	2025-01-31	
Nitrate (as N)	**0.194**	0.010	mg/L	2025-01-31	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-01-31	
Calculated Parameters					
Nitrate+Nitrite (as N)	**0.194**	0.0100	mg/L	N/A	
Nitrogen, Total	**0.692**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.447**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	**0.051**	0.050	mg/L	2025-02-04	
Conductivity (EC)	**1430**	2.0	µS/cm	2025-01-31	
Nitrogen, Total Kjeldahl	**0.498**	0.050	mg/L	2025-02-04	
pH	**8.42**	0.10	pH units	2025-01-31	HT2
Phosphorus, Total (as P)	**0.112**	0.0050	mg/L	2025-02-01	
Phosphorus, Total Dissolved	**0.107**	0.0050	mg/L	2025-02-01	
Phosphorus, Dissolved Reactive	**0.105**	0.0050	mg/L	2025-02-01	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**344**	1	MPN/100 mL	2025-01-30	
Coliforms, Fecal (Q-Tray)	**75**	1	MPN/100 mL	2025-01-30	
Total Metals					
Sodium, total	**153**	0.10	mg/L	2025-02-03	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25B2740
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-03-05 07:49

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25B2740-01) | Matrix: Water | Sampled: 2025-02-26					FILT, PRES
Anions					
Chloride	**175**	0.10	mg/L	2025-02-27	
Nitrate (as N)	**0.649**	0.010	mg/L	2025-02-27	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-02-27	
Calculated Parameters					
Nitrate+Nitrite (as N)	**0.649**	0.100	mg/L	N/A	
Nitrogen, Total	**1.18**	0.100	mg/L	N/A	
Nitrogen, Organic	**0.526**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-03-04	
Conductivity (EC)	**1370**	2.0	µS/cm	2025-02-27	
Nitrogen, Total Kjeldahl	**0.526**	0.050	mg/L	2025-03-04	
pH	**8.36**	0.10	pH units	2025-02-27	HT2
Phosphorus, Total (as P)	**0.159**	0.0050	mg/L	2025-02-27	
Phosphorus, Total Dissolved	**0.133**	0.0050	mg/L	2025-02-27	
Phosphorus, Dissolved Reactive	**0.122**	0.0050	mg/L	2025-02-27	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**517**	1	MPN/100 mL	2025-02-26	
Coliforms, Fecal (Q-Tray)	**19**	1	MPN/100 mL	2025-02-26	
Total Metals					
Sodium, total	**130**	0.10	mg/L	2025-03-03	
Bailey Springs Duplicate (25B2740-02) | Matrix: Water | Sampled: 2025-02-26					FILT, PRES
Anions					
Chloride	**174**	0.10	mg/L	2025-02-27	
Nitrate (as N)	**0.630**	0.010	mg/L	2025-02-27	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-02-27	
Calculated Parameters					
Nitrate+Nitrite (as N)	**0.630**	0.100	mg/L	N/A	
Nitrogen, Total	**1.21**	0.100	mg/L	N/A	
Nitrogen, Organic	**0.579**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-03-04	
Conductivity (EC)	**1390**	2.0	µS/cm	2025-02-27	
Nitrogen, Total Kjeldahl	**0.579**	0.050	mg/L	2025-03-04	
pH	**8.38**	0.10	pH units	2025-02-27	HT2
Phosphorus, Total (as P)	**0.150**	0.0050	mg/L	2025-02-28	
Phosphorus, Total Dissolved	**0.126**	0.0050	mg/L	2025-02-28	

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25B2740
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-03-05 07:49

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs Duplicate (25B2740-02) | Matrix: Water | Sampled: 2025-02-26, Continued					FILT, PRES
General Parameters, Continued					
Phosphorus, Dissolved Reactive	**0.122**	0.0050	mg/L	2025-02-27	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**645**	1	MPN/100 mL	2025-02-26	
Coliforms, Fecal (Q-Tray)	**11**	1	MPN/100 mL	2025-02-26	
Total Metals					
Sodium, total	**132**	0.10	mg/L	2025-03-03	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25C3601
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-04-07 13:43

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25C3601-01) | Matrix: Water | Sampled: 2025-03-31					FILT, PRES
Anions					
Chloride	**181**	0.10	mg/L	2025-04-02	
Nitrate (as N)	**0.318**	0.010	mg/L	2025-04-02	HT1
Nitrite (as N)	< 0.010	0.010	mg/L	2025-04-02	HT1
Calculated Parameters					
Nitrate+Nitrite (as N)	**0.318**	0.0100	mg/L	N/A	
Nitrogen, Total	**0.950**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.632**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-04-02	
Conductivity (EC)	**1410**	2.0	µS/cm	2025-04-02	
Nitrogen, Total Kjeldahl	**0.632**	0.050	mg/L	2025-04-04	
pH	**8.33**	0.10	pH units	2025-04-02	HT2
Phosphorus, Total (as P)	**0.160**	0.0050	mg/L	2025-04-03	
Phosphorus, Total Dissolved	**0.106**	0.0050	mg/L	2025-04-03	
Phosphorus, Dissolved Reactive	**0.0826**	0.0050	mg/L	2025-04-03	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**363**	1	MPN/100 mL	2025-03-31	
Coliforms, Fecal (Q-Tray)	**30**	1	MPN/100 mL	2025-03-31	
Total Metals					
Sodium, total	**143**	0.10	mg/L	2025-04-06	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT1	The sample was prepared and/or analyzed past the recommended holding time.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25D2475
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-04-25 11:15

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25D2475-01) | Matrix: Water | Sampled: 2025-04-16 00:00 To 2025-04-17 00:00					FILT, PRES
Anions					
Chloride	**180**	0.10	mg/L	2025-04-19	
Nitrate (as N)	**0.228**	0.010	mg/L	2025-04-19	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-04-19	
Calculated Parameters					
Nitrate+Nitrite (as N)	**0.228**	0.0100	mg/L	N/A	
Nitrogen, Total	**0.740**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.512**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-04-22	
Conductivity (EC)	**1420**	2.0	µS/cm	2025-04-19	
Nitrogen, Total Kjeldahl	**0.512**	0.050	mg/L	2025-04-25	
pH	**8.37**	0.10	pH units	2025-04-19	HT2
Phosphorus, Total (as P)	**0.102**	0.0050	mg/L	2025-04-23	
Phosphorus, Total Dissolved	**0.0893**	0.0050	mg/L	2025-04-23	
Phosphorus, Dissolved Reactive	**0.0839**	0.0050	mg/L	2025-04-18	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**2420**	1	MPN/100 mL	2025-04-17	
Coliforms, Fecal (Q-Tray)	**1**	1	MPN/100 mL	2025-04-17	
Total Metals					
Sodium, total	**147**	0.10	mg/L	2025-04-24	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25E4209
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-06-06 16:51

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25E4209-01) | Matrix: Water | Sampled: 2025-05-30					FILT, PRES
Anions					
Chloride	**184**	0.10	mg/L	2025-05-31	
Nitrate (as N)	< 0.010	0.010	mg/L	2025-05-31	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-05-31	
Calculated Parameters					
Nitrate+Nitrite (as N)	< 0.0100	0.0100	mg/L	N/A	
Nitrogen, Total	**0.719**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.719**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-06-04	
Conductivity (EC)	**1430**	2.0	µS/cm	2025-06-04	
Nitrogen, Total Kjeldahl	**0.719**	0.050	mg/L	2025-06-06	
pH	**8.44**	0.10	pH units	2025-06-04	HT2
Phosphorus, Total (as P)	**0.140**	0.0050	mg/L	2025-06-05	
Phosphorus, Total Dissolved	**0.140**	0.0050	mg/L	2025-06-05	
Phosphorus, Dissolved Reactive	**0.108**	0.0050	mg/L	2025-05-31	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**3090**	1	MPN/100 mL	2025-05-30	
Coliforms, Fecal (Q-Tray)	**727**	1	MPN/100 mL	2025-05-30	
Total Metals					
Sodium, total	**147**	0.10	mg/L	2025-06-05	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25F3517
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-07-02 13:23

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25F3517-01) | Matrix: Water | Sampled: 2025-06-24					FILT, PRES
Anions					
Chloride	**182**	0.10	mg/L	2025-06-25	
Nitrate (as N)	< 0.010	0.010	mg/L	2025-06-25	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-06-25	
Calculated Parameters					
Nitrate+Nitrite (as N)	< 0.0100	0.0100	mg/L	N/A	
Nitrogen, Total	**0.604**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.604**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-06-28	
Conductivity (EC)	**1350**	2.0	µS/cm	2025-06-27	
Nitrogen, Total Kjeldahl	**0.604**	0.050	mg/L	2025-06-30	
pH	**8.41**	0.10	pH units	2025-06-27	HT2
Phosphorus, Total (as P)	**0.148**	0.0050	mg/L	2025-07-01	
Phosphorus, Total Dissolved	**0.126**	0.0050	mg/L	2025-07-01	
Phosphorus, Dissolved Reactive	**0.120**	0.0050	mg/L	2025-06-26	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**38700**	1	MPN/100 mL	2025-06-25	HT4
Coliforms, Fecal (Q-Tray)	**261**	1	MPN/100 mL	2025-06-25	HT4
Total Metals					
Sodium, total	**139**	0.10	mg/L	2025-06-26	

Sample Qualifiers:

FILT	The sample has been filtered for DP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
HT4	The collection date and/or time was not provided. Therefore holding time exceedances cannot be properly identified.
PRES	Sample has been preserved for DP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25G3027
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-07-28 16:13

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25G3027-01) | Matrix: Water | Sampled: 2025-07-21 09:30					
Anions					
Chloride	**169**	0.10	mg/L	2025-07-23	
Nitrate (as N)	< 0.010	0.010	mg/L	2025-07-23	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-07-23	
Calculated Parameters					
Nitrate+Nitrite (as N)	< 0.0100	0.0100	mg/L	N/A	
Nitrogen, Total	**0.643**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.421**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	**0.222**	0.050	mg/L	2025-07-25	
Conductivity (EC)	**1360**	2.0	µS/cm	2025-07-22	
Nitrogen, Total Kjeldahl	**0.643**	0.050	mg/L	2025-07-28	
pH	**8.49**	0.10	pH units	2025-07-22	HT2
Phosphorus, Total (as P)	**0.169**	0.0050	mg/L	2025-07-28	
Phosphorus, Total Dissolved	**0.143**	0.0050	mg/L	2025-07-28	
Phosphorus, Dissolved Reactive	**0.120**	0.0050	mg/L	2025-07-23	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**16200**	1	MPN/100 mL	2025-07-22	
Coliforms, Fecal (Q-Tray)	**548**	1	MPN/100 mL	2025-07-22	
Total Metals					
Sodium, total	**143**	0.10	mg/L	2025-07-25	

Sample Qualifiers:

HT2 The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25H1768
PROJECT	Centrifuged Biosolids Cake	**REPORTED**	2025-08-20 14:50

Analyte	Result	RL	Units	Analyzed	Qualifier
Biosolids (25H1768-01) | Matrix: Biosolids | Sampled: 2025-08-12					
General Parameters					
Moisture	**77.1**	1.0	% wet	2025-08-18	
Nitrogen, Total Kjeldahl	**5.99**	0.0004	% dry	2025-08-20	
Solids, Total	**22.9**	0.1	% wet	2025-08-18	
Solids, Volatile	**86.3**	0.1	% dry	2025-08-18	
Strong Acid Leachable Metals					
Aluminum	**1080**	40	mg/kg dry	2025-08-20	
Antimony	**0.67**	0.10	mg/kg dry	2025-08-20	
Arsenic	**1.30**	0.30	mg/kg dry	2025-08-20	
Barium	**65.7**	1.0	mg/kg dry	2025-08-20	
Beryllium	< 0.10	0.10	mg/kg dry	2025-08-20	
Bismuth	**15.3**	0.10	mg/kg dry	2025-08-20	
Boron	**15.9**	2.0	mg/kg dry	2025-08-20	
Cadmium	**0.493**	0.040	mg/kg dry	2025-08-20	
Calcium	**5410**	100	mg/kg dry	2025-08-20	
Chromium	**6.7**	1.0	mg/kg dry	2025-08-20	
Cobalt	**0.95**	0.10	mg/kg dry	2025-08-20	
Copper	**253**	0.40	mg/kg dry	2025-08-20	
Iron	**1920**	20.0	mg/kg dry	2025-08-20	
Lead	**5.76**	0.20	mg/kg dry	2025-08-20	
Lithium	**0.63**	0.10	mg/kg dry	2025-08-20	
Magnesium	**5100**	10	mg/kg dry	2025-08-20	
Manganese	**58.3**	0.40	mg/kg dry	2025-08-20	
Mercury	**0.261**	0.040	mg/kg dry	2025-08-20	
Molybdenum	**5.80**	0.10	mg/kg dry	2025-08-20	
Nickel	**7.49**	0.60	mg/kg dry	2025-08-20	
Phosphorus	**16300**	10	mg/kg dry	2025-08-20	
Potassium	**4310**	40	mg/kg dry	2025-08-20	
Selenium	**4.26**	0.20	mg/kg dry	2025-08-20	
Silver	**0.89**	0.10	mg/kg dry	2025-08-20	
Sodium	**397**	50	mg/kg dry	2025-08-20	
Strontium	**46.4**	0.20	mg/kg dry	2025-08-20	
Sulfur	**4440**	1000	mg/kg dry	2025-08-20	
Tellurium	< 0.10	0.10	mg/kg dry	2025-08-20	
Thallium	< 0.10	0.10	mg/kg dry	2025-08-20	
Thorium	< 0.50	0.50	mg/kg dry	2025-08-20	
Tin	**12.8**	0.20	mg/kg dry	2025-08-20	
Titanium	**29.4**	1.0	mg/kg dry	2025-08-20	
Tungsten	**0.46**	0.20	mg/kg dry	2025-08-20	
Uranium	**6.19**	0.050	mg/kg dry	2025-08-20	
Vanadium	**3.3**	1.0	mg/kg dry	2025-08-20	
Zinc	**347**	2.0	mg/kg dry	2025-08-20	
Zirconium	**3.6**	2.0	mg/kg dry	2025-08-20	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25I3666
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-10-03 12:08

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25I3666-01) | Matrix: Water | Sampled: 2025-09-25					FILT, PRES
Anions					
Chloride	**153**	0.10	mg/L	2025-09-26	
Nitrate (as N)	**0.019**	0.010	mg/L	2025-09-26	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-09-26	
Calculated Parameters					
Nitrate+Nitrite (as N)	**0.0189**	0.0100	mg/L	N/A	
Nitrogen, Total	**0.710**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.691**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-09-30	
Conductivity (EC)	**1340**	2.0	µS/cm	2025-09-29	
Nitrogen, Total Kjeldahl	**0.691**	0.050	mg/L	2025-10-02	
pH	**8.47**	0.10	pH units	2025-09-29	HT2
Phosphorus, Total (as P)	**0.159**	0.0050	mg/L	2025-10-01	
Phosphorus, Total Dissolved	**0.128**	0.0050	mg/L	2025-10-01	
Phosphorus, Dissolved Reactive	**0.118**	0.0050	mg/L	2025-09-27	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**13800**	1	MPN/100 mL	2025-09-26	HT4
Coliforms, Fecal (Q-Tray)	**435**	1	MPN/100 mL	2025-09-26	HT4
Total Metals					
Sodium, total	**143**	0.10	mg/L	2025-10-02	

Sample Qualifiers:

FILT	The sample has been filtered for PDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
HT4	The collection date and/or time was not provided. Therefore holding time exceedances cannot be properly identified.
PRES	Sample has been preserved for PDP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25J3648
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-11-03 10:44

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25J3648-01) | Matrix: Water | Sampled: 2025-10-27 10:30					FILT, PRES
Anions					
Chloride	**149**	0.10	mg/L	2025-10-28	
Nitrate (as N)	< 0.010	0.010	mg/L	2025-10-28	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-10-28	
Calculated Parameters					
Nitrate+Nitrite (as N)	< 0.0100	0.0100	mg/L	N/A	
Nitrogen, Total	**0.595**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.595**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-11-01	
Conductivity (EC)	**1350**	2.0	µS/cm	2025-10-29	
Nitrogen, Total Kjeldahl	**0.595**	0.050	mg/L	2025-11-01	
pH	**8.39**	0.10	pH units	2025-10-29	HT2
Phosphorus, Total (as P)	**0.120**	0.0050	mg/L	2025-10-30	
Phosphorus, Total Dissolved	**0.108**	0.0050	mg/L	2025-10-30	
Phosphorus, Dissolved Reactive	**0.0900**	0.0050	mg/L	2025-10-28	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**4410**	1	MPN/100 mL	2025-10-27	
Coliforms, Fecal (Q-Tray)	**326**	1	MPN/100 mL	2025-10-27	
Total Metals					
Sodium, total	**137**	0.10	mg/L	2025-10-30	

Sample Qualifiers:

FILT	The sample has been filtered for Dissolved P in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for Dissolved P in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25K1854
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-11-24 09:25

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25K1854-01) | Matrix: Water | Sampled: 2025-11-17 07:30					FILT, PRES
Anions					
Chloride	**157**	0.10	mg/L	2025-11-19	
Nitrate (as N)	< 0.010	0.010	mg/L	2025-11-19	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-11-19	
Calculated Parameters					
Nitrate+Nitrite (as N)	< 0.0100	0.0100	mg/L	N/A	
Nitrogen, Total	**0.574**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.574**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-11-18	
Conductivity (EC)	**1360**	2.0	µS/cm	2025-11-18	
Nitrogen, Total Kjeldahl	**0.574**	0.050	mg/L	2025-11-21	
pH	**8.31**	0.10	pH units	2025-11-18	HT2
Phosphorus, Total (as P)	**0.104**	0.0050	mg/L	2025-11-21	
Phosphorus, Total Dissolved	**0.0966**	0.0050	mg/L	2025-11-21	
Phosphorus, Dissolved Reactive	**0.0898**	0.0050	mg/L	2025-11-20	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**1300**	1	MPN/100 mL	2025-11-18	
Coliforms, Fecal (Q-Tray)	**23**	1	MPN/100 mL	2025-11-18	
Total Metals					
Sodium, total	**145**	0.10	mg/L	2025-11-19	

Sample Qualifiers:

FILT	The sample has been filtered for PDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for PDP in the laboratory and the holding time has been extended.

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Vernon Water Reclamation, City of	**WORK ORDER**	25L0602
PROJECT	Bailey Springs (ME12215) - EMS	**REPORTED**	2025-12-09 14:00

Analyte	Result	RL	Units	Analyzed	Qualifier
Bailey Springs 0500578 (25L0602-01) | Matrix: Water | Sampled: 2025-12-03 07:45					FILT, PRES
Anions					
Chloride	**165**	0.10	mg/L	2025-12-05	
Nitrate (as N)	**0.029**	0.010	mg/L	2025-12-05	
Nitrite (as N)	< 0.010	0.010	mg/L	2025-12-05	
Calculated Parameters					
Nitrate+Nitrite (as N)	**0.0292**	0.0100	mg/L	N/A	
Nitrogen, Total	**0.544**	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.515**	0.0500	mg/L	N/A	
General Parameters					
Ammonia, Total (as N)	< 0.050	0.050	mg/L	2025-12-08	
Conductivity (EC)	**1360**	2.0	µS/cm	2025-12-05	
Nitrogen, Total Kjeldahl	**0.515**	0.050	mg/L	2025-12-09	
pH	**8.33**	0.10	pH units	2025-12-05	HT2
Phosphorus, Total (as P)	**0.107**	0.0050	mg/L	2025-12-08	
Phosphorus, Total Dissolved	**0.0975**	0.0050	mg/L	2025-12-08	
Phosphorus, Dissolved Reactive	**0.0922**	0.0050	mg/L	2025-12-05	
Microbiological Parameters					
Coliforms, Total (Q-Tray)	**1410**	1	MPN/100 mL	2025-12-04	
Coliforms, Fecal (Q-Tray)	**12**	1	MPN/100 mL	2025-12-04	
Total Metals					
Sodium, total	**145**	0.10	mg/L	2025-12-06	

Sample Qualifiers:

FILT	The sample has been filtered for PDP in the laboratory. Results may not reflect conditions at the time of sampling.
HT2	The 15 minute recommended holding time (from sampling to analysis) has been exceeded - field analysis is recommended.
PRES	Sample has been preserved for PDP in the laboratory and the holding time has been extended.

Appendix G

2025 Reclaimed Water Irrigation Groundwater Monitoring Program

Associated Environmental Consultants Inc.

Associated Environmental | AN ASSOCIATED ENGINEERING COMPANY

REPORT

City of Vernon

Reclaimed Water Irrigation 2025 Groundwater Monitoring Report









MARCH 2026

carbon neutral since 2009

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CANADA BEST MANAGED COMPANIES Platinum member

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1 INTRODUCTION

1.1 Background

The City of Vernon (the City) treats municipal wastewater at the Vernon Water Reclamation Centre. The treated wastewater (referred to as "reclaimed water") is then stored in the MacKay Reservoir and used to irrigate approximately 1,500 ha of agricultural land on the south side of the city. The irrigation program is authorized by the BC Ministry of Environment and Parks (ENV) through Operational Certificate (OC) ME 12215 (MOE 2008). Under the OC, groundwater monitoring must be completed each year and an annual report submitted to ENV.

In 2010, the City retained Summit Environmental Consultants Inc. (now Associated Environmental Consultants Inc. [Associated]) to design and implement a groundwater monitoring program to assess the potential impacts of the reclaimed water irrigation operations on groundwater (Summit 2010). The groundwater monitoring program has been completed annually since that time, and reports are submitted to ENV each year. This report presents the results of the 2025 monitoring program. For more details on the historical program, see the previous annual reports (Summit 2010; Associated 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025).

1.2 Objective and Scope

The objective of the 2025 monitoring program was to monitor for potential effects of irrigation operations on groundwater, as required under Section 8.6 of the OC (MOE 2008). To meet this objective, Associated completed the annual groundwater sampling program from a network of monitoring and domestic wells, compared the water quality data to applicable guidelines and historical data, and prepared an annual report (this document) that discusses the results of the 2025 monitoring program. In addition, Associated compared water quality data for Bailey Springs[1] (provided by the City) to applicable guidelines and historical data, and included the results in this report.

1.3 Study Area

The City's reclaimed water irrigation distribution system is located on the lands between Kalamalka and Okanagan Lakes, as shown in Figure 1-1. The study area includes lands within and south of the city limits to just beyond the MacKay Reservoir, including Townships 9, 10, 13, and 14.

The study area includes a northeast–southwest-trending ridge (the Commonage Ridge) (Figure 1-1), where Commonage Road bisects the top of the ridge that descends to Okanagan Lake (northwest) and Kalamalka Lake (southeast). Several gullies with ephemeral streams draining toward Okanagan Lake are located on the bench lands to the west and east of Commonage Road.

Reclaimed water is applied to five major areas: the Rise Golf Course, the Vernon Golf and Country Club, the Predator Ridge Golf Resort, individual private properties in the Commonage area, and the City-managed area on the hillside northwest of Commonage Road. The current groundwater monitoring program focuses on the reclaimed water that is applied to the City-managed area on the hillside northwest of Commonage Road (Figure 1-1). Land use in this irrigated area includes forage production, livestock grazing, irrigated pasture, and a forest tree seedling nursery. The OC states that the "general philosophy of the operation of the reclaimed water irrigation system shall be for beneficial reuse of reclaimed water" (OC, Section 11.5.1). The City has control over irrigation rates in the City-managed area. For all other

[1] Section 8.9 of the OC requires the City to collect samples from a stream referred to as Bailey Springs (EMS 500578) (MOE 2008). Bailey Springs is a surface watercourse that originates south of the MacKay Reservoir and discharges to Kalamalka Lake.

areas, the City manages irrigation use through Bylaw 4899 (COV 2005) and by providing all lessees with a copy of Appendix A of the OC each year (as required) to remind them of their requirements regarding irrigation rates, aerosol drift, buffers, prevention of surface runoff, and other factors. Over the past several years, the City has been working with the lessees to improve water use practices and reduce instances of over-irrigation, which could cause saturated soils or surface runoff.

Associated prepared a conceptual model of groundwater flow (Associated 2019) to outline the aquifers, groundwater flow, and hydrogeochemistry. This was done to better determine variable groundwater chemistry results and attempt to set background groundwater monitoring wells. Since the conceptual model was initially developed, minor updates have been completed annually, including updates to cross-sections (Associated 2020) and groundwater level data (Associated 2025). A summary of this conceptual model is provided in Section 2.

ALTHOUGH ASSOCIATED HAS TAKEN THE EFFORT AND DUE CARE TO ENSURE THE ACCURACY OF THE INFORMATION DISPLAYED AT THE DATE OF PRODUCTION, THE USER ACKNOWLEDGES THAT CHANGES OVER TIME AND THE CURRENCY OF THE DATASET(S) MAY IMPACT THE ACCURACY OF THE INFORMATION WITHOUT NOTICE. ASSOCIATED SHALL NOT BE HELD LIABLE TOWARDS THE RESULTS OBTAINED FROM THE USE OF THIS INFORMATION. SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE ONLY.



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Associated Environmental

LEGEND

- Monitoring Well - Active
- Domestic Monitoring Well - Active
- Bailey Springs
- Commonage Ridge
- Reclaimed Water Irrigated Area

AE PROJECT NO.	2024-8715-00
SCALE	1:30,000
COORD. SYSTEM	NAD 1983 UTM ZONE 11N
DATE	2025-03-07
REV	00
DRAWN BY	MS
CHECKED BY	CI

FIGURE 1-1 RECLAIMED WATER IRRIGATION AREA AND MONITORING WELL NETWORK

CITY OF VERNON

CITY OF VERNON GROUNDWATER MONITORING PROGRAM

2 CONCEPTUAL MODEL OF GROUNDWATER FLOW

Associated (2019) completed an in-depth review of available information to create a conceptual model of groundwater flow. The review focused on the study area north of the Commonage Ridge, as this is where the larger aquifers are located and where the more complex groundwater flow patterns are likely to occur. The following sections summarize that review, supplemented by additional data collected from 2019 to 2025.

2.1 Lithology

Associated (2019) reviewed borehole lithology data from publicly available sources and from well logs of monitoring wells drilled by Associated for other City projects in the area. The lithology observed in the boreholes is consistent with that described by Nasmith (1962) and Fulton et al. (1965). The study area north of the Commonage Ridge comprises undivided glacial deposits (i.e., sand, gravel, clay, and till) along the hillside and predominantly fluvial/alluvial deposits in the valley bottom, which is commonly called Priest Valley.

ENV updated the aquifer mapping for the North Okanagan most recently in 2019; these updates were based on extensive work completed by Hassan et al. (2019). Four aquifers are mapped in the study area (GovBC 2026) (Table 2-1).

Table 2-1 Aquifers in the Study Area

Aquifer Information	Aquifer 346	Aquifer 347	Aquifer 1227	Aquifer 471
Name	South Vernon Unconfined	South Vernon Confined	Okanagan Landing Deep Confined	Unnamed
Productivity	Moderate	High	High	Low
Vulnerability	Moderate	Low	Low	Moderate
Lithology	Likely alluvium or stream terrace deposits	Sands and gravels from alluvium or stream terrace deposits	Sand and gravel dominated, but can be silty; contact with bedrock	Fractured crystalline bedrock; granite and alkali feldspar
Groundwater recharge	Assumed to be from precipitation, leakage from creeks/alluvial fans, and mountain block recharge	Predominantly from leakage through overlying confining unit from Aquifer 346; also from mountain block recharge and leakage from sediments along the valley margins	Expected predominantly from mountain block recharge via seepage from fractures and faults	Likely occurs from direct infiltration of precipitation at bedrock outcrops, slow leakage, and/or from surface water features
Size (km^2)	14.7	6.8	3.75	127.6
Number of registered wells correlated to the aquifer	105	113	7	118
Median well depth (m)	13.7	38.1	112.8	85.34
Number of registered flowing artesian wells	17 (16% of wells)	48 (42% of wells)	2 (29% of wells)	1 (<1% of wells)

Source: GovBC 2026.

Cross-sections generated by Associated (2019) are provided in Appendix A.[2] Figure A-1 shows the locations of the cross-sections. Cross-section A-A′ (Figure A-2) was updated (Associated 2020) given the information in Hassan et al. (2019) to show the distinction between the South Vernon Unconfined Aquifer (Aquifer 346), the South Vernon Confined Aquifer (Aquifer 347), and the Okanagan Landing Deep Confined Aquifer (Aquifer 1227) (the boundaries between these units are extrapolated and have not been confirmed).

Cross-sections B-B′ and C-C′ (Figures A-3 and A-4, respectively) show that the lithology on the hillside is complex and that lithological units are not laterally extensive east–west.

2.2 Groundwater Chemistry

Associated (2021) developed trilinear diagrams (i.e., Piper, extended Durov, and Stiff diagrams) to support conceptual model interpretation using data from 2011 to 2020. Trilinear diagrams aid with assessing groundwater "type" and can help classify different groundwater regimes. Groundwater flowing in an aquifer during the natural cycle is influenced by residence time and interaction with the host rock or material along the flow path, and can be generally classified as more freshly recharged (i.e., low mineralization) or having a long residence time (i.e., higher mineralization). Details of this assessment, including the trilinear diagrams, are provided in Associated 2021. The trilinear plots were not updated for this report; the following points summarize the findings from the 2021 assessment:

- Groundwater wells north of the Commonage Ridge typically plot as calcium-bicarbonate, calcium-magnesium, and calcium-sulphate water types, which suggests short to moderate residence times. Wells south of the Commonage Ridge (i.e., DMW-4 and DMW-5) plot as mainly calcium-sulphate.
- Five chemical signatures were evident in the Stiff diagrams:
  - MW11-02 is at the western extent of the study area and has higher concentrations of all ions.
  - WTN 24991 and MW-5 are located centrally along Okanagan Avenue and are flowing artesian. These wells show younger, more recently recharged groundwater.
  - DMW-1, MW-2, WTN 39421, and DMW18-1 are located at the eastern end of the study area, and all except for DMW-1 are installed to relatively similar depths. Although MW-2 is similar to the others, it has a slightly different source influencing its chemistry and may be isolated from the other wells.
  - DMW-3 is the upgradient well and based on groundwater level data (Associated 2025), it is closely tied to surface water. It contains high concentrations of ions and is therefore potentially influenced by other upgradient activities (e.g., road salt, animal pasture).
  - DMW-4 and DMW-5 are located south of the Commonage Ridge and are unique from the others, based on their higher levels of sodium, potassium, and alkalinity.
- Some of the deeper, flowing artesian wells (WTN 24991 and MW-5) exhibit water that is typical of freshly recharged (i.e., younger) groundwater, which is counterintuitive since deeper aquifers typically host older groundwater.[3] A potential reason for this is a pathway of higher transmissivity (e.g., a fracture or fault within the bedrock). WTN 39421 is a flowing artesian well located on Okanagan Avenue that has higher equivalents of sulphate and calcium, suggesting a different aquifer from WTN 24991 and MW-5.

[2] The accuracy of the cross-sections relies on the lithological information from publicly available well logs and the accuracy of the available elevation data. Monitoring wells installed for the Hesperia Landfill groundwater monitoring program (MW17-1, MW17-5, MW17-6, MW2018-1, MW2018-2, MW2018-3) have been surveyed to geodetic datum (+/– 1 cm) (Associated 2019). The ground elevations for other wells used were determined based on elevation data available from the City and have an accuracy of +/– 1 m (COV 2016). The borehole logs used to develop the cross-sections are provided in Associated 2019.

[3] While it is typically the case that deeper aquifers host older groundwater, deeper aquifers can host younger groundwater when the hydraulic conductivity and/or hydraulic gradient is higher.

- Although there is no confirmed lithological log for DMW-1, this well is much shallower than WTN 39421 and is likely installed across a different aquifer. Based on the available lithological data for the study area, DMW-1 and WTN 39421 are likely separated by a 30–40 m thick unit of clay (Figure A-2, in Appendix A). Both wells have similar water quality and similar signatures, which may be due to similar material hosting the aquifers (i.e., although these two wells are separated by a thick clay unit, the geological depositional environment for the aquifers could be similar).

Since groundwater chemistry throughout the study area varies spatially and with depth, it is difficult to ascertain true background water quality for the area. Monitoring well DMW-3 is upgradient of the reclaimed water irrigation area but is installed across a bedrock aquifer and is closely tied to surface water. This makes it unique among other wells within the irrigation area that are typically much deeper and installed in unconsolidated aquifers. Monitoring well MW11-02 is within the irrigation area and has several parameters that are orders of magnitude higher than other wells, suggesting some additional influence(s) compared to other monitoring wells.

3 GROUNDWATER QUALITY

3.1 Methods

3.1.1 Monitoring Network

The groundwater monitoring network consists of monitoring wells and domestic water supply wells, as listed in Table 3-1 and shown in Figure 1-1. Eight of the 10 wells were sampled on October 20 and 21, 2025, at the end of the irrigation season, which aligns with previous sampling programs. WTN 24991 was sampled on December 11, 2025, after delays in obtaining access to the well, while DMW-5 was not sampled as access from the well owner was not secured. Table 3-1 also summarizes the depth to water and depth to bottom of each well in the monitoring program and indicates whether a well log is available. All available well logs are provided in Appendix A.

Table 3-1 2025 Groundwater Monitoring Network and Well Details

Location ID	Well Type	Well Log Available?	Depth to Water	Well Depth	UTM Coordinates (11U)[1]	
					Easting	Northing
MW-2	Monitoring well	Yes (WTN 58804)	2.867 m btoc[2]	15.15 m btoc[2]	335363	5568422
MW-5	Flowing artesian well	No	Flowing artesian	49.8 m btoc[2]	334066	5567984
MW11-02	Monitoring well	Yes	32.642 m btoc[2]	35.498 m btoc[4]	332740	5567306
DMW-1	Private domestic well (dug well)	Possibly WTN 8414[3]	0.380 m btoc[2]	2.4 m[4]	335045	5568305
DMW-3	Monitoring well	Yes (WTN 58803)	3.374 m btoc[2]	6.256 m btoc[2]	334351	5566559
DMW-4	Private domestic well	No	0.6 m btoc[5]	4 m (estimated)[6]	332092	5563015
DMW-5[7]	Private domestic well	No	Flowing artesian	Unknown	332398	5561078
WTN 39421	Water supply well	Yes (WTN 39421)	Flowing artesian	45 m[4]	334975	5568344
WTN 24991	Water supply well	Yes (WTN 24991)	Flowing artesian	113 m[4]	333994	5567989
DMW18-1	Private domestic well	Yes (WTN 1950)	6 m[4]	8.5 m[4]	334611	5568228

[1] UTM coordinates were collected using a hand-held GPS unit with an estimated accuracy of +/– 5 m. [2] Depth is based on field measurements. [3] This is an assumed WTN based on well location and field-measured depth to bottom, but it has not been confirmed. [4] This depth is based on information in the registered well log. [5] Depth to water was measured in September 2018; the wellhead has been inaccessible since that time. [6] This depth is based on anecdotal information from the property owner. [7] This well was not sampled in 2025 due to the inability to obtain access from the well owner. m – metre (taken from registered well log; therefore, it is unknown whether the measurement is below top of casing or below ground); m bg – metres below ground; m btoc – metres below top of casing

This monitoring network is the same one used in 2020, 2021, 2022, 2023, and 2024 (Associated 2021, 2022, 2023, 2024, 2025). Groundwater well DMW18-1 is tested as part of the City's Hesperia Landfill monitoring program (Associated 2026), but data are included in this report for interpretation as this well is a potential domestic receptor in the study area.

3.1.2 Sampling Methodology and Parameters Tested

Groundwater samples were collected following standard BC methods (MOE 2013). Before sampling, groundwater wells were purged to remove at least three times the well volume, until dry or until field parameters stabilized, using a submersible pump, peristaltic pump, or foot valve inertial pumping system, depending on well depth. Field parameters

(i.e., temperature, conductivity, pH, dissolved oxygen, oxidation–reduction potential, and turbidity) were measured using field meters during purging. Domestic wells were generally purged using existing pumps until field parameters stabilized. DMW-1, which is a dug well that cannot be purged, was sampled from a cistern using a bailer. MW-2 and MW-5 were purged using a submersible pump, and MW11-02 was purged using Waterra tubing and a foot valve.

Groundwater samples were collected as grab samples in laboratory-supplied bottles, filtered and preserved in the field (where necessary), and shipped via chain-of-custody protocols to CARO Analytical Services (CARO), an accredited laboratory in Kelowna, BC, for analysis of the following parameters:[4]

- Alkalinity, bromide, chloride, fluoride, sodium, sulphate, total dissolved solids (TDS), hardness (total as $CaCO_3$), and dissolved organic carbon;
- Ammonia-N, nitrate-N, nitrite-N, total Kjeldahl nitrogen (TKN), organic nitrogen, and total nitrogen;
- Orthophosphate, dissolved phosphorus, and total phosphorus; and
- Dissolved metals.

A quality assurance and quality control (QA/QC) program was also followed, which included collecting field duplicate and blank samples. Detailed methods are provided in Section 3.1.5 and the results are in Section 3.2.3.

3.1.3 Comparison to Guidelines

Given the objective of the groundwater monitoring program (i.e., to establish whether irrigating with reclaimed water is impacting groundwater), the groundwater quality results were assessed relative to water quality guidelines. To protect nearby receptors (i.e., domestic wells used for drinking water and irrigation purposes, and groundwater discharging to surface waterbodies), the 2025 groundwater quality results were compared to the following water quality guidelines:

- Guidelines for Canadian Drinking Water Quality (Health Canada DW) (Health Canada 2025);
- BC Source Drinking Water Quality Guidelines (BC DW) (ENV 2020);
- BC Approved and Working Water[5] Quality Guidelines for aquatic life (BC AL) (acute guidelines only), irrigation water (BC IW), livestock water (BC LW), and wildlife (BC WL) (WLRS 2025a, WLRS 2025b); and
- BC *Contaminated Sites Regulation* (CSR) (BC Reg. 375/96) Schedule 3.2, generic numerical water standards for drinking water (DW), irrigation (IW), livestock (LW), and freshwater aquatic life (AW).

Drinking Water

For drinking water, comparison was made to the CSR DW standards and Health Canada DW and BC DW guidelines, as the monitoring program includes domestic wells that are used for drinking water purposes. The Health Canada DW guidelines apply to final, treated water, whereas the BC DW guidelines apply to water sourced for drinking water purposes. Although there is an important difference, the guidelines are applied equally throughout this report given that the program includes testing of domestic wells. This report uses whichever guideline (Health Canada or BC) is more stringent and refers to it as the DW guideline.

[4] DMW18-1, which is sampled quarterly as part of a different monitoring program (Associated 2026), was tested for the same parameters listed here, except for bromide, fluoride, organic nitrogen, dissolved phosphorus, and orthophosphate.
[5] Some BC water quality guidelines are considered working guidelines, but for the purposes of discussion in this report, they are given equal weight as approved guidelines.

The Health Canada DW and BC DW guideline levels are designated as either a maximum acceptable concentration (MAC) or an aesthetic objective (AO) (Health Canada 2025, ENV 2020). The MAC guidelines are based on health risk and are determined based on the known health effects associated with the substance. The AO guidelines apply to those variables that adversely affect taste or the intended, typical water uses (e.g., staining of laundry) but do not pose a health hazard.

After sampling, the results from the domestic supply wells were compared to the Health Canada DW and BC DW guidelines. Associated provided the well owners with a summary of the results and the original laboratory report, as a courtesy for participating in the study and to notify well owners of any drinking water guideline exceedances.

BC Water Quality Guidelines

Note that as per ENV, exceeding a BC Approved or Working Water Quality Guideline does not imply there are unacceptable risks, but rather that the potential for adverse effects may be increased and additional investigation may be required (WLRS 2025a). **Comparing the groundwater results to the BC Approved and Working Water Quality Guidelines (BC AL, BC IW, BC WL, and BC LW) is considered a conservative approach, particularly for the protection of aquatic life.**

Further guidance on applying the aquatic life guidelines specific to groundwater is provided in ENV 2017, which states that CSR AW standards should be used for groundwater samples collected >10 m from the high-water mark of a receiving environment, while water below the high-water mark should be compared to the BC AL. The area between the high-water mark and the 10 m distance is referred to as the dilution zone, where "concentration limits are not specified" and a risk-based approach should be followed (ENV 2017). The CSR AW standards are based on the assumption that groundwater will be diluted at least 10-fold before it is discharged to a receiving waterbody (ENV 2017). Most of the wells included in the program are more than 10 m from the nearest mapped watercourse, but numerous aquatic receiving environments (e.g., streams) exist throughout the project area, and investigations to confirm sample points relative to the high-water mark have not been completed.

3.1.4 Comparison to Background, Reclaimed Water Quality, and Historical Data

Water quality data and guideline exceedances were assessed and interpreted primarily by comparing results to reclaimed water quality and historical data, as well as to the limited background water quality data.

Background Groundwater Quality

The complex hydrogeological setting (Section 2) and extensive nature of the irrigation area makes it difficult to assess background water quality. Of the wells included in the standard monitoring program (Table 3-1), only monitoring well DMW-3 is upgradient of the reclaimed water irrigation area. However, as described in Section 2, DMW-3 likely does not represent background water quality for most wells because it is closely tied to surface water and is installed across fractured bedrock, which has a different chemical signature than the downgradient wells (which are generally installed in unconsolidated sand and gravel material). A review of the lithology in the area indicates that any additional monitoring wells intended for collection of representative upgradient samples would also likely need to be installed across fractured bedrock (similar to DMW-3) because the unconsolidated sediments are very thin on the upper valley walls and are typically not water bearing.

ENV (2023) provides regional background concentrations for select metals for the Thompson-Okanagan Region; these concentrations were used to aid with the interpretation of exceeding values (Section 3.2.2).

Reclaimed Water Quality

In addition to the wells listed in Table 3-1, water quality data collected for the program also included Clay Valve #4, which is at the distribution point after the MacKay Reservoir (i.e., these samples reflect the quality of the reclaimed water before irrigation). This location is sampled monthly by City staff during the irrigation season, as required by the OC (MOE 2008).

In 2025, City staff collected samples at Clay Valve #4 monthly during the irrigation season (i.e., between May and October) and submitted the samples to CARO for analysis of the following parameters:

- Biochemical oxygen demand;
- pH, total suspended solids, TDS, turbidity, chloride, sodium, and sulphate;
- Nitrogen (ammonia-N, nitrate-N, nitrite-N, TKN, organic nitrogen, and total nitrogen);
- Phosphorus (orthophosphate, dissolved phosphorus, and total phosphorus);
- Total coliforms and fecal coliforms; and
- Dissolved metals.

The Clay Valve #4 analytical list includes the parameters required under Section 8.3.4 of the OC, plus chloride, sodium, sulphate, and dissolved metals, which were added to make the list more consistent with groundwater analysis, to aid with interpretation. Each year, the City provides the water quality results from this location to Associated for inclusion in the water quality database.

Historical Water Quality Data

For most of the groundwater sampling locations, the dataset begins in 2011, when the groundwater monitoring program was initiated. The exceptions are DMW18-1 (first tested in 2018) and DMW-3 and MW-2 (part of a previous monitoring program, conducted by ENV between 1979 and 1995). The prior program collected data for DMW-3 from 1989 to 1995 and for MW-2 from 1979 to 1995.

3.1.5 Quality Assurance and Quality Control

The QA/QC measures applied as part of the sampling program conducted by Associated included calibrating instruments before sampling, wearing nitrile gloves, and using either dedicated well equipment or thoroughly decontaminating and rinsing equipment between wells. In addition, a blind duplicate sample was collected at DMW-3. Collection and analysis of duplicate samples provides information on the combined (field and analytical) precision of the sampling and the analytical program. The analytical results for each analyte in each sample of the duplicate pair were compared, and the relative percent difference (RPD) value was calculated for each analyte pair as follows:

$$RPD = \left(\frac{(|a - b|)}{\left(\frac{a + b}{2}\right)} \right) \times 100$$

where *a* and *b* are duplicate pair values in identical units.

An RPD value of 20% or less is generally considered acceptable, whereas an RPD value greater than 20% may indicate a problem with either sampling or analysis (MOE 2013). This limit may vary depending on the analysis involved and the concentration of the analyte. The RPD value also tends to increase as the result approaches the detection limit. Therefore, use of this threshold is restricted to duplicate pair values that are greater than five times their detection limit (MOE 2013).

In addition to collecting duplicate samples, trip and field blank samples were collected. Trip blanks are deionized water in sealed containers that are provided by the laboratory. These are taken into the field and remain in sample coolers during sampling; they are not opened. Field blank samples are deionized water provided by the laboratory, but these samples are handled the same way as monitoring well samples. Bottles are filled in the field using the same procedure for the samples being collected. Laboratory analytical results for both sample types are then compared to the analytical results expected for deionized water.

3.2 Results and Discussion

3.2.1 Guideline Exceedances

Table 3-2 identifies the parameters that exceeded the applicable drinking water, aquatic life, irrigation, and livestock guidelines and/or standards in the 2025 groundwater samples. All 2025 results, tabulated and compared to all applicable guidelines, are included in Appendix B. Plots showing temporal changes in concentrations for these parameters are included in Appendix C. The original laboratory reports for 2025 are provided in Appendix D.

Table 3-2 Exceedances of Applicable Guidelines and/or Standards in Groundwater in 2025

Parameter	DMW-1	DMW-3	DMW-4	MW-2	MW11-02	MW-5	WTN 24991	WTN 39421	DMW18-1
Conductivity (field-measured)	X	X	X	X	X			X	X
pH (field-measured)						X			
Chloride	X	X	X	X	X				
Total dissolved solids	X	X	X	X	X			X	X
Sulphate					X				
Chromium (dissolved)	X				X			X	X
Cobalt (dissolved)					X				
Iron (dissolved)							X	X	
Lithium (dissolved)	X	X	X	X	X				X
Manganese (dissolved)						X	X		
Molybdenum (dissolved)			X	X			X		X
Selenium (dissolved)	X	X		X	X			X	X
Strontium (dissolved)		X			X				
Uranium (dissolved)	X		X	X	X				X

Although dissolved oxygen was below the BC aquatic life guideline in groundwater, it is not included as an exceedance in this table as dissolved oxygen in groundwater is not representative of dissolved oxygen in surface water.
X indicates an exceedance of the applicable guidelines and/or standards (listed in Section 3.1.3), differentiated as follows:
X – exceedance of the applicable drinking water guidelines/standards
X – exceedance of the applicable irrigation, wildlife, and/or livestock water guidelines/standards
□ – exceedance of the applicable aquatic life guidelines/standards

The DW MAC exceedances are considered to represent the highest concern because much of the study area is not serviced by public water supply, and domestic wells are used for consumption purposes. Exceedances of a DW MAC in 2025 included:

- Sulphate (MW11-02);
- Cobalt (MW11-02);
- Lithium[6] (DMW-1, DMW-3, DMW-4, MW-2, MW11-02, and DMW18-1);
- Selenium (DMW-1, MW11-02, and WTN 39421); and
- Uranium (DMW-1 and MW11-02).

3.2.2 Comparison to Background, Reclaimed Water Quality, and Historical Data

The following sections provide a brief interpretation and historical comparison of parameters that exceeded guidelines in groundwater in 2025 (Table 3-2) and key wastewater parameters. Plots showing temporal changes in concentrations for these parameters are included in Appendix C. Historical data can be found in Associated 2018. As described in Section 3.1.4, Clay Valve #4 is the distribution point after the MacKay Reservoir (i.e., the samples collected at Clay Valve #4 reflect the quality of the reclaimed water before irrigation). The results from Clay Valve #4 in 2025 are provided in Appendix B (Table B-3).

3.2.2.1 Routine Parameters

Conductivity and pH

There are no drinking water, aquatic life, or livestock guidelines for conductivity. The BC IW guideline for conductivity varies based on crop type. In 2025, conductivity exceeded the guideline for low-tolerance crops[7] (700 µS/cm) in all wells except MW-5 and WTN 24991, and exceeded the guideline for slightly tolerant crops[8] (1,200 µS/cm) in DMW-3 and MW11-02. Conductivity in the wells has remained relatively consistent since monitoring began (Figure C-1), and it is not measured in Clay Valve #4 (and is not required, according to the OC).

In 2025, field-measured pH met the guidelines in all wells except MW-5 (9.52), which was marginally above the BC LW guideline range (5.0–9.5). Since monitoring began, pH has remained relatively consistent (Figure C-2) and generally in the 7.0–8.0 range except in artesian well MW-5, which consistently has a higher pH (9.0–9.6). In 2025, laboratory-measured pH in Clay Valve #4 water ranged from 7.80 to 8.07.

Chloride

In 2025, chloride concentrations met all guidelines except the most stringent BC and CSR IW (100 mg/L) in DMW-1, DMW-3, DMW-4, MW-2, and MW11-02 (Figure C-3). Chloride in DMW-3 decreased from 298 mg/L in 2014 to 88.7 mg/L in 2021 but has steadily been increasing since then to 212 mg/L in 2025. In the other wells, chloride has generally either decreased or remained relatively consistent, except in DMW-1, where it has steadily increased from <50 mg/L in 2011 to 108 mg/L in 2025. The cause of the increase and the reason it is isolated to DMW-1 and DMW-3 (which is not located in the irrigated area) are unknown.

[6] Neither Health Canada DW nor the BC DW guideline specifies a limit for lithium in drinking water. Because the CSR does not specify standards as either MAC or AO, lithium was assumed to fall in the MAC category. The CSR DW is based on the 2015 United States Environmental Protection Agency's regional screening levels for tap water.
[7] Low-tolerance crops include strawberry, raspberry, bean, and carrot (CCREM 1987).
[8] Slightly tolerant crops include all other fruits and berries, corn, sweet corn, onion, parsnip, radish, pea, pumpkin, lettuce, pepper, muskmelon, sweet potato, potato, celery, cabbage, kohlrabi, cauliflower, cowpea, broadbean, flax, sunflower, and clover (CCREM 1987).

Chloride in Clay Valve #4 was tested in 2003 and 2015–2025 and has remained relatively consistent, with an average of 97.1 mg/L, except for values of 175 mg/L (in July 2003) and 309 mg/L (in May 2024), which are inconsistent with previous results, all of which have remained below 105 mg/L (Figure C-18).

Sulphate

In 2025, sulphate concentrations met the guidelines in all wells except MW11-02 (811 mg/L), which exceeded the DW AO and CSR DW (500 mg/L). Historically, sulphate concentrations in MW11-02 have been approximately double (i.e., ~700 to 900 mg/L) those found in the other monitoring wells (<400 mg/L). Sulphate in MW11-02 has generally increased since monitoring began, but it has remained relatively stable in other wells (Figure C-4). Clay Valve #4 has typically had lower sulphate concentrations (ranging from 91.3 mg/L to 97.5 mg/L in 2025) than all other wells, except for WTN 24991. This suggests that the concentrations in MW11-02 are unrelated to reclaimed water irrigation operations and may caused by other sources (discussed further in Section 3.2.2.2).

Total Dissolved Solids

TDS was added to the monitoring program in 2019. In 2025, TDS in all wells except artesian wells MW-5 and WTN 24991 exceeded the DW AO and BC IW guidelines (500 mg/L). In DMW-3, DMW-4, and MW11-02, TDS also exceeded the BC LW guideline (1,000 mg/L). Concentrations have remained relatively consistent since 2019; however, TDS was highest in 2025 in DMW-3, DMW-4, and WTN 24991 (Figure C-5).

3.2.2.2 Nitrogen

The different forms of nitrogen that make up the total nitrogen in soils and water are organic nitrogen, nitrate, nitrite, ammonia, and ammonium. Some of the organic nitrogen in soils and shallow groundwater is converted by microbes to ammonia and ammonium through the process of ammonification. Ammonium is converted to nitrite and then nitrate through microbial nitrification. Because of these processes, nitrogen in groundwater is typically found primarily as nitrate. Of the nitrogen forms, ammonia is most toxic to aquatic life, and nitrate is of higher concern for human health (i.e., drinking water). In addition, nitrate is an anion (a negatively charged particle) and tends not to bind with clay and organic matter, both of which are also mostly negatively charged. Therefore, it is soluble in water and is transported readily in groundwater via advective flow.

Clay Valve #4

Because inorganic nitrogen is converted readily between forms, it is important to assess all forms of nitrogen in reclaimed water, including total nitrogen. The City is not specifically required to treat for nitrogen under the OC (i.e., no maximum limit is specified), nor are limits set for nitrogen in reclaimed water under the BC *Municipal Wastewater Regulation* (BC Reg. 87/2012). However, in 2005, the treatment system was upgraded to include biological nutrient removal (BNR), which reduces the nitrogen and phosphorus content of wastewater.

Table 3-3 lists the average concentrations of key nitrogen parameters in Clay Valve #4 before BNR (before 2006) and after BNR (i.e., 2006–2025), and the range of concentrations in 2025. The most stringent applicable guidelines are provided in Table 3-3 for context, but note that these guidelines apply to the receiving environment (i.e., groundwater and surface water), not to Clay Valve #4. In 2025, the average concentration of nitrate-N was lower than the average concentrations after BNR was introduced, but average nitrite-N, ammonia-N, and total nitrogen were slightly higher.

Table 3-3 Nitrogen Concentrations in Clay Valve #4 (Average and 2025)

Nitrogen Form	Average Before BNR[1]	Average After BNR[2]	Average in 2025	Range in 2025	Guideline for Comparison Purposes Only
Ammonia-N (mg/L)	9.8	0.593	0.904	0.424–1.24	Drinking water: none Aquatic life:[3] 0.681 to 21.6 mg/L (BC); 1.3 to 18.5 mg/L (CSR)
Nitrate-N (mg/L)	2.0	1.19	1.03	0.561–1.82	Drinking water: 10 mg/L Aquatic life: 32.8 mg/L (BC); 400 mg/L (CSR)
Nitrite-N (mg/L)	0.17	0.033	0.046	<0.010–0.083	Drinking water: 1 mg/L Aquatic life:[4] 0.06 to 0.60 mg/L (BC); 0.2 to 2.0 mg/L (CSR)
Total nitrogen (mg/L)	13.9	2.98	3.21	2.88–3.68	None

For further information on guidelines, refer to Section 3.1.3. [1] The average is based on all available pre-2006 data, which include two samples from 1979 and samples from 1996 to 2005. [2] The average is based on data from 2006 to 2025. [3] The guideline/standard varies based on the water pH and temperature; the range for all temperatures and for pH range of 7.1 to 9.0 is shown (historical pH range for Clay Valve #4). [4] The guideline/standard varies based on the chloride concentration; the range based on chloride concentrations is shown. BNR – biological nutrient removal; CSR – *Contaminated Sites Regulation*

Nitrogen (in Groundwater)

In 2025, ammonia-N, nitrate-N, and nitrite-N in groundwater met all applicable guidelines in all wells. Nitrite-N was below the laboratory detection limit in all wells in 2025. Ammonia-N was detected only in DMW-4, MW-5, and WTN 24991, but concentrations remained below the BC AL acute guideline and CSR AW, both of which are calculated based on the sample pH and temperature. No drinking water, irrigation, livestock, or wildlife guidelines are available for ammonia-N.

Nitrate-N met the applicable guidelines, which range from 10 mg/L (DW MAC and CSR DW) to 400 mg/L (CSR AW), in all wells in 2025, but remained elevated in MW11-02 (7.48 mg/L), where it has historically exceeded the DW MAC (Figure C-6). It has consistently been decreasing since early 2012, when the measured concentration was approximately 20 mg/L. Given that the concentrations in this well are consistently higher than in all other wells and in Clay Valve #4, additional localized nitrate sources are suspected, potentially from the PRT commercial tree seedling nursery that is upgradient of MW11-02.

As reported in previous annual reports (Associated 2022, 2024, 2025), Associated contacted PRT on behalf of the City in 2021 and 2024. PRT indicated they were aware of the elevated nitrate concentrations and had been improving their irrigation and nutrient management through source control (i.e., testing the water before adding nitrogen fertilizer) and constructing a ditch (planted with willows) downslope of their operations to better capture runoff to extract nutrients before infiltration below the rooting zone (O. Bonnefoy, personal communication, 2021, as reported in Associated 2022). As of 2024, they began following a comprehensive nutrient management plan. Fertilizer is injected into the irrigation system (i.e., fertigation) and used to irrigate their commercial crops. Although the fertigation waters are directed onto the crops, some excess water reaches the ground and runs off. The runoff water is collected in a pond and irrigated onto the grass field located between the nursery and the paved trail that runs east–west (J. Sevilla,

personal communication, 2024). The general decrease in nitrate-N since 2022 is a positive sign, but ongoing monitoring of nitrate at MW11-02 and communication with PRT is warranted.

Although nitrate-N in all other wells also remained below the applicable guidelines, it was found at levels that are not likely naturally occurring in some wells. Nitrate can occur naturally in groundwater at low levels, but it mostly results from anthropogenic sources. The key anthropogenic sources of nitrate include agricultural activities (e.g., cattle manure, fertilizers) and human wastewater (e.g., from municipal treatment systems and private septic systems) (Health Canada 2013). The local baseline concentration of nitrate is difficult to determine due to the long history of development and agriculture in the area; however, natural processes typically result in nitrate concentrations of less than 1 mg/L in groundwater in BC, and concentrations above 3 mg/L usually suggest anthropogenic effects (GovBC 2025, Rivera 2014). In 2025, the lowest nitrate concentrations were in DMW-3, MW-5, and WTN 24991 (all below the laboratory detection limit of <0.010 mg/L), followed by DMW-4 and MW-2 (both less than 1 mg/L). Concentrations of nitrate-N were between 1 and 3 mg/L in DMW-1 and WTN 39421, and concentrations were above 3 mg/L in DMW18-1 (3.53 mg/L). The trends in nitrate-N in other wells have been inconsistent since 2011 (Figure C-6). DMW18-1 has experienced significant fluctuation and exceeded the 10 mg/L nitrate-N guideline at times, although concentrations remained below guidelines in 2025. Nitrate-N has generally been decreasing in DMW-4 since 2011. In DMW-1, nitrate increased from 2.43 mg/L in 2011 to a high of 3.79 mg/L in 2023; it was 2.03 mg/L in 2025 but remains below guidelines.

Nitrogen movement through groundwater can vary depending on crop cover, soil texture and organic matter content, and geology and infiltration rate. In some cases, nitrate that infiltrates below the rooting zone can remain in a groundwater system for a long time. Although the reclaimed water use may be contributing somewhat to the detected nitrate levels and the increases noted in DMW-1, the elevated concentration in MW11-02 and fluctuation in DMW18-1 are more likely the result of land use activities (i.e., horticulture, livestock, local residential septic fields, or lawn care products). However, nitrate remains a key parameter of concern, and ongoing monitoring is needed.

3.2.2.3 Phosphorus

The *Municipal Wastewater Regulation* does not set standards for phosphorus in reclaimed water, and there are no applicable guidelines for phosphorus in groundwater. The BC DW AO (0.01 mg/L) and BC AL (0.015 mg/L) guidelines apply only to lakes (ENV 2020, WLRS 2025a), and the other guidelines do not specify limits for total or dissolved phosphorus. However, phosphorus is discussed in this section as it is a key wastewater parameter. As a comparison, at ground dispersal sites (septic fields), inorganic phosphorus (orthophosphate) readily adsorbs onto the surface of soil particles, reducing the likelihood of its transport in groundwater.

Figure C-7 and Figure C-8 show the concentrations of total and dissolved phosphorus in groundwater since 2011. In 2025, the highest total phosphorus concentrations were observed in MW11-02 (0.314 mg/L) and DMW-4 (0.239 mg/L), similar to previous years. Dissolved phosphorus in 2025 was highest in DMW-4 (0.239 mg/L), but dissolved phosphorus in MW2011-02 was considerably lower, at 0.0248 mg/L. Phosphorus concentrations remained relatively consistent throughout the 2011–2025 monitoring period in all wells except MW11-02, which has shown notable fluctuations in total phosphorus only.

Total phosphorus in the reclaimed water at Clay Valve #4 in 2025 ranged from 0.855 to 1.37 mg/L, and dissolved phosphorus ranged from 0.84 to 1.37 mg/L, similar to previous years.

3.2.2.4 Metals

Metals concentrations have exceeded the guidelines since groundwater testing began in 2011. Two possible mechanisms exist by which irrigation with treated effluent could influence metals concentrations in groundwater:

1. Metals may be added to groundwater if they are present at elevated levels in the irrigation water. To assess this condition, the City has been testing metals in Clay Valve #4 samples since 2016.
2. Metals that are naturally present in the soil can be mobilized as irrigation water infiltrates and may result in elevated concentrations in groundwater over time. Note, however, that the average pH of the irrigation water (at Clay Valve #4) is typically near neutral, and heavy metal mobilization generally tends to be more significant when the pH of the water is lower (more acidic) than the observed range (USGS 2016). Some metals, such as selenium, are mobilized more readily when the pH is higher (more alkaline) (WHO 2003).

In 2025, dissolved metals that exceeded the applicable guidelines included chromium, cobalt, iron, lithium, manganese, molybdenum, selenium, strontium, and uranium. Exceedances of dissolved metals guidelines are common in BC, and many metals are naturally occurring. Obtaining representative upgradient samples to assess the range of background levels is difficult, as described in Section 2. Exceedances in groundwater are interpreted by comparing to the concentrations in Clay Valve #4. Regional background concentrations for the Thompson-Okanagan Region, provided in Protocol 9 for Contaminated Sites (ENV 2023) and summarized in Table 3-4, were also used to assess potential background concentrations for the project area.[9]

Table 3-4 Regional Background Concentrations of Exceeding Metals for the Thompson-Okanagan

Parameter	Regional Background Concentration (mg/L)
Chromium	0.019
Cobalt	0.016
Iron	12
Lithium	0.096
Manganese	7.6
Molybdenum	0.045
Selenium	0.120
Strontium	47
Uranium	0.087

Source: ENV 2023.

Figures C-9 to C-17 show the changes in concentrations in these dissolved metals parameters. In all cases, the concentrations measured in 2025 were below the regional background concentrations listed in Table 3-4. Furthermore, concentrations of chromium, cobalt, molybdenum, selenium, strontium, and uranium were also substantially lower in Clay Valve #4 than in the wells that exceeded the guidelines. Lithium is also generally lower in Clay Valve #4 than in the exceeding wells, but less so than the other parameters.

[9] Provincial mapping (iMap BC) shows the area in which these background concentrations apply. The boundary of the applicable area encompasses all wells included in the program except MW11-02, DMW-3, DMW-4, and DMW-5. The background concentrations generally suggest that these metals can be found in the Thompson-Okanagan Region at levels above the applicable guidelines/standards.

The wells in which the highest concentrations are typically found are not consistent across the monitoring program. For example, chromium is highest in DMW-1; cobalt and uranium in MW11-02; lithium, manganese, and strontium in DMW-5 (historically; not tested in 2025); and selenium in WTN 39421. In some cases, concentrations of these exceeding parameters have decreased since monitoring began (e.g., chromium in DMW-1 and WTN 39421, selenium in DMW-1 and DMW18-1, cobalt in MW11-02, and uranium and molybdenum in DMW-4). In other cases, they have generally been consistent. The exceptions that show an increase are molybdenum in DMW18-1, lithium in DMW-1, DMW-3, and MW11-02, and uranium in DMW-1 and MW11-02. Iron has consistently been higher in WTN 24991, except for spikes in MW-2 and DMW-3 between 2019 and 2020, and in WTN 39421, iron has been increasing since 2020.

Based on the concentrations recorded at Clay Valve #4, the regional background concentrations, and the general trends observed in the data, all of the metals exceedances are attributable to sources other than the reclaimed water, including, at least in part, background concentrations.

3.2.3 Quality Assurance and Quality Control

A duplicate sample was collected in DMW-3 in October 2025. After values less than five times their respective detection limit were removed (Section 3.1.5), the RPD ranged from 0.4 to 8.6% (average 1.8%). Results from the trip blank and field blank samples were consistent with those expected for deionized water (i.e., below detection limits).

Overall, the QA/QC results indicate acceptable precision of the analytical data. Further information about the laboratory's QA/QC is provided in the laboratory reports (Appendix D).

4 BAILEY SPRINGS WATER QUALITY

4.1 Methods

4.1.1 Sampling Location, Frequency, and Methodology

Section 8.9 of the OC requires that Bailey Springs be sampled monthly. In 2025, samples from Bailey Springs were collected each month by City staff and were submitted to CARO for analysis of the following parameters:

- Conductivity, pH, chloride, and sodium;
- Nitrogen (ammonia-N, nitrate-N, nitrite-N, TKN, organic nitrogen, and total nitrogen);
- Phosphorus (orthophosphate, dissolved phosphorus, and total phosphorus); and
- Total coliforms and fecal coliforms.

The analytical list includes the parameters required under Section 8.9 of the OC. In 2020, testing for dissolved metals was discontinued, based on the recommendations in Associated 2020. The OC does not require testing for metals, and the results of the monitoring programs from previous years indicate that Bailey Springs does not appear to be affected by metals related to the reclaimed water program (Associated 2020). In addition, temperature was measured at the time of sampling to allow for calculating the BC AL guidelines for ammonia-N.

Each year, the City provides the water quality results from Bailey Springs to Associated for inclusion in the water quality database, and Associated compares the data to applicable guidelines and historical data.

4.1.2 Comparison to Guidelines and Historical Data

To assess the potential risk to aquatic life receptors, the results from Bailey Springs were compared to the BC AL and BC WL (WLRS 2025a, 2025b) guidelines. The CSR AW standards were not applied to surface water, as they are designed for groundwater that flows to surface water. For this reason, in many cases, the CSR AW standards apply a dilution factor and are therefore less stringent than the BC AL. The BC AL guideline represents the levels of constituents that are considered protective of aquatic life (e.g., in a stream).

For some parameters, the BC AL guideline includes two maximum levels: chronic (or long-term average) and acute (or short-term maximum). Compliance with chronic guidelines is typically assessed by calculating the average concentration over a specified period (e.g., five samples in 30 days). The chronic guidelines are more stringent than the acute guidelines because they are designed to protect aquatic life from ongoing exposure. For screening purposes, the individual concentrations measured in Bailey Springs were assessed against both the chronic and the acute AL guidelines.

The results from Bailey Springs were also compared to the BC Recreational Water Quality Guidelines (BC REC) (ENV 2019), as the outflow to Kalamalka Lake is next to a commercial campground, beach area, and boat launch (Figure 1-1).

4.2 Results and Discussion

4.2.1 Guideline Exceedances

In 2025, all tested parameters in Bailey Springs met the BC AL, BC WL, and/or BC REC guidelines except for chloride (Section 4.2.2.1), which exceeded the chronic BC AL in most months, and temperature, which exceeded the acute BC AL in July and August. All results, tabulated and compared to the guidelines, are included in Appendix B. The sampling point for Bailey Springs is downstream of where the creek crosses Highway 97 and is in an agricultural area.

4.2.2 Comparison to Historical Data

Bailey Springs has been tested since 1976; therefore, there is a significant historical dataset. The following sections provide a brief interpretation and historical comparison of parameters that exceeded the guidelines in Bailey Springs in 2025 and/or that are considered key parameters of interest for reclaimed water. Plots showing temporal changes in concentrations for these parameters are included in Appendix C. Historical data are found in Associated 2018.

4.2.2.1 Chloride and Temperature

In 2025, chloride concentrations in Bailey Springs met the acute BC AL and BC WL guideline of 600 mg/L at all times, but they were above the chronic BC AL guideline of 150 mg/L during all months except October. There are no BC REC guidelines for chloride. Historically, chloride concentrations in Bailey Springs increased from <50 mg/L (1980) to 239 mg/L (2013), then decreased in 2017, at which point they remained relatively consistent and below guidelines until 2022 (Figure C-18). However, the concentrations in 2025 remain higher than those in 2022 and exceeded the chronic BC AL, ranging from 149 mg/L (October) to 184 mg/L (May). The cause of the higher concentrations in 2023–2025 is unknown, but it is not likely related directly to irrigation water at Clay Valve #4, which has averaged 96.3 mg/L since testing began and was relatively consistent in concentration through 2022–2025, except for a spike in May 2024 (309 mg/L).

Temperature in Bailey Springs in July and August exceeded the acute BC AL of 19°C for streams with an unknown fish distribution (WLRS 2025a); however, this is not surprising given the warm temperatures that occur in July and August and the low flow in Bailey Springs at that time of the year.

4.2.2.2 Nitrogen

In 2025, nitrite-N in Bailey Springs was below the laboratory detection limit (<0.010 mg/L) during all months. Nitrate-N remained well below the chronic and acute BC AL guidelines of 3.0 and 32.8 mg/L, respectively, and the BC REC guideline of 10 mg/L throughout 2025. The lowest levels were found in May through July, when nitrate-N was below the laboratory detection limit. During the other months, it ranged from 0.019 mg/L (in September) to 0.649 mg/L (in February). Nitrate-N concentrations have been relatively consistent in Bailey Springs over time (Figure C-19).

Ammonia-N in Bailey Springs was below the laboratory detection limit in 10 of the 12 months during which it was tested in 2025; it was detected only in January (0.051 mg/L) and July (0.222 mg/L). The BC AL for ammonia-N is calculated for each sample based on the water pH and temperature. The two detected results met the chronic and acute BC AL guidelines. As with nitrate-N, concentrations of ammonia-N have remained relatively stable over the period of record and have mostly been non-detectable since 2022 (Figure C-20).

4.2.2.3 Phosphorus

Phosphorus is not toxic to aquatic life in the concentrations found in municipal effluent; however, compared to other macronutrients required by aquatic plants, phosphorus is the least abundant and commonly the first nutrient that limits biological productivity (e.g., algal growth). It is a concern primarily in lakes, where increased phosphorus input can lead to increased algal growth, which can sometimes lead to decreased dissolved oxygen levels in water to levels that are harmful to aquatic life. There are no BC AL or REC guidelines for phosphorus in streams because there are other factors (e.g., flow velocity, light, temperature, and invertebrate grazing pressure) that affect algal growth.

Bailey Springs flows into Kalamalka Lake, so the concern is whether the spring is contributing phosphorus-elevated water to the lake. The BC AL for total and dissolved phosphorus applies to lakes; the guideline states that it is not possible to specify a single acceptable phosphorus concentration to protect aquatic life, but it suggests a range of 0.005 to 0.015 mg/L (WLRS 2025a). Furthermore, ENV has proposed a water quality objective (WQO) for total phosphorus in Kalamalka Lake of 0.008 mg/L (MOE 2001). The BC REC guideline for total and dissolved phosphorus in lakes is 0.01 mg/L.

In 2025, total and dissolved phosphorus were higher in Bailey Springs than the Kalamalka Lake WQO, BC AL, and BC REC during all months of the year. These are not considered exceedances because the guidelines do not apply to streams. Total phosphorus in Bailey Springs in 2025 ranged from 0.102 mg/L (in April) to 0.174 mg/L (in August), and dissolved phosphorus ranged from 0.0893 mg/L (in April) to 0.174 mg/L (in August). Total and dissolved phosphorus in Bailey Springs increased between 1976 and 2001; however, since that time, concentrations have stabilized (Figure C-21 and C-22).

Before 2006, when the treatment process was improved to include BNR, the average concentration of total (Figure C-23) and dissolved (Figure C-24) phosphorus in the irrigation water at Clay Valve #4 was 3.66 and 3.26 mg/L, respectively. Since 2006, total and dissolved phosphorus concentrations have averaged 1.28 and 1.13 mg/L, respectively. In 2025, total phosphorus in Clay Valve #4 ranged from 0.855 to 1.37 mg/L, and dissolved phosphorus ranged from 0.840 to 1.38 mg/L.

The increasing trend noted in total and dissolved phosphorus in Bailey Springs from 1976 to the early 2000s may be related to reclaimed water use, as concentrations in Clay Valve #4 water were historically higher. Concentrations appear to be more stable over the past 10 years, possibly relating to the improved treatment processes since 2006, but statistical trend analysis has not been completed. It is difficult to ascertain the source of the phosphorus in Bailey Springs in more recent years, as the creek is in the reclaimed water use area and is downstream of the MacKay Reservoir, but it is also in an agricultural area, where cattle are present and farmers may use phosphorus fertilizers.

Of note, Section 7.3.2 of the OC requires that no irrigation water be applied within 15 m of the edge of any flowing streams or bodies of water (MOE 2008). Following this requirement, is important to reduce direct phosphorus inputs to streams such as Bailey Springs.

4.2.2.4 Coliform Bacteria

The City tests fecal coliforms and total coliforms in Bailey Springs and Clay Valve #4, as per the requirements of the OC. There is no BC AL or BC REC guideline for fecal coliforms or total coliforms. The BC REC guideline for *Escherichia coli* is a maximum of ≤400 colony-forming units (CFU) per 100 mL and a geometric mean (based on a minimum of five samples) of ≤200 CFU/100 mL. Testing of *E. coli* in Bailey Springs or Clay Valve #4 is not required under the OC.[10]

In 2025, fecal coliforms in Bailey Springs ranged from a most probable number (MPN) of 1 per 100 mL (in April) to 1,050 MPN/100 mL (in August) (Figure C-25). Total coliforms ranged from 344 MPN/100 mL (in January) to 38,700 MPN/100 mL (in June). If it was assumed that all the fecal coliforms present were *E. coli*, concentrations in May, July, August, and September (ranging from 435 to 1,050 MPN/100 mL) would have exceeded the BC REC guideline. Coliforms are commonly found in surface water, especially where agricultural activity and cattle are present, as in Bailey Springs.

Given that the water from Clay Valve #4 is disinfected before use and that coliform counts are generally low or below detection, elevated fecal coliforms in Bailey Springs are not attributable to the use of reclaimed water. The OC requires disinfection such that fecal coliforms are <2.2 CFU/100 mL for irrigation water in unrestricted public access areas and <200 CFU/100 mL for use in restricted public access areas (MOE 2008). In 2025, fecal coliforms were non-detectable (<1 MPN/100 mL) in all Clay Valve #4 irrigation water samples except in September, when it was 1 MPN/100 mL.

[10] Historically, guidelines were based on fecal coliforms, which were considered an indicator of disease risk from pathogenic bacteria; more recently, guidelines have shifted to specify *E. coli*.

5 SUMMARY AND RECOMMENDATIONS

5.1 Summary

On behalf of the City, Associated completed the 2025 groundwater monitoring program for the City's reclaimed water irrigation operations to meet Section 8.6 of OC 12215. The monitoring program in 2025 followed the program completed in previous years. It consisted of groundwater sampling at the end of the 2025 irrigation season (mid-October)[11] from a network of monitoring wells and domestic wells, comparing the results to applicable water quality guidelines and historical data, and preparing the annual monitoring report (this document).

Under Section 8.9 of the OC, the City is also required to collect monthly samples from Bailey Springs, a surface watercourse. Data from those samples, which were collected directly by the City, were provided to Associated for inclusion in the 2025 groundwater monitoring program report. The City also provided Associated with data from Clay Valve #4, which represent the quality of the water before irrigation, to aid with interpretation.

5.1.1 Conceptual Model of Groundwater Flow

The conceptual model of groundwater flow in the study area can be divided into two parts: flow south of the Commonage Ridge and flow north of the Commonage Ridge. Groundwater flow south of this hydraulic divide is toward the south and is predominantly constrained to shallow surficial sediments and fractured bedrock. Groundwater eventually discharges to Kalamalka Lake. Flow north of the Commonage Ridge is more complex. Groundwater recharge occurs around Bench Row Road, as evidenced by the large influx of water at DMW-3 during freshet. Groundwater then flows toward the north, where it enters a deeper flow regime. From here, groundwater recharges the unconfined and confined valley aquifers before finally discharging to Vernon Creek and/or Okanagan Lake. Groundwater flow on the hillside is complicated by lithological units that are not laterally extensive, and perched aquifers can exist on top of some units with lower permeability.

The water chemistry of the downgradient wells further suggests variable flow paths; all of the wells along Okanagan Avenue show variable concentrations of constituents and variable water types. Data are inconsistent and, in some cases, counterintuitive. For example, deeper wells indicate younger groundwater, which suggests a shorter residence time in the aquifer, so it is possible that a pathway of high transmissivity (high porosity) exists at deeper depths. If the younger water was associated with reclaimed water irrigation, higher concentrations of nitrate-N and chloride would be expected. However, these constituents are lowest in some of these wells. The variety of groundwater types evident suggests that aquifers and lithological units are not connected throughout the study area.

5.1.2 Groundwater Quality

The complex hydrogeological setting north of the Commonage Ridge makes it difficult to assess background water quality. All of the wells in the irrigated lands are in unconsolidated materials, but upgradient from the irrigation areas, the unconsolidated materials are too thin to host any appreciable aquifers. Therefore, upgradient monitoring wells have to be installed in the bedrock (such as DMW-3, the only current upgradient well), which can show different chemistry than wells installed in unconsolidated aquifers. However, even though background wells are difficult to install outside the irrigation area and in the unconsolidated aquifers, the results can be interpreted in several ways. Given the available water quality data, the monitoring program is likely sufficient to identify potential widespread impacts on groundwater.

[11] WTN 24991 was sampled in December due to delays associated with accessing the well.

Potential groundwater receptors include downgradient domestic wells and aquatic life in surface waterbodies to which groundwater may discharge. To address potential risks to these receptors, groundwater results were compared to the drinking water, aquatic life, irrigation, and livestock guidelines. Of highest concern are the following parameters, which exceeded a human health–based (MAC) DW guideline in groundwater:

- Sulphate (MW11-02);
- Cobalt (MW11-02);
- Lithium (DMW-1, DMW-3, DMW-4, MW-2, MW11-02, and DMW18-1);
- Selenium (DMW-1, MW11-02, and WTN 39421); and
- Uranium (DMW-1 and MW11-02).

Although it is difficult to assess background groundwater quality, it is unlikely that these exceedances are related to reclaimed water use. Cobalt, lithium, selenium, and uranium concentrations in all wells were below the regional background concentrations established for the Thompson-Okanagan Region, which suggests that these parameters are naturally occurring in the Vernon area. Furthermore, the concentrations are lower in Clay Valve #4 (reclaimed water) than in the groundwater samples.

Although nitrate-N concentrations in MW11-02 have historically been elevated (with the highest concentration occurring in 2012), nitrate-N concentrations in MW11-02 met the applicable guidelines in 2025. Given that the concentrations have consistently been higher in MW11-02 than in all other wells and in Clay Valve #4, additional localized nitrate sources are suspected, potentially from the commercial tree nursery that is upgradient of this well. Associated communicated with the nursery in 2021 and 2023 and learned that the nursery is aware of the elevated nitrate concentrations and of a more recent drainage issue of nutrient-rich water, identified in 2023. Although the concentrations met the guidelines in 2025, Associated recommends that the City continue to engage directly with the nursery and ensure they (and other reclaimed water users) meet the requirements specified in Appendix A of the OC, including the requirement to ensure that no surface runoff occurs from irrigated lands.

Nitrate-N in all other wells also remained below the guidelines in 2025, but some wells have concentrations that are generally higher than what is likely to occur naturally (i.e., more than approximately 3 mg/L), particularly DMW18-1 and DMW-1. Some of this nitrate may have resulted from the City irrigation program; however, the spatial variability of the nitrate-N levels across the study area indicates that other, localized sources are likely contributing, particularly where there are notable fluctuations. Nonetheless, the ongoing assessment of nitrate-N in groundwater remains an important component of this annual monitoring program.

Generally, concentrations of most parameters appear to be relatively consistent, but a few trends are apparent. However, these trends are not consistent across the monitoring program with respect to parameters or locations, so these data do not clearly indicate a broad impact from reclaimed water. For example, some of the parameters that were previously noted to be increasing over time in DMW-5 appear to be stabilizing or decreasing (e.g., chloride, sodium, conductivity, lithium, and uranium). In DMW18-1, some metals (e.g., molybdenum) have increased and others (e.g., selenium and uranium) have decreased. In DMW-1, chromium and selenium have decreased, but uranium and chloride have increased. In MW11-02, several parameters are elevated relative to the other wells (e.g., sulphate, nitrate, cobalt, and uranium), but the trends are not consistent (e.g., sulphate and uranium have increased, whereas cobalt has decreased).

5.1.3 Bailey Springs

The results from Bailey Springs in 2025 met the applicable guidelines, except chloride, which met the acute BC AL guideline at all times but exceeded the chronic BC AL guideline during all months except October, and temperature, which exceeded the acute BC AL guideline in July and August. Chloride previously exceeded the chronic BC AL guideline regularly from 2003 to 2016, but it remained mostly below guidelines until late 2022 and throughout 2023–2025. The cause of the higher chloride since late 2022 is unknown, as there are several potential sources to consider. Temperature exceedances are attributable to warmer air temperatures during the summer months.

As in previous years, in 2025, dissolved and total phosphorus in Bailey Springs (which discharges to Kalamalka Lake approximately 450 m below the sampling point) consistently exceeded the WQO for Kalamalka Lake during all months. Total and dissolved phosphorus in Bailey Springs increased between 1976 and 2001; however, since that time, concentrations have stabilized. The improved treatment processes in 2006, which resulted in reduced total and dissolved phosphorus, may have contributed to the phosphorus concentrations levelling off over the past 10 years. It is difficult to ascertain the source of the phosphorus in Bailey Springs, as the watercourse is in the reclaimed water use area and is downstream of the MacKay Reservoir, but it is also in an agricultural area, where cattle are present. Continuing to follow the OC requirement to ensure no irrigation water is applied within 15 m of the edge of any flowing streams or bodies of water is particularly important to reduce direct phosphorus inputs to streams such as Bailey Springs.

5.2 Recommendations for 2026

Associated recommends that the City continue the monitoring program in 2026 to remain compliant with Sections 8.6 and 8.9 of the OC. Specifically:

- Sample groundwater annually, at the end of the irrigation season, from the same monitoring well network and for the same parameters that were tested in 2025.
- Continue to test Clay Valve #4 for chloride, sodium, sulphate, TDS, and dissolved metals monthly during the irrigation season, in addition to the parameters required by the OC. These data are necessary to compare concentrations in groundwater.
- Test Bailey Springs for the same parameters tested in 2025, including field-measured temperature (needed to calculate the guideline for ammonia-N).

CLOSURE

This report was prepared for the City of Vernon to document the results of the 2025 groundwater monitoring program for the City's reclaimed water use program.

The services provided by Associated Environmental Consultants Inc. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practising under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,

Associated Environmental Consultants Inc.
Engineers & Geoscientists BC Permit Number: 1001754



Christine Indrigo, M.Sc.
Environmental Scientist

Mike Weldon, P.Geo.
Project Hydrogeologist
Geoscientist-of-Record

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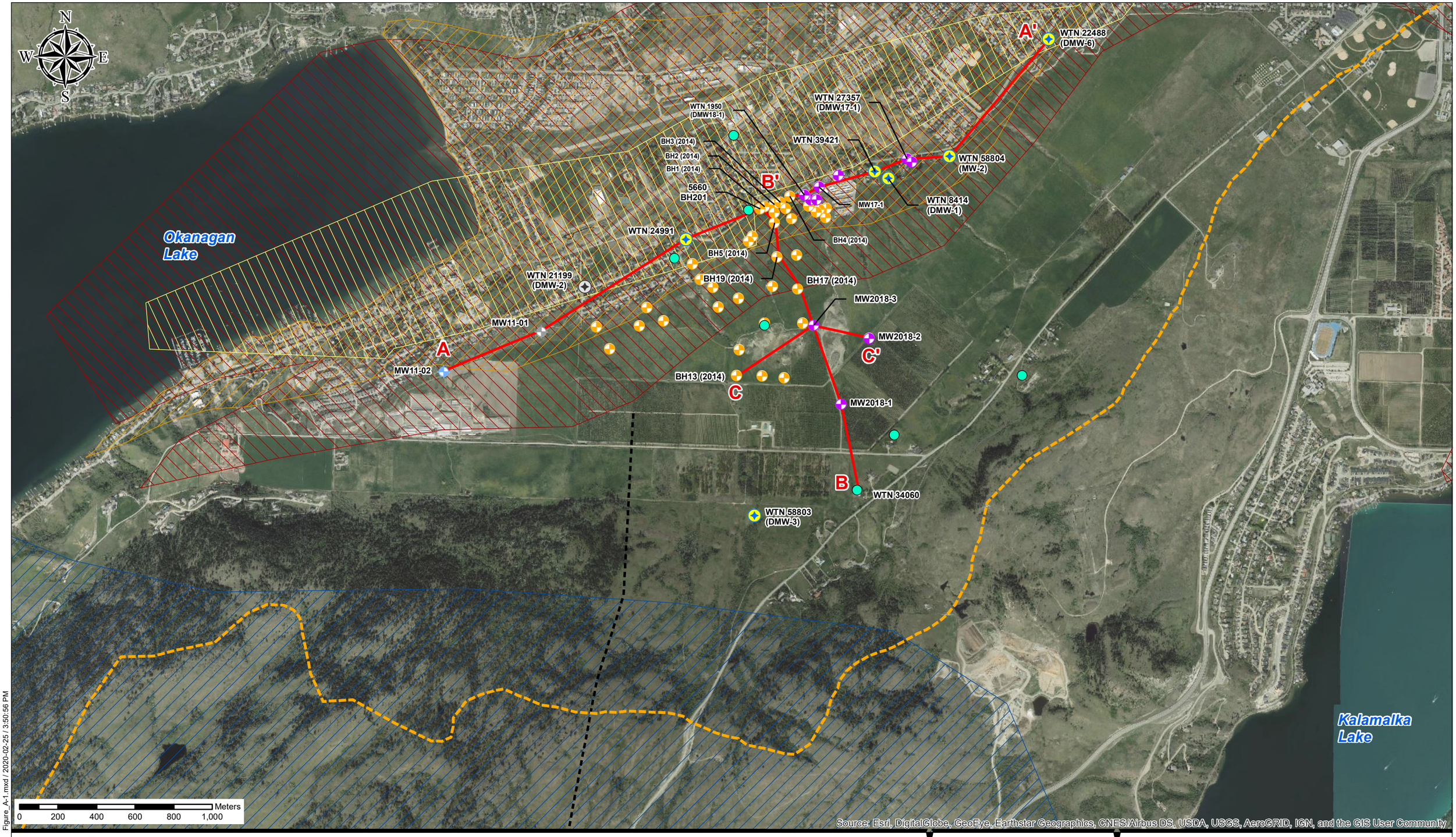
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APPENDIX A – CROSS-SECTIONS AND WELL LOGS



Figure_A-1.mxd / 2020-02-25 / 3:50:56 PM

Associated Environmental

- Domestic Monitoring Well - Active
- Domestic Monitoring Well - Closed
- Monitoring Well - Active
- Monitoring Well - Closed
- Fletcher Paine Borehole
- Hesperia Monitoring Well
- Other Well
- Cross-section lines
- Commonage Ridge
- Fault (Approximate)

Aquifers

- 346
- 347
- 471
- 1227

PROJECT NO.: 2019-8456
DATE: February 2020
DRAWN BY: BdJ

FIGURE A-1: CROSS-SECTIONS & LITHOLOGICAL INFORMATION USED FOR INTERPRETATION

City of Vernon

City of Vernon Groundwater Monitoring Program

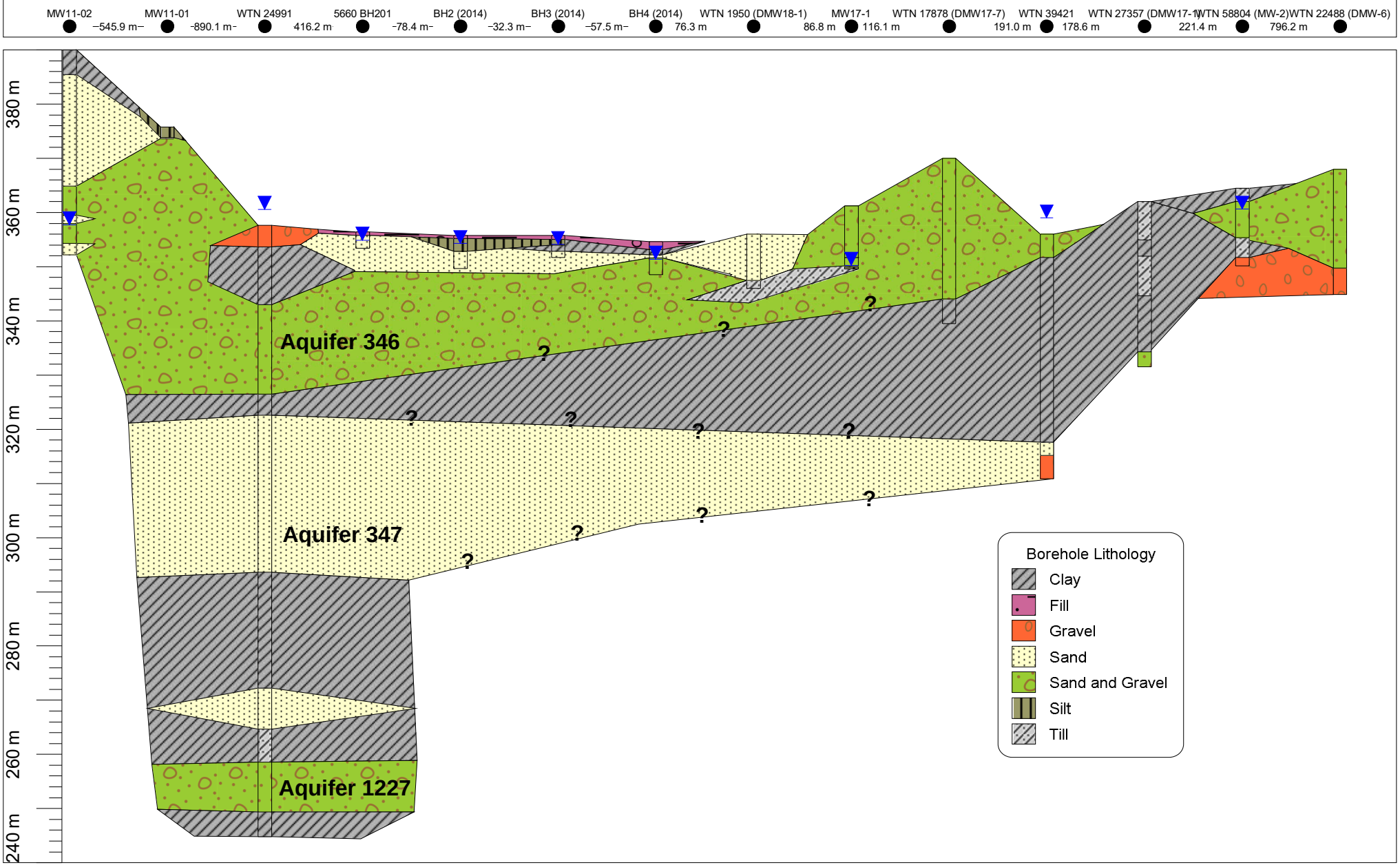
Associated Environmental

PROJECT NO.:	2019-8456
DATE:	February 2020
DRAWN BY:	MW

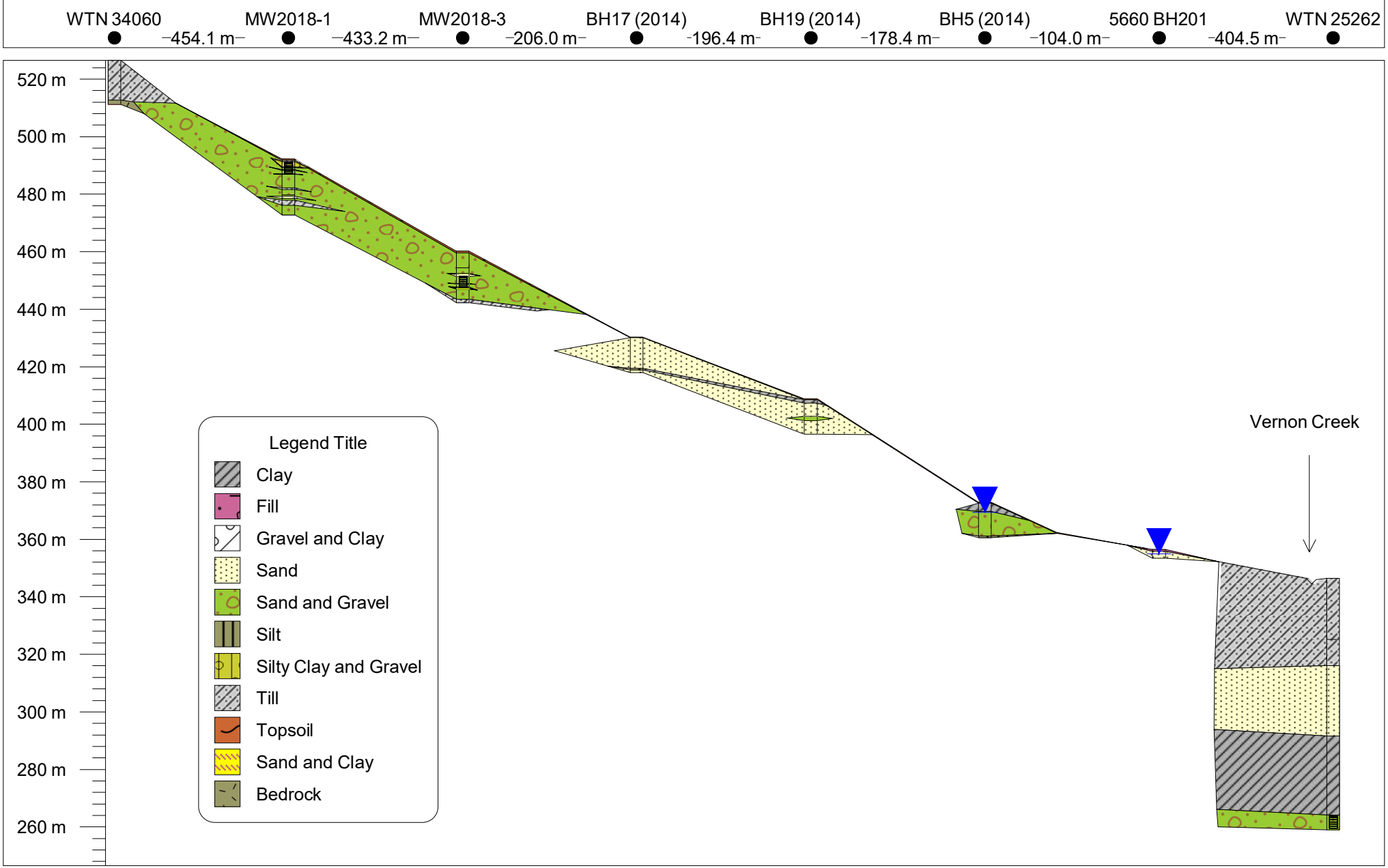
FIGURE A-2: CROSS SECTION A-A'

City of Vernon

2019 Spray Irrigation Monitoring



Associated Environmental	PROJECT NO.: 2019-8456.000	**FIGURE A-3: CROSS SECTION B-B'**
	DATE: January 2019	City of Vernon
	DRAWN BY: MW	2019 Groundwater Monitoring Program - Reclaimed Water Use



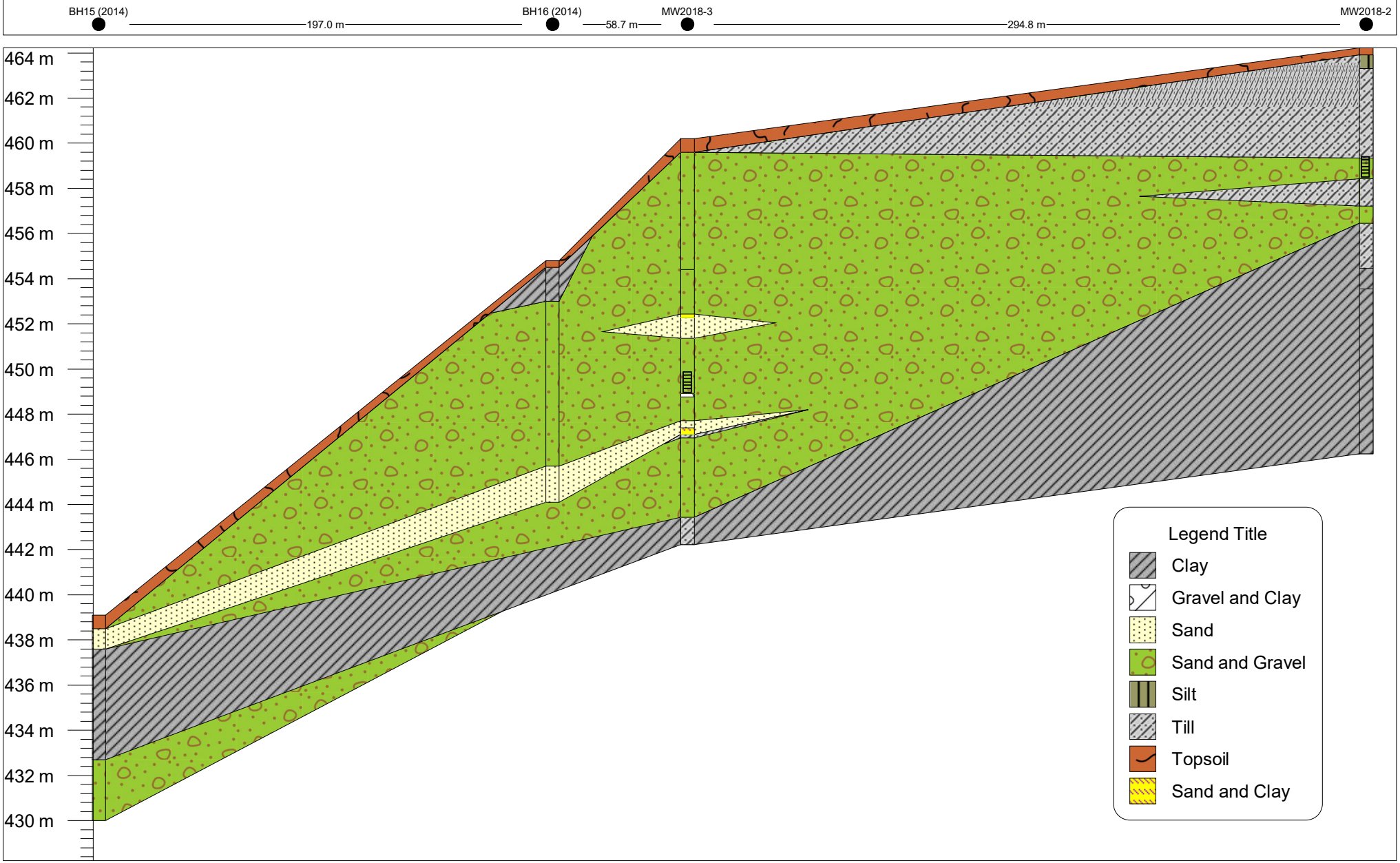
Associated Environmental

PROJECT NO.:	2019-8456.000
DATE:	February 2019
DRAWN BY:	MW

FIGURE A-4: CROSS SECTION C-C'

City of Vernon

2019 Groundwater Monitoring Program - Reclaimed Water Use



Project No: **2010-8911.010**

Client: **City of Vernon**

Location: **Okanagan Landing, Vernon, BC**

Logged by/ Checked by: **CDH**

Test Hole / Borehole I.D.: BH11-05

Well I.D.: **MW11-02**

Location on site: **Below PRT site**

Northing/ Easting: **0**

Elevation: **0**

SUBSURFACE PROFILE			SAMPLE			WELL	
Depth (ft / m)	Symbol	Description	Type	I.D.	flag for analysis	Well Details	Well Completion
-5		Ground Surface				Monument stick-up casing protector	
5		**SILTY CLAY** Dk. brown silty clay -some f-m gravel @ 7'					Bentonite Seal 0.3-1.5m
15		**SAND** Brown v.f.-m sand, tr.-some lt. brown silt					Cuttings (clayey) 1.5-9.1m
25 / 9		**SAND** Brown- lt. brown+ tan f-c sand, tr. moist, tr. v.f. gravel -siltier section @ 30'				-slightly more silty 30-32'	Bentonite Seal 9.1-9.8m
35		**SAND** Lt. brown v.f-m sand, tr. silt, tr. v.c. sand, sl. moist					
45		**SAND** Lt. brown v.f-m sand, tr. v.c. sand, tr. silt, dry. -some f. gravel, well rounded, dry.				- f. gravel 52-55'	Bentonite Seal 15.2-15.8m
55 / 19		**SAND** Tan-brown f-m sand, tr. c sand, tr. silt, sl. moist -dry, less silt					
65							

SUMMIT ENVIRONMENTAL CONSULTANTS INC.
A Member of the Associated Engineering Group of Companies

Contractor: Kel Drilling
Operator(s): Kelvin Marte
Drill Method: ODEX
Ground conditions: clay over sand

Date: Oct. 15, 2011
Time:
Temperature:
Sheet: 1 of 2

Project No: **2010-8911.010**

Client: **City of Vernon**

Location: **Okanagan Landing, Vernon, BC**

Logged by/ Checked by: **CDH**

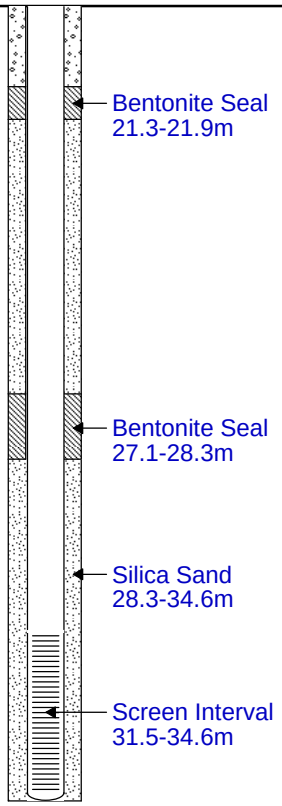
Test Hole / Borehole I.D.: BH11-05

Well I.D.: **MW11-02**

Location on site: **Below PRT site**

Northing/ Easting: **0**

Elevation: **0**

SUBSURFACE PROFILE			SAMPLE			WELL	
Depth	Symbol	Description	Type	I.D.	flag for analysis	Well Details	Well Completion
75		**SAND** Brown-lt. brown v.f-m sand, some silt, moist - some-tr. f-gravel, dry				- moist silt, not wet 68' - granule - v.f. gravel 71-73'	
		SAND Lt. brown -brown v.f-m sand, tr.-some f. gravel					
85		**SAND + GRAVEL** Lt. brown f-c sand + f. gravel, coated gravels				- f-c sand + f gravel 83-84'	
95	29						
		SAND Lt. brown f-v.c. sand, some f. gravel				- moist, coated sands and gravels 98-100'	
105		**SAND + GRAVEL** Brown f-v.c. sand + f. gravel - some gravel moist -wet					
115		**SILTY SAND** Blue-brown silty f-c sand, loss of water in return					
125	39	End of Borehole				Drilled using ODEX 4" casing with NWJ rods, 10' lengths. Rental 175-400 compressor pushing under 400 cfm.	
135							

SUMMIT ENVIRONMENTAL CONSULTANTS INC.
A Member of the Associated Engineering Group of Companies

Contractor: Kel Drilling

Operator(s): Kelvin Marte

Drill Method: ODEX

Ground conditions: clay over sand

Date: Oct. 15, 2011

Time:

Temperature:

Sheet: 2 of 2

DMW18-1

BRITISH COLUMBIA

Report 1 - Detailed Well Record

Well Tag Number: 1950	Construction Date: 1940-01-01 00:00:00
Owner: L FUHR	Driller: Unknown
	Well Identification Plate Number:
Address:	Plate Attached By:
	Where Plate Attached:
Area: VERNON	
	PRODUCTION DATA AT TIME OF DRILLING:
WELL LOCATION:	Well Yield: 0 (Driller's Estimate)
OSOYOOS (ODYD) Land District	Development Method:
District Lot: Plan: Lot:	Pump Test Info Flag: N
Township: Section: Range:	Artesian Flow:
Indian Reserve: Meridian: Block:	Artesian Pressure (ft):
Quarter:	Static Level: 20 feet
Island:	
BCGS Number (NAD 83): 082L024144 Well: 45	WATER QUALITY:
	Character:
Class of Well:	Colour:
Subclass of Well:	Odour:
Orientation of Well:	Well Disinfected: N
Status of Well: New	EMS ID:
Licence General Status: UNLICENSED	Water Chemistry Info Flag:
Well Use: Private Domestic	Field Chemistry Info Flag:
Observation Well Number:	Site Info (SEAM):
Observation Well Status:	
Construction Method: Dug	Water Utility:
Diameter: 0.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:

Well Depth: 28 feet	
Elevation: 0 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag: N
Well Cap Type:	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag: N	Depth (ft):
File Info Flag: N	Thickness (in):
Sieve Info Flag: N	
Screen Info Flag: N	WELL CLOSURE INFORMATION:
	Reason For Closure:
Site Info Details:	Method of Closure:
Other Info Flag:	Closure Sealant Material:
Other Info Details:	Closure Backfill Material:
	Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From 0	to 28 Ft.		SANDY CLAY
From 28	to 0 Ft.		HARDPAN,WATER ON TOP OF HARDPAN

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer

The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.

DMW-1

BRITISH COLUMBIA

Report 1 - Detailed Well Record

Well Tag Number: 8414	Construction Date: 1950-01-01 00:00:00
Owner: W E DOUGLAS	Driller: Unknown
	Well Identification Plate Number:
Address:	Plate Attached By:
	Where Plate Attached:
Area:	
	PRODUCTION DATA AT TIME OF DRILLING:
WELL LOCATION:	Well Yield: 0 (Driller's Estimate)
OSOYOOS (ODYD) Land District	Development Method:
District Lot: Plan: Lot:	Pump Test Info Flag:
Township: Section: Range:	Artesian Flow:
Indian Reserve: Meridian: Block:	Artesian Pressure (ft):
Quarter:	Static Level: 3 feet
Island:	
BCGS Number (NAD 83): 082L024144 Well: 5	WATER QUALITY:
	Character:
Class of Well:	Colour:
Subclass of Well:	Odour:
Orientation of Well:	Well Disinfected: N
Status of Well: New	EMS ID:
Licence General Status: UNLICENSED	Water Chemistry Info Flag:
Well Use: Private Domestic	Field Chemistry Info Flag:
Observation Well Number:	Site Info (SEAM):
Observation Well Status:	
Construction Method: Dug	Water Utility:
Diameter: 0.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:

Well Depth: 8 feet	
Elevation: 0 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag:
Well Cap Type:	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag:	Depth (ft):
File Info Flag:	Thickness (in):
Sieve Info Flag:	
Screen Info Flag:	WELL CLOSURE INFORMATION:
	Reason For Closure:
Site Info Details:	Method of Closure:
Other Info Flag:	Closure Sealant Material:
Other Info Details:	Closure Backfill Material:
	Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From 0 to 0 Ft. NO LOG- SOIL,CLAY & ROCK

- Return to Main
- Return to Search Options
- Return to Search Criteria

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DMW-3

Report 1 - Detailed Well Record

Well Tag Number: 58803 Owner: CITY OF VERNON Address: BENCH ROW RD Area: VERNON WELL LOCATION: OSOYOOS (ODYD) Land District District Lot: Plan: Lot: Township: 9 Section: 20 Range: Indian Reserve: Meridian: Block: Quarter: SW Island: BCGS Number (NAD 27): 082L024142 Well: 12 Class of Well: Subclass of Well: Orientation of Well: Status of Well: New Well Use: Private Domestic Observation Well Number: Observation Well Status: Construction Method: Drilled Diameter: 6.0 inches Casing drive shoe: Well Depth: 19 feet Elevation: 0 feet (ASL) Final Casing Stick Up: inches Well Cap Type: Bedrock Depth: 6 feet Lithology Info Flag: File Info Flag: Sieve Info Flag: Screen Info Flag: Site Info Details: Other Info Flag: Other Info Details:	Construction Date: 1989-05-12 00:00:00.0 Driller: Dan Gare Drilling Well Identification Plate Number: Plate Attached By: Where Plate Attached: PRODUCTION DATA AT TIME OF DRILLING: Well Yield: 0 (Driller's Estimate) Development Method: Pump Test Info Flag: Artesian Flow: Artesian Pressure (ft): Static Level: 10 feet WATER QUALITY: Character: Colour: Odour: Well Disinfected: N EMS ID: Water Chemistry Info Flag: Field Chemistry Info Flag: Site Info (SEAM): Water Utility: Water Supply System Name: Water Supply System Well Name: SURFACE SEAL: Flag: Material: Method: Depth (ft): Thickness (in): WELL CLOSURE INFORMATION: Reason For Closure: Method of Closure: Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:
MONITOR WELL

LITHOLOGY INFORMATION:

From	0 to	6 Ft.	SANDY CLAY,RED
From	6 to	10 Ft.	BROKEN BEDROCK
From	10 to	19 Ft.	FRACTURED BEDROCK

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer
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DMW-6

BRITISH COLUMBIA

Report 1 - Detailed Well Record

Well Tag Number: 22488	Construction Date: 1969-06-18 00:00:00
Owner: PAUL WARWICK	Driller: Pacific Water Wells
	Well Identification Plate Number:
Address: OK AVENUE	Plate Attached By:
	Where Plate Attached:
Area: VERNON	
	PRODUCTION DATA AT TIME OF DRILLING:
WELL LOCATION:	Well Yield: 30 (Driller's Estimate) Gallons per Minute (U.S./Imperial)
OSOYOOS (ODYD) Land District	Development Method:
District Lot: Plan: B3911 Lot:	Pump Test Info Flag:
Township: 9 Section: 28 Range:	Artesian Flow:
Indian Reserve: Meridian: Block:	Artesian Pressure (ft):
Quarter: NW	Static Level: 32 feet
Island:	
BCGS Number (NAD 83): 082L024322 Well: 38	WATER QUALITY:
	Character:
Class of Well:	Colour:
Subclass of Well:	Odour:
Orientation of Well:	Well Disinfected: N
Status of Well: New	EMS ID:
Licence General Status: UNLICENSED	Water Chemistry Info Flag:
Well Use: Unknown Well Use	Field Chemistry Info Flag:
Observation Well Number:	Site Info (SEAM):
Observation Well Status:	
Construction Method: Drilled	Water Utility:
Diameter: 6.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:
Well Depth: 76 feet	
Elevation: 0 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag:
Well Cap Type:	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag:	Depth (ft):
File Info Flag:	Thickness (in):
Sieve Info Flag:	
Screen Info Flag:	WELL CLOSURE INFORMATION:
	Reason For Closure:
Site Info Details:	Method of Closure:
Other Info Flag:	Closure Sealant Material:
Other Info Details:	Closure Backfill Material:

		Details of Closure:		
Screen from	to feet	Type	Slot Size	
Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From 0 to 60 Ft. SANDY GRAVEL

From 60 to 76 Ft. GRAVEL WATER-BEARING

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer
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MW-2

Report 1 - Detailed Well Record

Well Tag Number: 58804	Construction Date: 1989-05-12 00:00:00
Owner: CITY OF VERNON	Driller: Dan Gare Drilling
	Well Identification Plate Number:
Address: OKANAGAN AVE.	Plate Attached By:
	Where Plate Attached:
Area: VERNON	
	PRODUCTION DATA AT TIME OF DRILLING:
WELL LOCATION:	Well Yield: 0 (Driller's Estimate)
OSOYOOS (ODYD) Land District	Development Method:
District Lot: 64 Plan: 2591 Lot: B	Pump Test Info Flag:
Township: 9 Section: Range:	Artesian Flow:
Indian Reserve: Meridian: Block:	Artesian Pressure (ft):
Quarter:	Static Level: 39 feet
Island:	
BCGS Number (NAD 83): 082L024144 Well: 48	WATER QUALITY:
	Character:
Class of Well:	Colour:
Subclass of Well:	Odour:
Orientation of Well:	Well Disinfected: N
Status of Well: New	EMS ID:
Licence General Status: UNLICENSED	Water Chemistry Info Flag:
Well Use: Private Domestic	Field Chemistry Info Flag:
Observation Well Number:	Site Info (SEAM):
Observation Well Status:	
Construction Method: Drilled	Water Utility:
Diameter: 6.0 inches	Water Supply System Name:
Casing drive shoe:	Water Supply System Well Name:
Well Depth: 47 feet	
Elevation: 0 feet (ASL)	SURFACE SEAL:

Final Casing Stick Up: inches	Flag:
Well Cap Type:	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag:	Depth (ft):
File Info Flag:	Thickness (in):
Sieve Info Flag:	
Screen Info Flag:	WELL CLOSURE INFORMATION:
	Reason For Closure:
Site Info Details:	Method of Closure:
Other Info Flag:	Closure Sealant Material:
Other Info Details:	Closure Backfill Material:
	Details of Closure:

~~Screen from~~	~~to feet~~	~~Type~~	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From 0 to 8 Ft. CLAY & ROCKS

From 8 to 30 Ft. SAND & GRAVEL,RED

From 30 to 42 Ft. CLAY & ROCKS

From 42 to 47 Ft. COARSE GRAVEL

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer
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BRITISH COLUMBIA

Report 1 - Detailed Well Record

Well Tag Number: 39421	Construction Date: 1978-03-28 00:00:00
Owner: CROWN VILLA MHP - CAROL GOLDSTONE	Driller: Okanagan Rotary Well Drilling
	Well Identification Plate Number: 10073
Address: 6080 OKANAGAN AVE	Plate Attached By: MIKE KAPINIAK
	Where Plate Attached: WELL CASING
Area: VERNON	
	PRODUCTION DATA AT TIME OF DRILLING:
WELL LOCATION:	Well Yield: 80 (Driller's Estimate) Gallons per Minute (U.S./Imperial)
OSOYOOS (ODYD) Land District	Development Method:
District Lot: 62 Plan: 4685 Lot: 1	Pump Test Info Flag: N
Township: Section: Range:	Artesian Flow: 3 Gallons per Minute (U.S./Imperial)
Indian Reserve: Meridian: Block:	Artesian Pressure (ft):
Quarter:	Static Level:
Island:	
BCGS Number (NAD 83): 082L024144 Well: 9	WATER QUALITY:
	Character:
Class of Well: Water supply	Colour:
Subclass of Well: Domestic	Odour:
Orientation of Well:	Well Disinfected: N
Status of Well: New	EMS ID: E262160
Licence General Status: UNLICENSED	Water Chemistry Info Flag: N
Well Use: Water Supply System	Field Chemistry Info Flag:
Observation Well Number:	Site Info (SEAM): N
Observation Well Status:	
Construction Method: Drilled	Water Utility: N
Diameter: inches	Water Supply System Name: CROWN VILLA MHP WATER SYSTEM
Casing drive shoe:	Water Supply System Well Name:
Well Depth: 148 feet	
Elevation: 1171.3 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag: N
Well Cap Type:	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag: Y	Depth (ft):
File Info Flag: N	Thickness (in):
Sieve Info Flag: N	Liner from To: feet
Screen Info Flag: N	
	WELL CLOSURE INFORMATION:
Site Info Details:	Reason For Closure:
Other Info Flag:	Method of Closure:

Other Info Details:	Closure Sealant Material: Closure Backfill Material: Details of Closure:

Screen from	to feet	Type	Slot Size

Casing from	to feet	Diameter	Material	Drive Shoe
0	16	null	null	null

GENERAL REMARKS:

LITHOLOGY INFORMATION:

From 0 to 14 Ft. SAND & GRAVEL (DRY) 0 nothing entered

From 14 to 23 Ft. BROWN CLAY

From 23 to 60 Ft. HARD GRAYISH BLUE CLAY

From 60 to 100 Ft. SOFT LIGHT GRAY CLAY

From 100 to 126 Ft. VERY HARD STIFF DARK GRAY CLAY

From 126 to 134 Ft. FINE SAND

From 134 to 148 Ft. CLEAN GRAVEL (WATER) 0 nothing entered

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer
The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.

BRITISH COLUMBIA

Report 1 - Detailed Well Record

Well Tag Number: 24991	Construction Date: 1971-06-24 00:00:00
Owner: CLAIRMONT UTILITIES	Driller: Pacific Water Wells
	Well Identification Plate Number: 10033
Address:	Plate Attached By:
	Where Plate Attached:
Area: OKANAGAN LANDING	
	PRODUCTION DATA AT TIME OF DRILLING:
WELL LOCATION:	Well Yield: 30 (Driller's Estimate) U.S. Gallons per Minute
OSOYOOS (ODYD) Land District	Development Method:
District Lot: 62 & 63 Plan: Lot:	Pump Test Info Flag: Y
Township: Section: Range:	Artesian Flow:
Indian Reserve: Meridian: Block:	Artesian Pressure (ft):
Quarter:	Static Level: 8 feet
Island:	
BCGS Number (NAD 83): 082L024143 Well: 44	WATER QUALITY:
	Character:
Class of Well: Water supply	Colour:
Subclass of Well: Domestic	Odour:
Orientation of Well:	Well Disinfected: N
Status of Well: New	EMS ID: E262182
Licence General Status: UNLICENSED	Water Chemistry Info Flag: Y
Well Use: Water Supply System	Field Chemistry Info Flag:
Observation Well Number:	Site Info (SEAM): N
Observation Well Status:	
Construction Method: Drilled	Water Utility: Y
Diameter: 8 inches	Water Supply System Name: CLAREMONT UTILITIES
Casing drive shoe:	Water Supply System Well Name: WELL NO. 2
Well Depth: 370 feet	
Elevation: 1177.8 feet (ASL)	SURFACE SEAL:
Final Casing Stick Up: inches	Flag: N
Well Cap Type:	Material:
Bedrock Depth: feet	Method:
Lithology Info Flag: Y	Depth (ft):
File Info Flag: N	Thickness (in):
Sieve Info Flag: N	

Screen Info Flag: Y	WELL CLOSURE INFORMATION:
	Reason For Closure:
Site Info Details:	Method of Closure:
Other Info Flag:	Closure Sealant Material:
Other Info Details:	Closure Backfill Material:
	Details of Closure:

Screen from	to feet	Type	Slot Size
334	null		20
null	null		30
null	null		50
null	355		80

Casing from	to feet	Diameter	Material	Drive Shoe
0	210	10	null	null
210	335	8	null	null

GENERAL REMARKS:
DRAWDOWN AT 1.6 X 108 TO THE 4TH. SPECIFIC CAPACITY = 2.54 USGM

LITHOLOGY INFORMATION:

From	0	to	13	Ft. COBBLES,GRAVEL
From	13	to	48	Ft. CLAY
From	48	to	102	Ft. TIGHT GRAVEL,WATER-BEARING
From	102	to	115	Ft. CLAY
From	115	to	210	Ft. SAND,FINE SILTY
From	210	to	280	Ft. CLAY
From	280	to	305	Ft. SILTY SAND
From	305	to	325	Ft. STONEY CLAY
From	325	to	355	Ft. SAND GRAVEL
From	355	to	370	Ft. CLAY,BACKFILLED TO 355'

- Return to Main
- Return to Search Options
- Return to Search Criteria

Information Disclaimer
The Province disclaims all responsibility for the accuracy of information provided. Information provided should not be used as a basis for making financial or any other commitments.

APPENDIX B – TABULATED 2025 WATER QUALITY DATA

Table B-1: 2025 Groundwater Quality Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Legend for Table B-1:

<	Less than reported detection limit
GCDWQ AO	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives
GCDWQ MAC	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations
BC SDWQG AO	BC Source Drinking Water Quality Guidelines - Aesthetic Objectives
BC SDWQG MAC	BC Source Drinking Water Quality Guidelines - Maximum Acceptable Concentrations
BCAWQG AL (ST)	BC Approved Water Quality Guidelines for freshwater aquatic life (Short-term acute)
BCWWQG AL	BC Working Water Quality Guidelines for Freshwater Aquatic Life
BCAWQG WL	BC Approved Water Quality Guidelines for wildlife
BCAWQG I	BC Approved Water Quality Guidelines for Irrigation
BCWWQG I	BC Working Water Quality Guidelines for Irrigation
BCAWQG L	BC Approved Water Quality Guidelines for Livestock
BCWWQG L	BC Working Water Quality Guidelines for Livestock
Calc	Calculated guideline or standard. The guideline or standard is dependent on the value of one or more other analytes, and is calculated from a formula or table.
CSR AW	BC CSR Generic Numerical Water Standards for Freshwater Aquatic Life
CSR DW	BC CSR Generic Numerical Water Standards for Drinking Water
CSR IW	BC CSR Generic Numerical Water Standards for Irrigation
CSR LW	BC CSR Generic Numerical Water Standards for Livestock
N	Narrative type of guideline or standard, or Result Note.
NG	No Guideline
	Highlighted value has a lower detection limit that is greater than the guideline/standard maximum and/or the guideline/standard minimum, or has an upper detection limit that is less than the guideline/standard maximum and/or the guideline/standard minimum.
GCDWQ AO	Highlighted value exceeds GCDWQ AO
GCDWQ MAC	Highlighted value exceeds GCDWQ MAC
BC SDWQG AO	Highlighted value exceeds BC SDWQG AO
BC SDWQG MAC	Highlighted value exceeds BC SDWQG MAC
CSR DW	Highlighted value exceeds CSR DW
BCAWQG I	Highlighted value exceeds BCAWQG I
BCWWQG I	Highlighted value exceeds BCWWQG I
CSR IW	Highlighted value exceeds CSR IW
BCAWQG L	Highlighted value exceeds BCAWQG L
BCWWQG L	Highlighted value exceeds BCWWQG L
BCAWQG WL	Highlighted value exceeds BCAWQG WL
CSR LW	Highlighted value exceeds CSR LW
BCAWQG AL (ST)	Highlighted value exceeds BCAWQG AL (ST)
BCWWQG AL	Highlighted value exceeds BCWWQG AL
CSR AW	Highlighted value exceeds CSR AW

Table B-1: 2025 Groundwater Quality Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Guideline																			
		GCDWQ MAC	GCDWQ AO & O	BC SDWQG MAC	BC SDWQG AO	CSR DW	BCAWQG I	BCWWQG I	CSR IW	BCAWQG L	BCWWQG L	CSR LW	BCAWQG AL (ST)	BCWWQG AL	BCAWQG WL	CSR AW						
Sampling Location																	DMW-1	DMW18-1	DMW-3	DMW-3	DMW-4	MW-2	MW11-02
Date Sampled																	20-Oct-25	22-Oct-25	21-Oct-25	21-Oct-25	21-Oct-25	20-Oct-25	20-Oct-25
Lab Sample ID																	25J2897-03	25J3304-01	25J3205-01	25J3205-02	25J3205-04	25J2897-01	25J2897-04
Sample Type																	Normal	Normal	Normal	Duplicate	Normal	Normal	Normal
Field Results																							
Conductivity	µS/cm	NG	NG	NG	NG	NG	NG	700 [7.1]	NG	NG	NG	NG	NG	NG	NG	NG	922	1054	1268	1268	1031	956	1579
Oxidation reduction potential	mV	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	235.4	-	180	180	236.9	237.3	280
Dissolved oxygen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	min 5 [12.1]	NG	NG	NG	7.64	-	2.72	2.72	4.18	1.11	8.69
pH		NG	7.0 - 10.5 [2.1]	NG	NG	NG	5.0 - 9.5 [6.1]	NG	NG	5.0 - 9.5 [9.1]	NG	NG	NG	NG	NG	NG	7.54	7.56	7.07	7.07	7.1	7.47	7.22
Temperature	°C	NG	NG	NG	15	NG	N [6.2]	NG	NG	N [9.2]	NG	NG	19 [12.2]	NG	N [14.1]	NG	12	12.1	11.7	11.7	14.3	11.6	11
Turbidity	NTU	N [1.1]	NG	N [3.1]	NG	NG	N [6.3]	NG	NG	N [9.3]	NG	NG	N [12.3]	NG	N [14.2]	NG	0.2	0.19	0.38	0.38	-0.77	10.33	74.1
																	-	-	-	-	-	-	-
Lab Results																							
General																							
Alkalinity (bicarbonate, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	257	220	443	440	350	294	393
Alkalinity (carbonate, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity (hydroxide, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity (phenolphthalein, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity (total, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	min 20 [13.1]	NG	NG	257	220	443	440	350	294	393
Bromide	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.10	-	0.20	0.19	<0.10	<0.10	<0.10
Dissolved organic carbon	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	N [14.3]	NG	1.72	2.15	5.30	5.15	5.99	3.77	3.52
Chemical oxygen demand	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	-	<20	-	-	-	-	-
Chloride	mg/L	NG	250	NG	250	250 [5.1]	100	NG	100 [8.1]	600 [9.4]	NG	600	600 [12.4]	NG	600	1500	108	20.5	203	212	136	107	120
Fluoride	mg/L	1.5	NG	1.5	NG	1.500	2.0 [6.4]	NG	1.000	1.5 [9.5]	NG	1.000 [11.1]	Calc [12.5]	NG	1.5 [14.4]	Calc [15.1]	0.16	-	0.43	0.45	0.38	0.19	0.16
Hardness (as CaCO3), dissolved	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	547	450	730	727	355	537	996
Total dissolved solids	mg/L	NG	500	NG	NG	NG	NG	500 [7.2]	NG	NG	1000 [10.2]	NG	NG	NG	NG	NG	**792**	**713**	**1030**	**1040**	**1010**	**914**	**1410**
Sulphate	mg/L	NG	500 [2.2]	NG	500	500 [5.2]	NG	NG	NG	1000	1000 [10.1]	1000	NG	NG	NG	Calc [15.2]	277	322	155	169	140	319	**811**
Nutrients																							
Ammonia (total, as N)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	Calc [12.6]	NG	NG	Calc [15.3]	<0.050	<0.050	<0.050	<0.050	0.058	<0.050	<0.050
Nitrate (as N)	mg/L	10	NG	10	NG	10 [5.3]	NG	NG	NG	100 [9.6]	NG	100 [11.2]	32.8 [12.7]	NG	100 [14.5]	400 [15.4]	2.03	3.53	<0.010	<0.010	0.570	0.343	7.48
Nitrate + Nitrite (as N)	mg/L	10 [1.2]	NG	NG	NG	10 [5.4]	NG	NG	NG	100 [9.7]	NG	100 [11.3]	NG	NG	100 [14.6]	400 [15.5]	2.03	-	<0.0100	<0.0100	0.570	0.343	7.48
Nitrite (as N)	mg/L	1	NG	1.0	NG	1	NG	NG	NG	10 [9.8]	NG	10.000	Calc [12.8]	NG	10	Calc [15.6]	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	2.23	-	0.321	0.319	1.08	0.691	7.94
Total kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.202	-	0.321	0.319	0.511	0.348	0.466
Total organic nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.202	-	0.321	0.319	0.453	0.348	0.466
Phosphorus (dissolved, by ICPMS/ICPOES)	mg/L	NG	NG	NG	N [4.2]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.050	<0.050	<0.050	<0.050	0.255	<0.050	<0.050
Phosphorus (total, APHA 4500-P)	mg/L	NG	NG	NG	N [4.3]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.0262	0.0137	0.0121	0.0124	0.239	0.0436	0.314
Phosphorus (dissolved, APHA 4500-P)	mg/L	NG	NG	NG	N [4.1]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.0166	-	0.0102	0.0109	0.235	0.0272	0.0248
Phosphorus, dissolved reactive	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.0127	-	<0.0050	<0.0050	0.214	0.0226	0.0177
Potassium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	6.79	5.82	9.28	9.32	19.5	7.10	9.41
Dissolved Metals																							
Aluminum (dissolved)	mg/L	2.9 [1.3]	0.100 [2.3]	9.5	NG	9.500 [5.5]	5 [6.5]	NG	5.000	5 [9.9]	NG	5.000	NG	NG	5	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Antimony (dissolved)	mg/L	0.006	NG	0.006	NG	0.006	NG	NG	NG	NG	NG	NG	0.250 [12.9]	NG	NG	0.090	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Arsenic (dissolved)	mg/L	0.010 [1.4]	NG	0.01	NG	0.010	0.100 [6.6]	NG	0.100	0.025 [9.10]	NG	0.025	NG	NG	0.025	0.050	0.00080	0.00268	0.00054	0.00059	0.00191	0.00095	0.00065
Barium (dissolved)	mg/L	2.0 [1.5]	NG	NG	NG	1.000	NG	NG	NG	NG	NG	NG	NG	1	NG	10.000	0.0429	0.0259	0.0349	0.0346	0.0342	0.0536	0.0308
Beryllium (dissolved)	mg/L	NG	NG	NG	NG	0.008	NG	0.100	0.100	NG	0.100	0.100	NG	0.00013	NG	0.0015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Boron (dissolved)	mg/L	5	NG	5.0	NG	5.000	0.5 [6.7]	NG	0.500 [8.2]	5 [9.11]	NG	5.000	NG	NG	5.0	12.000	<0.0500	<0.0500	<0.0500	<0.0500	0.200	0.0597	0.120

Table B-1: 2025 Groundwater Quality Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

																Sampling Location	DMW-1	DMW18-1	DMW-3	DMW-3	DMW-4	MW-2	MW11-02
																Date Sampled	20-Oct-25	22-Oct-25	21-Oct-25	21-Oct-25	21-Oct-25	20-Oct-25	20-Oct-25
																Lab Sample ID	25J2897-03	25J3304-01	25J3205-01	25J3205-02	25J3205-04	25J2897-01	25J2897-04
																Sample Type	Normal	Normal	Normal	Duplicate	Normal	Normal	Normal
Analyte	**Unit**	**Guideline**																					
		GCDWQ MAC	**GCDWQ AO & O**	**BC SDWQG MAC**	**BC SDWQG AO**	**CSR DW**	BCAWQG I	BCWWQG I	CSR IW	BCAWQG L	BCWWQG L	CSR LW	BCAWQG AL (ST)	BCWWQG AL	BCAWQG WL	CSR AW								
Cadmium (dissolved)	mg/L	0.007 [1.6]	NG	0.005	NG	0.005	NG	0.0051 [7.3]	0.005	NG	0.080 [10.3]	0.080	Calc [12.10]	NG	NG	Calc [15.7]		0.000022	0.000023	0.000041	0.000042	0.000234	0.000061	0.000087
Calcium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	1000	1000	NG	NG	NG	NG		109	78.1	202	200	99.3	102	210
Chromium (dissolved)	mg/L	0.05	NG	0.05	NG	0.050 [5.6]	NG	0.0049 [7.4]	0.005 [8.3]	NG	0.050 [10.4]	0.050 [11.4]	NG	0.0025 [13.2]	NG	0.010 [15.8]		0.00536	0.00183	<0.00050	<0.00050	<0.00050	<0.00050	0.00194
Cobalt (dissolved)	mg/L	NG	NG	0.001	NG	0.001 [5.7]	NG	0.050 [7.5]	0.050	NG	1	1.000	NG	NG	NG	0.040		<0.00010	<0.00010	<0.00010	<0.00010	0.00044	0.00021	**0.00271**
Copper (dissolved)	mg/L	2 [1.7]	1 [2.4]	2.0 [3.2]	1.0	1.500 [5.8]	0.200 [6.8]	NG	0.200	0.300 [9.12]	NG	0.300	Calc [12.11]	NG	0.300 [14.7]	Calc [15.9]		<0.00040	0.00122	0.00261	0.00251	0.00893	0.00208	0.00145
Iron (dissolved)	mg/L	NG	0.1	NG	0.3	6.500 [5.9]	NG	NG	5.000 [8.4]	NG	NG	NG	0.35 [12.12]	NG	NG	NG		<0.010	<0.010	<0.010	<0.010	0.013	<0.010	<0.010
Lead (dissolved)	mg/L	0.005 [1.8]	NG	0.005	NG	0.010	0.200 [6.9]	NG	0.200	0.100 [9.13]	NG	0.100	NG	NG	0.100	Calc [15.10]		<0.00020	<0.00020	<0.00020	<0.00020	0.00022	<0.00020	<0.00020
Lithium (dissolved)	mg/L	NG	NG	NG	NG	0.008	NG	0.75 [7.6]	2.500 [8.5]	NG	NG	5.000	NG	NG	NG	NG		**0.00959**	**0.00926**	**0.0206**	**0.0208**	**0.0169**	**0.00888**	**0.0189**
Magnesium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		66.4	61.8	54.6	55.1	25.9	68.3	114
Manganese (dissolved)	mg/L	0.12 [1.9]	0.02 [2.5]	0.12	0.02	1.500 [5.10]	NG	0.200	0.200 [8.6]	NG	NG	NG	Calc [12.13]	NG	NG	NG		0.00026	0.00045	0.00048	0.00046	0.00030	0.0137	<0.00020
Mercury (dissolved)	mg/L	0.001	NG	0.001	NG	0.001	0.0020 [6.10]	NG	0.001	0.0030 [9.14]	NG	0.002	NG	NG	0.00002 [14.8]	0.00025		<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (dissolved)	mg/L	NG	NG	0.088	NG	0.250	0.01 [6.11]	NG	0.010 [8.7]	0.016 [9.15]	NG	0.050	46 [12.14]	NG	0.034 [14.9]	10.000		0.00762	0.0148	0.00840	0.00828	0.0135	0.0132	0.00947
Nickel (dissolved)	mg/L	NG	NG	0.08	NG	0.080	NG	0.200	0.200	NG	1	1.000	Calc [12.15]	NG	NG	Calc [15.11]		0.00118	<0.00040	0.00133	0.00132	0.00167	0.00192	0.0125
Selenium (dissolved)	mg/L	0.05	NG	0.01	NG	0.010	0.010 [6.12]	NG	0.020 [8.8]	0.0300 [9.16]	NG	0.030	NG	NG	0.002 [14.10]	0.020		**0.0304**	0.00740	0.00221	0.00214	<0.00050	0.00204	**0.0262**
Silicon (dissolved, as Si)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		11.0	9.4	14.7	14.3	9.0	10.2	13.6
Silver (dissolved)	mg/L	NG	NG	NG	NG	0.020	NG	NG	NG	NG	NG	NG	NG	NG	NG	Calc [15.12]		<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (dissolved)	mg/L	NG	200	NG	NG	200 [5.11]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		53.0	59.3	84.4	85.0	137	87.6	133
Strontium (dissolved)	mg/L	7.0 [1.10]	NG	7.0	NG	2.500	NG	NG	NG	NG	NG	NG	NG	1.250	NG	NG		1.22	0.907	1.50	1.51	0.910	1.16	1.50
Sulphur (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		95.3	117	58.2	57.3	49.0	121	259
Tellurium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Thallium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.00003	NG	0.003		<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Thorium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (dissolved)	mg/L	NG	NG	NG	NG	2.500	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		0.00062	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	1.000		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tungsten (dissolved)	mg/L	NG	NG	NG	NG	0.003	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium (dissolved)	mg/L	0.02	NG	0.02	NG	0.020	NG	0.010	0.010	NG	0.200	0.200	NG	0.0075 [13.3]	NG	0.085		**0.0248**	0.0129	0.00621	0.00635	0.00784	0.0186	**0.0336**
Vanadium (dissolved)	mg/L	NG	NG	NG	NG	0.020	NG	0.100	0.100	NG	0.100	0.100	NG	0.060	NG	NG		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (dissolved)	mg/L	NG	5.0	3.0	5.0	3.000 [5.12]	1.000 [6.13]	NG	1.000 [8.9]	2.000 [9.17]	NG	2.000	Calc [12.16]	NG	NG	Calc [15.13]		<0.0040	0.0067	0.0282	0.0290	0.0236	0.0336	<0.0040
Zirconium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG		<0.00010	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010

WIRELESS WATER

Table B-1: 2025 Groundwater Quality Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

																Sampling Location	MW-5	WTN 24991	WTN 39421
																Date Sampled	20-Oct-25	11-Dec-25	20-Oct-25
																Lab Sample ID	25J2897-02	25L1784-01	25J2897-05
																Sample Type	Normal	Normal	Normal
Analyte	**Unit**	**Guideline**																	
		GCDWQ MAC	**GCDWQ AO & O**	**BC SDWQG MAC**	**BC SDWQG AO**	**CSR DW**	BCAWQG I	BCWWQG I	CSR IW	BCAWQG L	BCWWQG L	CSR LW	BCAWQG AL (ST)	BCWWQG AL	BCAWQG WL	CSR AW			
Field Results																			
Conductivity	µS/cm	NG	NG	NG	NG	NG	NG	700 [7.1]	NG	NG	NG	NG	NG	NG	NG	NG	389.5	240.2	767
Oxidation reduction potential	mV	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	215.7	-	235.9
Dissolved oxygen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	min 5 [12.1]	NG	NG	NG	0.77	1.73	6.48
pH		NG	7.0 - 10.5 [2.1]	NG	NG	NG	5.0 - 9.5 [6.1]	NG	NG	5.0 - 9.5 [9.1]	NG	NG	NG	NG	NG	NG	9.52	8.02	7.57
Temperature	°C	NG	NG	NG	15	NG	N [6.2]	NG	NG	N [9.2]	NG	NG	19 [12.2]	NG	N [14.1]	NG	11.3	13.4	12
Turbidity	NTU	N [1.1]	NG	N [3.1]	NG	NG	N [6.3]	NG	NG	N [9.3]	NG	NG	N [12.3]	NG	N [14.2]	NG	12.9	0.16	0.13
																	-	-	-
Lab Results																			
General																			
Alkalinity (bicarbonate, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	53.8	197	197
Alkalinity (carbonate, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	31.7	<1.0	<1.0
Alkalinity (hydroxide, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<1.0	<1.0	<1.0
Alkalinity (phenolphthalein, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	15.8	<1.0	<1.0
Alkalinity (total, as CaCO3)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	min 20 [13.1]	NG	NG	85.5	197	197
Bromide	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.10	<0.10	<0.10
Dissolved organic carbon	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	N [14.3]	NG	0.76	0.88	2.82
Chemical oxygen demand	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	-	-	-
Chloride	mg/L	NG	250	NG	250	250 [5.1]	100	NG	100 [8.1]	600 [9.4]	NG	600	600 [12.4]	NG	600	1500	8.68	1.60	49.9
Fluoride	mg/L	1.5	NG	1.5	NG	1.500	2.0 [6.4]	NG	1.000	1.5 [9.5]	NG	1.000 [11.1]	Calc [12.5]	NG	1.5 [14.4]	Calc [15.1]	<0.10	0.26	0.15
Hardness (as CaCO3), dissolved	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	162	193	480
Total dissolved solids	mg/L	NG	500	NG	NG	NG	NG	500 [7.2]	NG	NG	1000 [10.2]	NG	NG	NG	NG	NG	311	314	**684**
Sulphate	mg/L	NG	500 [2.2]	NG	500	500 [5.2]	NG	NG	NG	1000	1000 [10.1]	1000	NG	NG	NG	Calc [15.2]	201	82.0	353
Nutrients																			
Ammonia (total, as N)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	Calc [12.6]	NG	NG	Calc [15.3]	0.278	0.161	<0.050
Nitrate (as N)	mg/L	10	NG	10	NG	10 [5.3]	NG	NG	NG	100 [9.6]	NG	100 [11.2]	32.8 [12.7]	NG	100 [14.5]	400 [15.4]	<0.010	<0.010	2.41
Nitrate + Nitrite (as N)	mg/L	10 [1.2]	NG	NG	NG	10 [5.4]	NG	NG	NG	100 [9.7]	NG	100 [11.3]	NG	NG	100 [14.6]	400 [15.5]	<0.0100	<0.0100	2.41
Nitrite (as N)	mg/L	1	NG	1.0	NG	1	NG	NG	NG	10 [9.8]	NG	10.000	Calc [12.8]	NG	10	Calc [15.6]	<0.010	<0.010	<0.010
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.392	0.194	2.55
Total kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.392	0.194	0.137
Total organic nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.114	<0.0500	0.137
Phosphorus (dissolved, by ICPMS/ICPOES)	mg/L	NG	NG	NG	N [4.2]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.050	<0.050	<0.050
Phosphorus (total, APHA 4500-P)	mg/L	NG	NG	NG	N [4.3]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.0209	0.0148	0.0128
Phosphorus (dissolved, APHA 4500-P)	mg/L	NG	NG	NG	N [4.1]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.0054	0.0135	0.0126
Phosphorus, dissolved reactive	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.0050	0.0093	0.0050
Potassium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	3.09	3.43	6.52
Dissolved Metals																			
Aluminum (dissolved)	mg/L	2.9 [1.3]	0.100 [2.3]	9.5	NG	9.500 [5.5]	5 [6.5]	NG	5.000	5 [9.9]	NG	5.000	NG	NG	5	NG	<0.0050	<0.0050	<0.0050
Antimony (dissolved)	mg/L	0.006	NG	0.006	NG	0.006	NG	NG	NG	NG	NG	NG	0.250 [12.9]	NG	NG	0.090	<0.00020	<0.00020	<0.00020
Arsenic (dissolved)	mg/L	0.010 [1.4]	NG	0.01	NG	0.010	0.100 [6.6]	NG	0.100	0.025 [9.10]	NG	0.025	NG	NG	0.025	0.050	<0.00050	0.00114	0.00062
Barium (dissolved)	mg/L	2.0 [1.5]	NG	NG	NG	1.000	NG	NG	NG	NG	NG	NG	NG	1	NG	10.000	<0.0050	0.0199	0.0497
Beryllium (dissolved)	mg/L	NG	NG	NG	NG	0.008	NG	0.100	0.100	NG	0.100	0.100	NG	0.00013	NG	0.0015	<0.00010	<0.00010	<0.00010
Bismuth (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010
Boron (dissolved)	mg/L	5	NG	5.0	NG	5.000	0.5 [6.7]	NG	0.500 [8.2]	5 [9.11]	NG	5.000	NG	NG	5.0	12.000	<0.0500	<0.0500	<0.0500

Table B-1: 2025 Groundwater Quality Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

																Sampling Location	MW-5	WTN 24991	WTN 39421
																Date Sampled	20-Oct-25	11-Dec-25	20-Oct-25
																Lab Sample ID	25J2897-02	25L1784-01	25J2897-05
																Sample Type	Normal	Normal	Normal
Analyte	**Unit**	**Guideline**																	
		GCDWQ MAC	**GCDWQ AO & O**	**BC SDWQG MAC**	**BC SDWQG AO**	**CSR DW**	BCAWQG I	BCWWQG I	CSR IW	BCAWQG L	BCWWQG L	CSR LW	BCAWQG AL (ST)	BCWWQG AL	BCAWQG WL	CSR AW			
Cadmium (dissolved)	mg/L	0.007 [1.6]	NG	0.005	NG	0.005	NG	0.0051 [7.3]	0.005	NG	0.080 [10.3]	0.080	Calc [12.10]	NG	NG	Calc [15.7]	<0.000010	<0.000010	<0.000010
Calcium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	1000	1000	NG	NG	NG	NG	4.86	43.5	109
Chromium (dissolved)	mg/L	0.05	NG	0.05	NG	0.050 [5.6]	NG	0.0049 [7.4]	0.005 [8.3]	NG	0.050 [10.4]	0.050 [11.4]	NG	0.0025 [13.2]	NG	0.010 [15.8]	<0.00050	<0.00050	0.00091
Cobalt (dissolved)	mg/L	NG	NG	0.001	NG	0.001 [5.7]	NG	0.050 [7.5]	0.050	NG	1	1.000	NG	NG	NG	0.040	<0.00010	<0.00010	<0.00010
Copper (dissolved)	mg/L	2 [1.7]	1 [2.4]	2.0 [3.2]	1.0	1.500 [5.8]	0.200 [6.8]	NG	0.200	0.300 [9.12]	NG	0.300	Calc [12.11]	NG	0.300 [14.7]	Calc [15.9]	<0.00040	<0.00040	<0.00040
Iron (dissolved)	mg/L	NG	0.1	NG	0.3	6.500 [5.9]	NG	NG	5.000 [8.4]	NG	NG	NG	0.35 [12.12]	NG	NG	NG	0.022	**0.221**	**0.107**
Lead (dissolved)	mg/L	0.005 [1.8]	NG	0.005	NG	0.010	0.200 [6.9]	NG	0.200	0.100 [9.13]	NG	0.100	NG	NG	0.100	Calc [15.10]	<0.00020	<0.00020	<0.00020
Lithium (dissolved)	mg/L	NG	NG	NG	NG	0.008	NG	0.75 [7.6]	2.500 [8.5]	NG	NG	5.000	NG	NG	NG	NG	0.00114	0.00366	0.00714
Magnesium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	36.4	20.5	50.5
Manganese (dissolved)	mg/L	0.12 [1.9]	0.02 [2.5]	0.12	0.02	1.500 [5.10]	NG	0.200	0.200 [8.6]	NG	NG	NG	Calc [12.13]	NG	NG	NG	**0.0303**	**0.0812**	0.00902
Mercury (dissolved)	mg/L	0.001	NG	0.001	NG	0.001	0.0020 [6.10]	NG	0.001	0.0030 [9.14]	NG	0.002	NG	NG	0.00002 [14.8]	0.00025	<0.000010	<0.000010	<0.000010
Molybdenum (dissolved)	mg/L	NG	NG	0.088	NG	0.250	0.01 [6.11]	NG	0.010 [8.7]	0.016 [9.15]	NG	0.050	46 [12.14]	NG	0.034 [14.9]	10.000	0.00337	0.0103	0.00733
Nickel (dissolved)	mg/L	NG	NG	0.08	NG	0.080	NG	0.200	0.200	NG	1	1.000	Calc [12.15]	NG	NG	Calc [15.11]	<0.00040	<0.00040	0.00094
Selenium (dissolved)	mg/L	0.05	NG	0.01	NG	0.010	0.010 [6.12]	NG	0.020 [8.8]	0.0300 [9.16]	NG	0.030	NG	NG	0.002 [14.10]	0.020	<0.00050	<0.00050	**0.0338**
Silicon (dissolved, as Si)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<1.0	10.3	11.8
Silver (dissolved)	mg/L	NG	NG	NG	NG	0.020	NG	NG	NG	NG	NG	NG	NG	NG	NG	Calc [15.12]	<0.000050	<0.000050	<0.000050
Sodium (dissolved)	mg/L	NG	200	NG	NG	200 [5.11]	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	48.4	30.4	44.0
Strontium (dissolved)	mg/L	7.0 [1.10]	NG	7.0	NG	2.500	NG	NG	NG	NG	NG	NG	NG	1.250	NG	NG	0.0295	0.463	1.13
Sulphur (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	68.9	26.8	111
Tellurium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00050	<0.00050	<0.00050
Thallium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	0.00003	NG	0.003	<0.000020	<0.000020	<0.000020
Thorium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010
Tin (dissolved)	mg/L	NG	NG	NG	NG	2.500	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00020	<0.00020	<0.00020
Titanium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	1.000	<0.0050	<0.0050	<0.0050
Tungsten (dissolved)	mg/L	NG	NG	NG	NG	0.003	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.0010	<0.0010	<0.0010
Uranium (dissolved)	mg/L	0.02	NG	0.02	NG	0.020	NG	0.010	0.010	NG	0.200	0.200	NG	0.0075 [13.3]	NG	0.085	<0.000020	0.00195	0.00500
Vanadium (dissolved)	mg/L	NG	NG	NG	NG	0.020	NG	0.100	0.100	NG	0.100	0.100	NG	0.060	NG	NG	<0.0050	<0.0050	<0.0050
Zinc (dissolved)	mg/L	NG	5.0	3.0	5.0	3.000 [5.12]	1.000 [6.13]	NG	1.000 [8.9]	2.000 [9.17]	NG	2.000	Calc [12.16]	NG	NG	Calc [15.13]	<0.0040	<0.0040	0.0240
Zirconium (dissolved)	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	<0.00010	<0.00010	<0.00010

Guideline Notes for Table B-1: 2025 Groundwater Quality Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

1. Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)
Note 1.1 for Turbidity:
Waterworks systems that use a surface water source or a groundwater source under the direct influence of surface water should filter the source water to meet health-based turbidity limits, as defined for specific treatment technologies. Where possible, filtration systems should be designed and operated to reduce turbidity levels as low as possible, with a treated water turbidity target of less than 0.1 NTU at all times. Where this is not achievable, the treated water turbidity levels from individual filters should meet the requirements described in GCDWQ. For systems that use groundwater that is not under the direct influence of surface water, which are considered less vulnerable to faecal contamination, turbidity should generally be below 1.0 NTU. For effective operation of the distribution system, it is good practice to ensure that water entering the distribution system has turbidity levels below 1.0 NTU.
Note 1.2 for Nitrate + Nitrite (as N):
The MAC for Nitrate (as N) is 10 mg/L
Note 1.3 for Aluminum (dissolved):
The maximum acceptable concentration (MAC) for total aluminum in drinking water is 2.9 mg/L (2 900 µg/L) based on a locational running annual average of a minimum of quarterly samples taken in the distribution system. (Update March 5, 2021)
Note 1.4 for Arsenic (dissolved):
Every effort should be made to maintain arsenic levels in drinking water as low as reasonably achievable.
Note 1.5 for Barium (dissolved):
Update January 24, 2020. The MAC was revised from 1.0 mg/L to 2.0 mg/L.
Note 1.6 for Cadmium (dissolved):
A maximum acceptable concentration (MAC) of 0.007 mg/L (7 µg/L) is established for total cadmium in drinking water, based on a sample of water taken at the tap. (Update July 14, 2020)
Note 1.7 for Copper (dissolved):
A maximum acceptable concentration (MAC) of 2 mg/L is established for total copper in drinking water, based on a sample of water taken at the tap. Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on Copper, June 2019.
Note 1.8 for Lead (dissolved):
The maximum acceptable concentration (MAC) for total lead in drinking water is 0.005 mg/L (5 µg/L), based on a sample of water taken at the tap and using the appropriate protocol for the type of building being sampled. Every effort should be made to maintain lead levels in drinking water as low as reasonably achievable (or ALARA). (GCDWQ: Guideline Technical Document; March, 2019)
Note 1.9 for Manganese (dissolved):
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on manganese, May 2019.
Note 1.10 for Strontium (dissolved):
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on strontium, May 2019.
2. Notes for Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives and Other (GCDWQ AO & O)
General Notes:
Includes Aesthetic Objective, Operational Guidance Value, and Objective types of guidelines. The guidelines are Aesthetic Objectives unless stated otherwise in the guideline note.
Note 2.1 for pH:
The operational guideline for pH is a range of 7.0 to 10.5 in finished drinking water.
Note 2.2 for Sulphate:
There may be a laxative effect in some individuals when sulphate levels exceed 500 mg/L. Health authorities should be notified of drinking water sources containing above 500 mg/L.
Note 2.3 for Aluminum (dissolved):
The operational guidance (OG) value for total aluminum in drinking water is 0.100 mg/L (100 µg/L) to optimize water treatment and distribution system operations. This value is based on a locational running annual average. The sampling frequency required to calculate the locational running annual average will vary based on the type of treatment facility and the sampling location. (Update March 5, 2021)
Note 2.4 for Copper (dissolved):
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on Copper, June 2019.

Note 2.5 for Manganese (dissolved):
Guidelines for Canadian Drinking Water Quality - Guideline Technical Document on manganese, May 2019.
3. Notes for BC Source Drinking Water Quality Guidelines - Maximum Acceptable Concentrations (2020 and updates) (BC SDWQG MAC)
General Notes:
Reference: British Columbia Ministry of Environment and Climate Change Strategy. 2020. B.C. Source Drinking Water Quality Guidelines: Guideline Summary. The source drinking water quality guidelines apply to the ambient water before it is treated and distributed for domestic use. The guidelines apply to drinking water sources from surface water and groundwater.
Note 3.1 for Turbidity:
For raw drinking water without treatment for particulates the guideline is: ≤ 1 NTU of turbidity. For raw drinking water with treatment for particulates the guideline is: Natural background turbidity is ≤ 50 NTU: Change from background should not exceed 5 NTU. Natural background turbidity is > 50 NTU: Change from background should not exceed 10% of the background turbidity.
Note 3.2 for Copper (dissolved):
Includes short-term and long-term exposure.
4. Notes for BC Source Drinking Water Quality Guidelines - Aesthetic Objectives (2020 and updates) (BC SDWQG AO)
General Notes:
Reference: British Columbia Ministry of Environment and Climate Change Strategy. 2020. B.C. Source Drinking Water Quality Guidelines: Guideline Summary. The source drinking water quality guidelines apply to the ambient water before it is treated and distributed for domestic use. The guidelines apply to drinking water sources from surface water and groundwater.
Note 4.1 for Phosphorus (dissolved, APHA 4500-P):
The AO for lakes is 0.01 mg/L. For lakes with residence time > 6 months, measure total P during spring overturn. For lakes with residence time < 6 months, measure mean epilimnetic total P during the growing season (ENV 1985).
Note 4.2 for Phosphorus (dissolved, by ICPMS/ICPOES):
The AO for lakes is 0.01 mg/L. For lakes with residence time > 6 months, measure total P during spring overturn. For lakes with residence time < 6 months, measure mean epilimnetic total P during the growing season (ENV 1985).
Note 4.3 for Phosphorus (total, APHA 4500-P):
The AO for lakes is 0.01 mg/L. For lakes with residence time > 6 months, measure total P during spring overturn. For lakes with residence time < 6 months, measure mean epilimnetic total P during the growing season (ENV 1985).
5. Notes for BC CSR Generic Numerical Water Standards for Drinking Water (CSR DW)
General Notes:
BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 133/2022 March 1, 2023. Drinking water standards are for unfiltered samples obtained at the point of consumption. Heavy metals, metalloids and inorganic ions are expressed as total substance concentrations unless otherwise indicated.
Note 5.1 for Chloride:
Standard to protect against taste and odour concerns.
Note 5.2 for Sulphate:
Standard to protect against taste and odour concerns.
Note 5.3 for Nitrate (as N):
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
Note 5.4 for Nitrate + Nitrite (as N):
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
Note 5.5 for Aluminum (dissolved):
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.
Note 5.6 for Chromium (dissolved):
Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary. Standard is 50 µg/L for chromium, hexavalent. Standard is 6000 µg/L for chromium, trivalent. The standard of 50 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.

Note 5.7 for Cobalt (dissolved):
The standard in Schedule 3.2 is 1 µg/L. However, BC CSR Protocol 9 has background concentrations in groundwater for cobalt in ug/L for regions of BC as follows. "Lower Mainland Sub-Region 1: 62 Lower Mainland Sub-Region 2: 18 Thompson Okanagan Region: 16 Southern Vancouver Island Region: 14 The interim cobalt value of 20 ug/L for the remaining regions of the province remains in effect." Reference: BC CSR Protocol 9 for Contaminated Sites, Establishing Local Background Concentrations in Groundwater, BC Ministry of Environment and Climate Change Strategy, February 1, 2023.
Note 5.8 for Copper (dissolved):
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.
Note 5.9 for Iron (dissolved):
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item A6, A7, A8 or A11 (b) item C1, C2, C3, C4 or C6, (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above. Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.
Note 5.10 for Manganese (dissolved):
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item B1 (b) item C1, C3 or C4 (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H3 or H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above. Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups. Standard may not address aesthetic (organoleptic) concerns related to drinking water quality. Water treatment may be required.
Note 5.11 for Sodium (dissolved):
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups.
Note 5.12 for Zinc (dissolved):
Standard is specific to protection of human health. Standard is derived with TRV protective of adults. Standard may not adequately protect other age groups.
6. Notes for BC Approved Water Quality Guidelines for irrigation (BCAWQG I)
General Notes:
References: British Columbia Ministry of Water, Land, and Resource Stewardship. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary (May 2025). Water Quality Guideline Series, WQG-20; and B.C. Guideline Overview and Technical Reports.
Note 6.1 for pH:
Update August 2019 Summary Report.
Note 6.2 for Temperature:
The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.

Note 6.3 for Turbidity:
Induced turbidity should not exceed 10 NTU when background turbidity is less than or equal to 50 NTU, nor should induced turbidity be more than 20 % of background when background is greater than 50 NTU.
Note 6.4 for Fluoride:
Total fluoride in irrigation water should not exceed 1.0 mg/L as a 30-day average or a maximum of 2.0 mg/L.
Note 6.5 for Aluminum (dissolved):
The guideline maximum for total aluminum is 5 mg/L. A separate guideline for dissolved aluminum is not provided.
Note 6.6 for Arsenic (dissolved):
The interim guideline for total arsenic is 100 µg/L.
Note 6.7 for Boron (dissolved):
The guideline for total boron depends on the crop, and varies from 0.5 mg/L to 6 mg/L. The most stringent guideline maximum of 0.5 mg/L, for very sensitive and sensitive crops, was used to identify exceedances for this report.
Note 6.8 for Copper (dissolved):
The guideline maximum for total copper is 200 µg/L.
Note 6.9 for Lead (dissolved):
For neutral and alkaline fine-textured soils the total lead concentration in irrigation water should not exceed 400 µg/L at any time. The concentration of total lead in irrigation water for use on all other soils should not exceed 200 µg/L at any time. / The most stringent guideline maximum was used in this report.
Note 6.10 for Mercury (dissolved):
The guideline maximum for total mercury is 2.0 µg/L.
Note 6.11 for Molybdenum (dissolved):
The long-term chronic guidelines for total molybdenum are as follows: Forage crops-poorly drained soil: 0.01 mg/L Forage crops-well drained soil: 0.02 mg/L Non-forage crops: 0.028 mg/L. This guideline is intended to be protective of terrestrial plants and is not necessarily protective of livestock consuming these plants. The most stringent guideline (0.01 mg/L for forage crops-poorly drained soil) has been used.
Note 6.12 for Selenium (dissolved):
The guideline for total selenium is 10 µg/L mean. The mean concentrations in the water column are based on at least 5 weekly samples taken over a 30-day period.
Note 6.13 for Zinc (dissolved):
The guideline maximum for total zinc for irrigation is as follows: - Soil pH less than 6: 1000 µg/L. - Soil pH equal to or greater than 6, and less than 7: 2000 µg/L. - Soil pH greater than or equal to 7: 5000 µg/L. / The most stringent guideline maximum was used in this report.
7. Notes for BC Working Water Quality Guidelines for Irrigation (BCWWQG I)
General Notes:
Reference: B.C. Ministry of Water, Land and Resource Stewardship 2024. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Quality Guideline Series, WQG-08-01. Prov. B.C., Victoria B.C. Working Water Quality Guideline (WWQG) values are long-term chronic concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. WWQG are given for total substance concentrations unless otherwise noted.
Note 7.1 for Conductivity:
The guideline varies from 700 to 5000 µS/cm depending on the type of crop. The most stringent guideline has been used for this report.
Note 7.2 for Total dissolved solids:
The guideline varies from 500 to 3500 mg/L depending on the type of crop. The most stringent guideline has been used for this report.
Note 7.3 for Cadmium (dissolved):
This is a Short-term maximum guideline.
Note 7.4 for Chromium (dissolved):
The guideline for Cr(VI) is 8 µg/L (total). The guideline for Cr(III) is 4.9 µg/L (total). The guideline of 4.9 µg/L for Cr(III) was used, in this report, to identify exceedances for dissolved chromium, and total chromium as a means for determining the potential for exceeding the Cr(VI) and/or Cr(III) guidelines.

Note 7.5 for Cobalt (dissolved):
Continuous or intermittent use on all soils.
Note 7.6 for Lithium (dissolved):
The guideline is 2.5 mg/L for non-citrus crops (May not be protective of barley and other cereal crops; 1.0 mg/L suggested for cereal crops). The guideline is 0.75 mg/L for citrus crops. / The most stringent guideline was used in this report.
8. Notes for BC CSR Generic Numerical Water Standards for Irrigation (CSR IW)
General Notes:
BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 133/2022 March 1, 2023. Standards for all organic substances are for total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered. Standards for surface water samples to be analyzed for heavy metals, metalloids and inorganic ions are total substance concentrations. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for dissolved substance concentrations. Standards for groundwater samples for heavy metals, metalloids and inorganic ions are for dissolved substance concentrations. In addition, it is recommended that groundwater samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for total substance concentrations. Standards apply to irrigation of all soil types, unless otherwise indicated. There are several different standards for site-specific factors for some analytes. The most stringent standards were used for this criteria set.
Note 8.1 for Chloride:
Standard to protect all types of crops.
Note 8.2 for Boron (dissolved):
Standard varies depending on crop. This standard is for blackberry crop.
Note 8.3 for Chromium (dissolved):
Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary. Standard is 8 µg/L for chromium, hexavalent. Standard is 5 µg/L for chromium, trivalent. The standard of 5 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.
Note 8.4 for Iron (dissolved):
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item A6, A7, A8 or A11 (b) item C1, C2, C3, C4 or C6, (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above.
Note 8.5 for Lithium (dissolved):
Standard to protect all types of crops.
Note 8.6 for Manganese (dissolved):
Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as (a) item B1 (b) item C1, C3 or C4 (c) item D2, D3, D5, or D6 (d) item E4, or (e) item H3 or H14. Standard applies to a site used for an industrial or commercial purpose or activity set out in Schedule 2 as item H11 or H20, but only if the site was used for the purpose or activity in conjunction with or as a result of the site also being used for at least one of the purposes or activities set out above.
Note 8.7 for Molybdenum (dissolved):
Standard varies with crop, soil drainage and Mo:Cu ratio. Standard is 10 – 30 µg/L. Consult a director for further advice. The most stringent standard of 10 µg/L has been used.

Note 8.8 for Selenium (dissolved):
Standard varies with type of application; continuous or intermittent. This standard is for continuous applications on crops.
Note 8.9 for Zinc (dissolved):
The standard varies (from 1000 to 5000 µg/L) with soil pH. This standard (which is the most stringent) is for soil pH less than 6.0
9. Notes for BC Approved Water Quality Guidelines for livestock (BCAWQG L)
General Notes:
References: British Columbia Ministry of Water, Land, and Resource Stewardship. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary (May 2025). Water Quality Guideline Series, WQG-20; and B.C. Guideline Overview and Technical Reports.
Note 9.1 for pH:
Update August 2019 Summary Report.
Note 9.2 for Temperature:
The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.
Note 9.3 for Turbidity:
Induced turbidity should not exceed 5 NTU when background turbidity is less than or equal to 50 NTU, nor should induced turbidity be more than 10 % of background when background is greater than 50 NTU.
Note 9.4 for Chloride:
The water quality guideline for chloride for livestock watering is 600 mg/L.
Note 9.5 for Fluoride:
The total fluoride recommendation for dairy cows, breeding stock and other long-lived animals is 1.0 mg/L as a 30-day mean and 1.5 mg/L as a maximum. Total fluoride should not exceed 2.0 mg/L as a 30-day mean or 4.0 mg/L maximum in the drinking water of all other types of livestock, unless fluoride is provided in the diet by bone meal or mineral additives, in which case 1.0 mg/L as a 30-day mean and 2.0 mg/L maximum is recommended. / The most stringent guideline maximum was used in this report.
Note 9.6 for Nitrate (as N):
Overview Report Update, September 2009.
Note 9.7 for Nitrate + Nitrite (as N):
The guideline maximum for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value. Overview Report Update, September 2009.
Note 9.8 for Nitrite (as N):
Overview Report Update, September 2009.
Note 9.9 for Aluminum (dissolved):
The guideline maximum for total aluminum is 5 mg/L. A separate guideline for dissolved aluminum is not provided.
Note 9.10 for Arsenic (dissolved):
The interim guideline for total arsenic is 25 µg/L.
Note 9.11 for Boron (dissolved):
The guideline maximum for total boron is 5 mg/L.
Note 9.12 for Copper (dissolved):
The guideline maximum for total copper is 300 µg/L.
Note 9.13 for Lead (dissolved):
The guideline maximum for total lead is 100 µg/L.
Note 9.14 for Mercury (dissolved):
The guideline maximum for total mercury is 3.0 µg/L.
Note 9.15 for Molybdenum (dissolved):
Interim guidelines for total molybdenum are based on differences in sensitivity to molybdenum exposure: 1) ruminant livestock, 0.016 mg/L; and 2) non-ruminant livestock: 0.284 mg/L. The most stringent guideline (0.016 mg/L for ruminant livestock) has been used.
Note 9.16 for Selenium (dissolved):
The guideline for total selenium is 30.0 µg/L mean. The mean concentrations in the water column are based on at least 5 weekly samples taken over a 30-day period.
Note 9.17 for Zinc (dissolved):
The guideline maximum for total zinc is 2000 µg/L.

10. Notes for BC Working Water Quality Guidelines for Livestock (BCWWQG L)
General Notes:
Reference: B.C. Ministry of Water, Land and Resource Stewardship 2024. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Quality Guideline Series, WQG-08-01. Prov. B.C., Victoria B.C. Working Water Quality Guideline (WWQG) values are long-term chronic concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. WWQG are given for total substance concentrations unless otherwise noted.
Note 10.1 for Sulphate:
The guideline is for dissolved sulphate.
Note 10.2 for Total dissolved solids:
The guideline is 1,000-3,000 mg/L, and is species dependent. Maximum of 1000 mg/L is relatively low level of salinity; excellent for all classes of livestock. TDS between 1000 and 3000 mg/L is satisfactory for all classes of livestock and poultry, but some loss in productivity should be anticipated: may cause temporary and mild diarrhoea in livestock not accustomed to them or watery droppings in poultry. / The most stringent guideline was used in this report.
Note 10.3 for Cadmium (dissolved):
This is a Short-term maximum guideline.
Note 10.4 for Chromium (dissolved):
The guideline for Cr(VI) is 50 µg/L (total). The guideline for Cr(III) is 50 µg/L (total). The guideline of 50 µg/L for Cr(VI), and for Cr(III) was used, in this report, to identify exceedances for dissolved chromium, and total chromium as a means for determining the potential for exceeding the Cr(VI) and/or Cr(III) guidelines.
11. Notes for BC CSR Generic Numerical Water Standards for Livestock (CSR LW)
General Notes:
BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 133/2022 March 1, 2023. Standards for all organic substances are for total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered. Standards for surface water samples to be analyzed for heavy metals, metalloids and inorganic ions are total substance concentrations. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for dissolved substance concentrations. Standards for groundwater samples for heavy metals, metalloids and inorganic ions are for dissolved substance concentrations. In addition, it is recommended that groundwater samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for total substance concentrations.
Note 11.1 for Fluoride:
Standard varies with type of livestock. Consult a director for further advice.
Note 11.2 for Nitrate (as N):
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
Note 11.3 for Nitrate + Nitrite (as N):
Where nitrate and nitrite are present, total nitrate plus nitrite-nitrogen should not exceed this value.
Note 11.4 for Chromium (dissolved):
Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary. Standard is 50 µg/L for chromium, hexavalent. Standard is 50 µg/L for chromium, trivalent. The standard of 50 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.
12. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (Short-term acute) (BCAWQG AL (ST))
General Notes:
References: British Columbia Ministry of Water, Land, and Resource Stewardship. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary (May 2025). Water Quality Guideline Series, WQG-20; and B.C. Guideline Overview and Technical Reports. / There are two types of water quality guidelines: the short-term acute guideline (i.e. maximum), and the long-term chronic guideline (i.e. average). Only the short-term acute guidelines are included in this criteria set.
Note 12.1 for Dissolved oxygen:
The aquatic life instantaneous minimum guideline for dissolved oxygen is 5 mg/L for all life stages other than buried embryo/alevin. The instantaneous minimum guideline for dissolved oxygen in the water column is 9 mg/L for buried embryo/alevin. The instantaneous minimum guideline for dissolved oxygen in interstitial water is 6 mg/L for buried embryo/alevin.

Note 12.2 for Temperature:
The freshwater aquatic life guideline for streams with unknown fish distribution is: Maximum daily temperature of 19 degrees Celsius; MWMT = 18 degrees Celsius. (MWMT, mean weekly short-term temperature, is defined as the average of the warmest daily short-term temperatures for 7 consecutive days; Hourly rate of change not to exceed 1 degree Celsius; Short-term incubation temperature = 12 degrees Celsius (in spring and fall). See BC MOE Overview Report for additional details for streams with unknown fish distribution, and specific guidelines for streams with known fish distribution, and guideline for lakes and impoundments.
Note 12.3 for Turbidity:
Aquatic life guidelines for turbidity are: Change from background of 8 NTU at any one time for a duration of 24 h in all waters during clear flows or in clear waters; Change from background of 2 NTU at any one time for a duration of 30 d in all waters during clear flows or in clear waters; Change from background of 5 NTU at any time when background is 8 - 50 NTU during high flows or in turbid waters; Change from background of 10% when background is > 50 NTU at any time during high flows or in turbid waters.
Note 12.4 for Chloride:
To protect freshwater aquatic life from acute and lethal effects, the maximum concentration of chloride (mg/L as NaCl) at any time should not exceed 600 mg/L. When ambient chloride concentrations exceed guidelines, increases in chloride due to human activities should be avoided.
Note 12.5 for Fluoride:
The freshwater aquatic life short-term acute Interim guideline for total fluoride is as follows: If hardness is less than or equal to 10 mg/L then the guideline is 0.4 mg/L; If hardness is greater than 10 mg/L then the guideline (in units mg/L) is based on the equation: WQG = [-51.73 + 92.57 log10 (hardness)] × 0.01. Hardness is as $CaCO_3$ in units mg/L. The equation applies to water hardness (as $CaCO_3$) between 10 – 385 mg/L, and is an interim WQG until carefully controlled experiments can determine the appropriate levels of fluoride under various combinations of water temperature and hardness. When water hardness exceeds highest hardness tested (i.e. upper bound), a site-specific assessment may be required.
Note 12.6 for Ammonia (total, as N):
The freshwater aquatic life short-term acute guideline for ammonia varies as a function of pH and temperature. See Table 3 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia for this report. If a lab pH result was not available then the field pH result was used.
Note 12.7 for Nitrate (as N):
Freshwater aquatic life short-term acute guideline.
Note 12.8 for Nitrite (as N):
The freshwater aquatic life short-term acute guideline for nitrite as N is: 0.06 mg/L if chloride less than 2 mg/L 0.12 mg/L if chloride is 2 to 4 mg/L 0.18 mg/L if chloride is 4 to 6 mg/L 0.24 mg/L if chloride is 6 to 8 mg/L 0.30 mg/L if chloride is 8 to 10 mg/L 0.60 mg/L if chloride is greater than 10 mg/L.
Note 12.9 for Antimony (dissolved):
The guideline is for total antimony.
Note 12.10 for Cadmium (dissolved):
Freshwater aquatic life short-term acute guideline: The guideline for cadmium is determined on a site-specific basis according to the local water hardness. The guideline for cadmium (dissolved) in µg/L is determined by the following equations for short term exposure: 1. If hardness (as $CaCO_3$) is less than 7 mg/L then maximum is 0.0380 µg/L 2. If hardness (as $CaCO_3$) is from 7 to 45 mg/L then maximum is based on equation: e to the power of {1.03[ln(hardness)] - 5.274} 3. If hardness (as $CaCO_3$) is greater than 455 mg/L then maximum is 2.8 µg/L. When water hardness is greater than the upper bound (i.e., highest water hardness tested), a site-specific assessment may be required.

Note 12.11 for Copper (dissolved):

The guideline for dissolved copper has multiple dependent analytes. Calculating a guideline using the full BC Biotic Ligand Model (BC BLM) software requires 11 water chemistry parameters. The simplified version of the BC BLM requires only four water chemistry parameters: temperature, DOC, pH, and hardness.
An Excel file with a lookup table (BC lookup table) is available from the BC Webpage at the Copper section of the Guideline Technical Reports section. A constant temperature (15° C) was assumed for all scenarios in the BC lookup table (the effect of temperature on determining guideline is minor). Therefore, the BC lookup table has 3 dependent analytes: DOC, pH, and hardness. The BC lookup table was used in the Wireless Water® application to calculate the guideline value for each sample.
References: (1) B.C. Ministry of Environment and Climate Change Strategy 2019. Copper Water Quality Guideline for the Protection of Freshwater Aquatic Life-Technical Report. WQG-03-1, and (2) B.C. Ministry of Environment and Climate Change Strategy. 2019. Copper Water Quality Guideline for Protection of Freshwater Aquatic Life-User's Guide. WQG-03-3.

Note 12.12 for Iron (dissolved):

Freshwater aquatic life short-term acute guideline.

Note 12.13 for Manganese (dissolved):

The freshwater aquatic life short-term acute guideline for total manganese in mg/L is determined by the following relationship:
0.01102 hardness + 0.54
where water hardness is reported as mg/L of CaCO3.
The guideline applies to water hardness between 25 – 259 mg/L CaCO3. When water hardness is outside hardness range tested (i.e. lower or upper bound), a site-specific assessment may be required.

Note 12.14 for Molybdenum (dissolved):

The guideline is for total molybdenum.

Note 12.15 for Nickel (dissolved):

The guideline for dissolved nickel has multiple dependent analytes. Calculating a guideline using the full BC Biotic Ligand Model (BC BLM) software requires 11 water chemistry parameters. The simplified version of the BC BLM requires only four water chemistry parameters: temperature, DOC, pH, and hardness.
An Excel file with a lookup table (BC lookup table) is available from the BC Webpage at the Nickel section of the Guideline Technical Reports section. The BC lookup table has 4 dependent analytes: temperature, DOC, pH, and hardness. The BC lookup table was used in the Wireless Water® application to calculate the guideline value for each sample. A constant temperature of 15° C was assumed (the effect of temperature on determining guideline is minor).
Reference: B.C. Ministry of Water, Land, and Resources Stewardship. 2024. Nickel Water Quality Guideline for the Protection of Freshwater Aquatic Life-Technical Report. WQG-22-1.

Note 12.16 for Zinc (dissolved):

The guideline is for dissolved zinc (µg/L) and is calculated using the following equation: (exp(0.833[ln(hardness (as CaCO3) mg/L)] + 0.240[ln(DOC mg/L)] + 0.526))/2.
The equation is valid between hardness (as CaCO3) 13.8 and 250.5 mg/L, and between dissolved organic carbon (DOC) 0.3 and 17.3 mg/L. If results are outside these equation limits, then the value of the closest equation limit is used in the formula calculation. When water hardness exceeds highest hardness tested (i.e. upper bound), a site-specific assessment may be required.
Reference: B.C. Ministry of Water, Land, and Resource, Stewardship, 2023. Zinc Water Quality Guidelines - Freshwater Aquatic Life. Water Quality Guideline Series, WQG-19-1.

13. Notes for BC Working Water Quality Guidelines for Freshwater Aquatic Life (BCWWQG AL)

General Notes:

Reference: B.C. Ministry of Water, Land and Resource Stewardship. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (March 2025). Water Quality Guideline Series, WQG-08-01.
Working Water Quality Guideline (WWQG) values are long-term chronic concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. WWQG are given for total substance concentrations unless otherwise noted.

Note 13.1 for Alkalinity (total, as CaCO3):

The long-term chronic guideline for alkalinity (total as CaCO3) is 20 mg/L or more except where natural concentrations are less.

Note 13.2 for Chromium (dissolved):

The guideline for Cr(VI) (total) is 2.5 µg/L. The guideline for Cr(III) (total) is 8.9 µg/L The guideline of 2.5 µg/L for Cr(VI) was used to identify exceedances for chromium (dissolved) as a means for determining the potential for exceeding the Cr(VI) and/or Cr(III) guidelines.

Note 13.3 for Uranium (dissolved):
The short-term acute guideline is 16.5 µg/L.
14. Notes for BC Approved Water Quality Guidelines for wildlife (BCAWQG WL)
General Notes:
References: British Columbia Ministry of Water, Land, and Resource Stewardship. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary (May 2025). Water Quality Guideline Series, WQG-20; and B.C. Guideline Overview and Technical Reports.
Note 14.1 for Temperature:
An interim guideline to protect wildlife from excessive temperature changes is based on natural background levels. The guideline for temperature is ± 1 degree Celsius maximum change from natural ambient background; the hourly rate of change should not exceed 0.5 degrees Celsius.
Note 14.2 for Turbidity:
Induced turbidity should not exceed 10 NTU when background turbidity is less than or equal to 50 NTU, nor should induced turbidity be more than 20 % of background when background is greater than 50 NTU.
Note 14.3 for Dissolved organic carbon:
Recommended guideline for dissolved organic carbon (DOC) is 30-day median ± 20% of the median background concentration.
Note 14.4 for Fluoride:
Total fluoride should not exceed 1.0 mg/L as a 30-day average or 1.5 mg/L as a maximum in fresh water used by wildlife.
Note 14.5 for Nitrate (as N):
The guideline maximum for Wildlife for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value.
Note 14.6 for Nitrate + Nitrite (as N):
The guideline maximum for Wildlife for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value.
Note 14.7 for Copper (dissolved):
The guideline maximum is for total copper.
Note 14.8 for Mercury (dissolved):
The aquatic life long-term chronic guideline for total mercury for aquatic life is based on the formula 0.0001 / (MeHg/total Hg), where MeHg is mass (or concentration) of methyl mercury and total Hg is total mass (or concentration) of mercury in a given water volume. The guideline is 0.02 µg/L when the methyl mercury (MeHg) constitutes less than or equal to 0.5% of the total mercury concentration. When the proportion of MeHg is greater than 0.5%, the guideline should be adjusted. A guideline of 0.02 µg/L has been used for this report.
Note 14.9 for Molybdenum (dissolved):
Interim long-term chronic guidelines for total molybdenum are based on differences in sensitivity to molybdenum exposure: 1) ruminant wildlife, 0.034 mg/L; and 3) non-ruminant wildlife: 0.284 mg/L. The most stringent guideline (0.034 mg/L for ruminant wildlife) has been used.
Note 14.10 for Selenium (dissolved):
The water column (aquatic life) guideline of 2 µg/L, and the dietary guideline of 4 µg/g in food items, are applicable to wildlife species. The 30-day average water quality guideline for protection of aquatic life is 2 µg/L determined as the mean concentration of 5 evenly spaced samples collected over 30 days, and measured as total selenium. The chronic tissue guideline for the protection of wildlife, using birds as a surrogate, is 6 µg/g (dw) in bird egg tissue, calculated as the mean concentration of at least 8 eggs (from 8 individual nests) in a representative area, reported as dry weight.

15. Notes for BC CSR Generic Numerical Water Standards for Freshwater Aquatic Life (CSR AW)
General Notes:
BC Contaminated Sites Regulation, Generic Numerical Water Standards, Schedule 3.2; includes amendments up to B.C. Reg. 133/2022 March 1, 2023. Aquatic life standards assume minimum 1:10 dilution available, and are to protect freshwater life. Standards for all organic substances are for total substance concentrations. Any water sample to be analyzed for organic substances should not be filtered. Standards for surface water samples to be analyzed for heavy metals, metalloids and inorganic ions are total substance concentrations. In addition, it is recommended that surface water samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for dissolved substance concentrations. Standards for groundwater samples for heavy metals, metalloids and inorganic ions are for dissolved substance concentrations. In addition, it is recommended that groundwater samples being analyzed for heavy metals, metalloids and inorganic ions should also be analyzed for total substance concentrations.
Note 15.1 for Fluoride:
The standard for fluoride is: 2000 µg/L @ H < 50 3000 µg/L @ H ≥ 50 Where H means water hardness in mg/L as CaCO3.
Note 15.2 for Sulphate:
The standard for sulfate is: 1280 mg/L @ H ≤ 30 2180 mg/L @ H 31 - 75 3090 mg/L @ H 76 - 180 4290 mg/L @ H > 180 Where H means water hardness in mg/L as CaCO3.
Note 15.3 for Ammonia (total, as N):
Standard varies with pH and temperature. 10 degrees C is assumed. Consult a director for further advice. The standard for ammonia, total (as N) is: 1,310 µg/L @ pH ≥ to 8.5 3,700 µg/L @ pH 8.0 - < 8.5 11,300 µg/L @ pH 7.5 - < 8.0 18,500 µg/L @ pH 7.0 - < 7.5 18,400 µg/L @ pH < 7.0
Note 15.4 for Nitrate (as N):
Standard may not protect all amphibians. Consult director for further advice.
Note 15.5 for Nitrate + Nitrite (as N):
Standard may not protect all amphibians. Consult director for further advice.
Note 15.6 for Nitrite (as N):
Standard varies with chloride concentration. Consult a director for further advice. The standard for nitrite (as N) is: 200 µg/L (Cl < 2 mg/L) 400 µg/L (Cl 2 - < 4 mg/L) 600 µg/L (Cl 4 - < 6 mg/L) 800 µg/L (Cl 6 - < 8 mg/L) 1,000 µg/L (Cl 8 - < 10 mg/L) 2,000 µg/L (Cl ≥ 10 mg/L)
Note 15.7 for Cadmium (dissolved):
The standard for cadmium is as follows: 0.5 µg/L @ H < 30 1.5 µg/L @ H 30 - < 90 2.5 µg/L @ H 90 - < 150 3.5 µg/L @ H 150 - < 210 4 µg/L @ H ≥ 210 Where H means water hardness in mg/L as CaCO3.

Note 15.8 for Chromium (dissolved):
Analytical results for chromium (all species) in water may be used to demonstrate compliance with the standards. Where the standards cannot be met based on analytical results for chromium (all species), chromium speciation may be necessary. Standard is 10 µg/L for chromium, hexavalent. Standard is 90 µg/L for chromium, trivalent. The standard of 10 µg/L was used to identify exceedances for dissolved chromium in order to demonstrate compliance with the standards.
Note 15.9 for Copper (dissolved):
The standard for copper is as follows: 20 µg/L @ H < 50 30 µg/L @ H 50 - < 75 40 µg/L @ H 75 - < 100 50 µg/L @ H 100 - < 125 60 µg/L @ H 125 - < 150 70 µg/L @ H 150 - < 175 80 µg/L @ H 175 - < 200 90 µg/L @ H ≥ 200 Where H means water hardness in mg/L as CaCO3.
Note 15.10 for Lead (dissolved):
The standard for lead is as follows: 40 µg/L @ H < 50 50 µg/L @ H 50 - < 100 60 µg/L @ H 100 - < 200 110 µg/L @ H 200 - < 300 160 µg/L @ ≥ 300 Where H means water hardness in mg/L as CaCO3.
Note 15.11 for Nickel (dissolved):
The standard for nickel is as follows: 250 µg/L @ H < 60 650 µg/L @ H 60 - < 120 1,100 µg/L @ H 120 - < 180 1,500 µg/L @ H ≥ 180 Where H means water hardness in mg/L as CaCO3.
Note 15.12 for Silver (dissolved):
The standard for silver is: 0.5 µg/L @ H ≤ 100 15 µg/L @ H > 100 Where H means water hardness in mg/L as CaCO3.
Note 15.13 for Zinc (dissolved):
The standard for zinc is as follows: 75 µg/L @ H < 90 150 µg/L @ H = 90 - < 100 900 µg/L @ H = 100 - < 200 1,650 µg/L @ H = 200 - < 300 2,400 µg/L @ H = 300 - < 400 3,150 µg/L @ H = 400 - < 500 If H ≥ 500 then use following formula: Standard (µg/L) = 10 x [7.5 +{(0.75)(H – 90)}] Where H means water hardness in mg/L as CaCO3. There are special ministry approval and data reporting requirements for water hardness values ≥ 500 mg/L as CaCO3. Reference is Schedule 3.2 and Protocol 10.

Table B-2: 2025 Bailey Springs Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Legend for Table B-2:

<	Less than reported detection limit
BC RWQG	BC Recreational Water Quality Guidelines (2019)
BCAWQG AL (LT)	BC Approved Water Quality Guidelines for freshwater aquatic life (Long-term chronic)
BCAWQG AL (ST)	BC Approved Water Quality Guidelines for freshwater aquatic life (Short-term acute)
BCWWQG AL	BC Working Water Quality Guidelines for Freshwater Aquatic Life
BCAWQG WL	BC Approved Water Quality Guidelines for wildlife
Calc	Calculated guideline or standard. The guideline or standard is dependent on the value of one or more other analytes, and is calculated from a formula or table.
N	Narrative type of guideline or standard, or Result Note.
NG	No Guideline
BC RWQG	Highlighted value exceeds BC RWQG
BCAWQG AL (LT)	Highlighted value exceeds BCAWQG AL (LT)
BCAWQG AL (ST)	Highlighted value exceeds BCAWQG AL (ST)
BCWWQG AL	Highlighted value exceeds BCWWQG AL
BCAWQG WL	Highlighted value exceeds BCAWQG WL

Table B-2: 2025 Bailey Springs Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Guideline					Sampling Location	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs	Bailey Springs
							Date Sampled	30-Jan-25	26-Feb-25	26-Feb-25	31-Mar-25	17-Apr-25	30-May-25	24-Jun-25	21-Jul-25	27-Aug-25	27-Aug-25	25-Sep-25	27-Oct-25	17-Nov-25	03-Dec-25
							Lab Sample ID														
							Sample Type	Normal	Normal	Duplicate	Normal	Normal	Normal	Normal	Normal	Normal	Duplicate	Normal	Normal	Normal	Normal
		BCAWQG AL (ST)	BCAWQG AL (LT)	BCWWQG AL	BCAWQG WL	**BC RWQG**															
Field Results																					
Temperature	°C	19 [1.1]	NG	NG	N [4.1]	N [5.1]		4	4	4	5	8	13	18	23	23	23	19	10	10	5
Lab Results																					
General																					
Chloride	mg/L	600 [1.2]	150 [2.1]	NG	600	NG		163	175	174	181	180	184	182	169	152	154	153	149	157	165
Conductivity	µS/cm	NG	NG	NG	NG	NG		1430	1370	1390	1410	1420	1430	1350	1360	1350	1350	1340	1350	1360	1360
pH		NG	N [2.2]	NG	NG	5.0 - 9.0		8.42	8.36	8.38	8.33	8.37	8.44	8.41	8.49	8.45	8.49	8.47	8.39	8.31	8.33
Nutrients																					
Ammonia (total, as N)	mg/L	Calc [1.3]	Calc [2.3]	NG	NG	NG		0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.222	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate (as N)	mg/L	32.8 [1.4]	3.0 [2.4]	NG	100 [4.2]	10		0.194	0.649	0.63	0.318	0.228	<0.010	<0.010	<0.010	0.042	0.041	0.019	<0.010	<0.010	0.029
Nitrate + Nitrite (as N)	mg/L	NG	NG	NG	100 [4.3]	NG		0.194	0.649	0.63	0.318	0.228	<0.0100	<0.0100	<0.0100	0.042	0.0409	0.0189	<0.0100	<0.0100	0.0292
Nitrite (as N)	mg/L	Calc [1.5]	Calc [2.5]	NG	10	1.0		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total nitrogen	mg/L	NG	NG	NG	NG	NG		0.692	1.18	1.21	0.95	0.74	0.719	0.604	0.643	0.67	0.701	0.71	0.595	0.574	0.544
Total kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG		0.498	0.526	0.579	0.632	0.512	0.719	0.604	0.643	0.628	0.66	0.691	0.595	0.574	0.515
Total organic nitrogen	mg/L	NG	NG	NG	NG	NG		0.447	0.526	0.579	0.632	0.512	0.719	0.604	0.421	0.628	0.66	0.691	0.595	0.574	0.515
Phosphorus (total, APHA 4500-P)	mg/L	NG	N [2.7]	NG	NG	N [5.3]		0.112	0.159	0.15	0.16	0.102	0.14	0.148	0.169	0.174	0.165	0.159	0.12	0.104	0.107
Phosphorus (dissolved, APHA 4500-P)	mg/L	NG	N [2.6]	NG	NG	N [5.2]		0.107	0.133	0.126	0.106	0.0893	0.14	0.126	0.143	0.174	0.157	0.128	0.108	0.0966	0.0975
Phosphorus, dissolved reactive	mg/L	NG	NG	NG	NG	NG		0.105	0.122	0.122	0.0826	0.0839	0.108	0.12	0.12	0.128	0.126	0.118	0.09	0.0898	0.0922
Microbiological																					
Total coliforms (MPN)	MPN/100 mL	NG	NG	NG	NG	NG		344	517	645	363	2420	3090	38700	16200	12600	11400	13800	4410	1300	1410
Fecal coliforms (MPN)	MPN/100 mL	NG	N [2.8]	NG	NG	NG		75	19	11	30	1	727	261	548	980	1050	435	326	23	12
Total Metals																					
Sodium (total)	mg/L	NG	NG	NG	NG	NG		153	130	132	143	147	147	139	143	155	157	143	137	145	145

Table B-2: 2025 Bailey Springs Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

1. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (Short-term acute) (BCAWQG AL (ST))
General Notes:
References: British Columbia Ministry of Water, Land, and Resource Stewardship. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary (May 2025). Water Quality Guideline Series, WQG-20; and B.C. Guideline Overview and Technical Reports. / There are two types of water quality guidelines: the short-term acute guideline (i.e. maximum), and the long-term chronic guideline (i.e. average). Only the short-term acute guidelines are included in this criteria set.
Note 1.1 for Chloride:
To protect freshwater aquatic life from acute and lethal effects, the maximum concentration of chloride (mg/L as NaCl) at any time should not exceed 600 mg/L. When ambient chloride concentrations exceed guidelines, increases in chloride due to human activities should be avoided.
Note 1.2 for Ammonia (total, as N):
The freshwater aquatic life short-term acute guideline for ammonia varies as a function of pH and temperature. See Table 3 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia for this report. If a lab pH result was not available then the field pH result was used.
Note 1.3 for Nitrate (as N):
Freshwater aquatic life short-term acute guideline.
Note 1.4 for Nitrite (as N):
The freshwater aquatic life short-term acute guideline for nitrite as N is: 0.06 mg/L if chloride less than 2 mg/L 0.12 mg/L if chloride is 2 to 4 mg/L 0.18 mg/L if chloride is 4 to 6 mg/L 0.24 mg/L if chloride is 6 to 8 mg/L 0.30 mg/L if chloride is 8 to 10 mg/L 0.60 mg/L if chloride is greater than 10 mg/L.
2. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (Long-term chronic) (BCAWQG AL (LT))
General Notes:
References: British Columbia Ministry of Water, Land, and Resource Stewardship. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary (May 2025). Water Quality Guideline Series, WQG-20; and B.C. Guideline Overview and Technical Reports. / There are two types of water quality guidelines: the short-term acute guideline (i.e. maximum), and the long-term chronic guideline (i.e. average). Only the long-term chronic guidelines are included in this criteria set.
Note 2.1 for Chloride:
To protect freshwater aquatic life from chronic effects, the average (arithmetic mean computed from five weekly samples collected over a 30-day period) concentration of chloride (mg/L as NaCl) should not exceed 150 mg/L. When ambient chloride concentrations exceed guidelines, increases in chloride due to human activities should be avoided.
Note 2.2 for pH:
The freshwater aquatic life long-term chronic guideline is: pH less than 6.5: No statistically significant decrease in pH from background; pH from 6.5 to 9.0: Unrestricted change permitted within this range; pH over 9.0: No statistically significant increase in pH from background. See BC MOE Overview Report for additional details.
Note 2.3 for Ammonia (total, as N):
The freshwater aquatic life long-term chronic guideline for ammonia varies as a function of pH and temperature. See Table 4 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia concentration for this report. If a lab pH result was not available then the field pH result was used.
Note 2.4 for Nitrate (as N):
Freshwater aquatic life long-term chronic guideline.

Note 2.5 for Nitrite (as N):
The freshwater aquatic life long-term chronic guideline for nitrite as N is: 0.02 mg/L if chloride less than 2 mg/L 0.04 mg/L if chloride is 2 to 4 mg/L 0.06 mg/L if chloride is 4 to 6 mg/L 0.08 mg/L if chloride is 6 to 8 mg/L 0.10 mg/L if chloride is 8 to 10 mg/L 0.20 mg/L if chloride is greater than 10 mg/L.
Note 2.6 for Phosphorus (dissolved, APHA 4500-P):
Streams: None proposed for streams. Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives.
Note 2.7 for Phosphorus (total, APHA 4500-P):
Streams: None proposed for streams. Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives.
Note 2.8 for Fecal coliforms (MPN):
There are insufficient data to set criteria for microbiological indicators for the protection of the health of aquatic organisms. The criteria below are for fresh or marine waters used for the growth and harvesting of shellfish for human consumption where the shellfish may be eaten raw and are used directly without a cleansing period prior to killing. The fecal coliform density in fresh and marine waters used for the growing and harvesting of shellfish for human consumption should not exceed a median MPN of 14/100 mL over 30 days, and at least 90% of the samples in a 30-day period should not exceed 43/100 mL.
3. Notes for BC Working Water Quality Guidelines for Freshwater Aquatic Life (BCWWQG AL)
General Notes:
Reference: B.C. Ministry of Water, Land and Resource Stewardship. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (March 2025). Water Quality Guideline Series, WQG-08-01. Working Water Quality Guideline (WWQG) values are long-term chronic concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. WWQG are given for total substance concentrations unless otherwise noted.
4. Notes for BC Approved Water Quality Guidelines for wildlife (BCAWQG WL)
General Notes:
References: British Columbia Ministry of Water, Land, and Resource Stewardship. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture - Guideline Summary (May 2025). Water Quality Guideline Series, WQG-20; and B.C. Guideline Overview and Technical Reports.
Note 4.1 for Nitrate (as N):
The guideline maximum for Wildlife for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value.
Note 4.2 for Nitrate + Nitrite (as N):
The guideline maximum for Wildlife for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value.
5. Notes for BC Recreational Water Quality Guidelines (2019) (BC RWQG)
General Notes:
Reference: British Columbia Ministry of Environment and Climate Change Strategy. 2019. B.C. Recreational Water Quality Guidelines: Guideline Summary. The guidelines are for primary contact recreational uses. Primary contact is defined as activities, such as swimming (this includes bathing/wading for the purposes of this document), windsurfing and waterskiing, as well as secondary contact activities, such as canoeing or fishing, in natural waters through intentional or incidental immersion.
Note 5.1 for Phosphorus (dissolved, APHA 4500-P):
The guideline for lakes is 0.01 mg/L.
Note 5.2 for Phosphorus (total, APHA 4500-P):
The guideline for lakes is 0.01 mg/L.

Table B-3: 2025 Clay Valve #4 Results
City of Vernon Reclaimed Water Irrigation Groundwater Monitoring Program

Analyte	Unit	Guideline	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4
Sampling Location			Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4	Clay Valve #4
Date Sampled			15-May-25	24-Jun-25	21-Jul-25	21-Jul-25	26-Aug-25	25-Sep-25	01-Oct-25
Lab Sample ID									
Sample Type			Normal	Normal	Normal	Duplicate	Normal	Normal	Normal
Lab Results									
General									
Biochemical oxygen demand	mg/L	NG	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0
Chloride	mg/L	NG	90	102	93.1	93.4	92.1	91.7	92.4
Hardness (as CaCO3), dissolved	mg/L	NG	237	230	253	241	239	238	232
pH		NG	7.95	7.92	7.96	8	8.01	8.07	7.8
Total dissolved solids	mg/L	NG	545	564	564	577	512	557	561
Total suspended solids	mg/L	NG	2.4	<2.0	<2.0	<2.0	3.6	2.2	2.5
Sulphate	mg/L	NG	96	96.8	96	97.5	91.3	96.6	92.7
Turbidity	NTU	NG	0.86	0.98	0.87	1	1.65	1.31	0.72
Nutrients									
Ammonia (total, as N)	mg/L	NG	0.424	0.64	0.886	0.896	1.04	1.2	1.24
Nitrate (as N)	mg/L	NG	1.38	1.82	0.988	0.975	0.897	0.572	0.561
Nitrate + Nitrite (as N)	mg/L	NG	1.38	1.82	1.05	1.04	0.932	0.64	0.644
Nitrite (as N)	mg/L	NG	<0.010	<0.010	0.06	0.063	0.035	0.068	0.083
Total nitrogen	mg/L	NG	2.98	3.68	3.15	3.13	3.39	2.88	3.28
Total kjeldahl nitrogen	mg/L	NG	1.6	1.86	2.1	2.09	2.45	2.24	2.64
Total organic nitrogen	mg/L	NG	1.17	1.22	1.22	1.2	1.42	1.04	1.4
Phosphorus (dissolved, by ICPMS/ICPOES)	mg/L	NG	0.865	0.937	1.29	1.28	1.34	1.43	1.39
Phosphorus (total, APHA 4500-P)	mg/L	NG	0.855	0.9	1.17	1.19	1.33	1.37	1.37
Phosphorus (dissolved, APHA 4500-P)	mg/L	NG	0.84	0.894	1.16	1.16	1.33	1.32	1.38
Phosphorus, dissolved reactive	mg/L	NG	0.701	0.823	1.04	1.03	1.13	1.15	1.2
Potassium (dissolved)	mg/L	NG	22.1	20.9	24.2	24	23.9	23.9	22.9
Microbiological									
Total coliforms (MPN)	MPN/100 mL	NG	28	8	4	<1	<1	1	2
Fecal coliforms (MPN)	MPN/100 mL	NG	<1	<1	<1	<1	<1	1	<1
Total Metals									
Sodium (total)	mg/L	NG	102	98.6	98.7	102	108	102	104
Dissolved Metals									
Aluminum (dissolved)	mg/L	NG	0.0052	0.0056	0.0083	0.0078	<0.0050	<0.0050	<0.0050
Antimony (dissolved)	mg/L	NG	0.00033	0.00032	0.00033	0.00034	0.00036	0.0003	0.00031
Arsenic (dissolved)	mg/L	NG	0.00088	0.00091	0.00091	0.00093	0.00095	0.0009	0.00086
Barium (dissolved)	mg/L	NG	0.0315	0.0307	0.0332	0.0335	0.0322	0.0296	0.0357
Beryllium (dissolved)	mg/L	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth (dissolved)	mg/L	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Boron (dissolved)	mg/L	NG	0.191	0.173	0.195	0.185	0.163	0.157	0.156
Cadmium (dissolved)	mg/L	NG	<0.000010	0.000034	0.00001	0.000012	<0.000010	<0.000010	<0.000010
Calcium (dissolved)	mg/L	NG	53.5	52	55.9	52	53.2	53.2	53.2
Chromium (dissolved)	mg/L	NG	<0.00050	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (dissolved)	mg/L	NG	0.00029	0.00029	0.00031	0.0003	0.00029	0.00029	0.00029
Copper (dissolved)	mg/L	NG	0.00505	0.0135	0.0045	0.00397	0.00366	0.00315	0.00352
Iron (dissolved)	mg/L	NG	0.033	0.044	0.06	0.057	0.055	0.059	0.055
Lead (dissolved)	mg/L	NG	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Lithium (dissolved)	mg/L	NG	0.0104	0.00992	0.0114	0.0106	0.0094	0.00943	0.00934
Magnesium (dissolved)	mg/L	NG	25.2	24.4	27.5	27	25.8	25.6	24.1
Manganese (dissolved)	mg/L	NG	0.0507	0.0721	0.115	0.112	0.136	0.152	0.165
Molybdenum (dissolved)	mg/L	NG	0.00375	0.00327	0.00364	0.00371	0.00314	0.00314	0.00311
Nickel (dissolved)	mg/L	NG	0.00167	0.00182	0.00166	0.00158	0.00171	0.00178	0.00162
Selenium (dissolved)	mg/L	NG	0.00069	0.00082	0.00075	0.0007	0.0007	0.00073	0.00067
Silicon (dissolved, as Si)	mg/L	NG	3.1	3	3.5	3.3	3.2	3.2	3.1
Silver (dissolved)	mg/L	NG	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (dissolved)	mg/L	NG	108	102	112	109	104	106	98.6
Strontium (dissolved)	mg/L	NG	0.582	0.576	0.538	0.536	0.531	0.55	0.533
Sulphur (dissolved)	mg/L	NG	41.6	37.4	44.4	37.7	35.6	35	34.8
Tellurium (dissolved)	mg/L	NG	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Thallium (dissolved)	mg/L	NG	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Thorium (dissolved)	mg/L	NG	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (dissolved)	mg/L	NG	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Titanium (dissolved)	mg/L	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Tungsten (dissolved)	mg/L	NG	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Uranium (dissolved)	mg/L	NG	0.00188	0.00181	0.0019	0.00189	0.00182	0.00176	0.00177
Vanadium (dissolved)	mg/L	NG	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (dissolved)	mg/L	NG	0.0308	0.0435	0.0396	0.0391	0.0362	0.0354	0.0328
Zirconium (dissolved)	mg/L	NG	0.00011	0.00011	0.00013	0.00012	0.00012	0.00013	0.00013

WIRELESS WATER

APPENDIX C – TIME-SERIES PLOTS

List of Acronyms:

GCDWQ MAC	Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations
GCDWQ AO	Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives
BC SDWQG MAC	BC Source Drinking Water Quality Guidelines - Maximum Acceptable Concentrations
BC SDWQG AO	BC Source Drinking Water Quality Guidelines - Aesthetic Objectives
CSR DW	BC CSR Generic Numerical Water Standards for Drinking Water
BCAWQG I	BC Approved Water Quality Guidelines for Irrigation
BCWWQG I	BC Working Water Quality Guidelines for Irrigation
CSR IW	BC CSR Generic Numerical Water Standards for Irrigation
BCAWQG L	BC Approved Water Quality Guidelines for Livestock
BCWWQG L	BC Working Water Quality Guidelines for Livestock
CSR LW	BC CSR Generic Numerical Water Standards for Livestock
BCAWQG AL (ST)	BC Approved Water Quality Guidelines for Freshwater Aquatic Life (short-term; acute)
BCAWQG AL (LT)	BC Approved Water Quality Guidelines for Freshwater Aquatic Life (long-term; chronic – Bailey Springs only)
BCWWQG AL	BC Working Water Quality Guidelines for Freshwater Aquatic Life
CSR AW	BC CSR Generic Numerical Water Standards for Freshwater Aquatic Life
BC RWQG	BC Recreational Water Quality Guidelines (Bailey Springs only)
Calc	Calculated guideline: the guideline is dependent on the value of one or more other analytes, and is calculated from a formula or table. Therefore, it is not shown on the plot. Refer to guideline notes in Appendix C for further details.
N	Narrative type of guideline; therefore, it is not shown on the plot. Refer to guideline notes in Appendix C for further details.

Note: On all plots, results that were below detection are plotted at one-half the detection limit. Guidelines are only shown on the figures if there is an applicable guideline for that parameter.

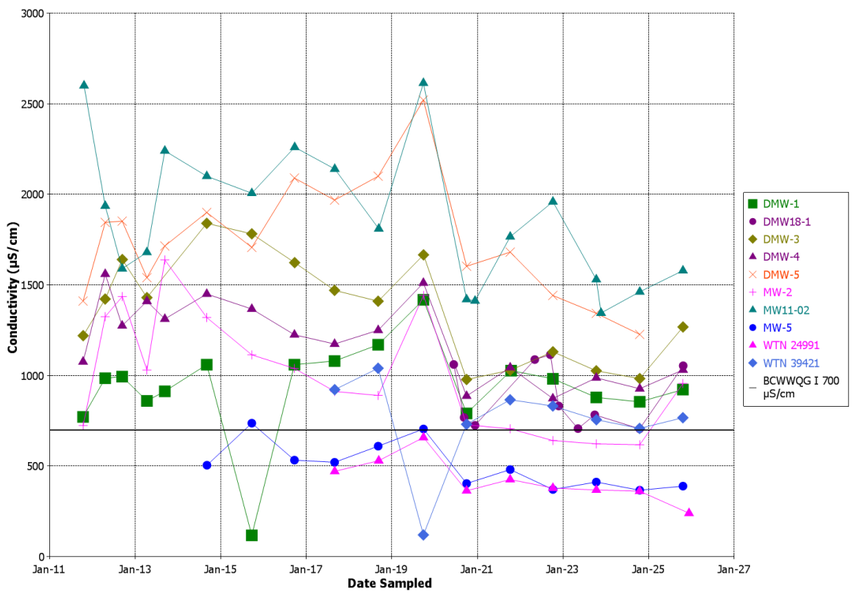


Figure C-1: Plot of field-measured conductivity in groundwater (all data since 2011)[1]

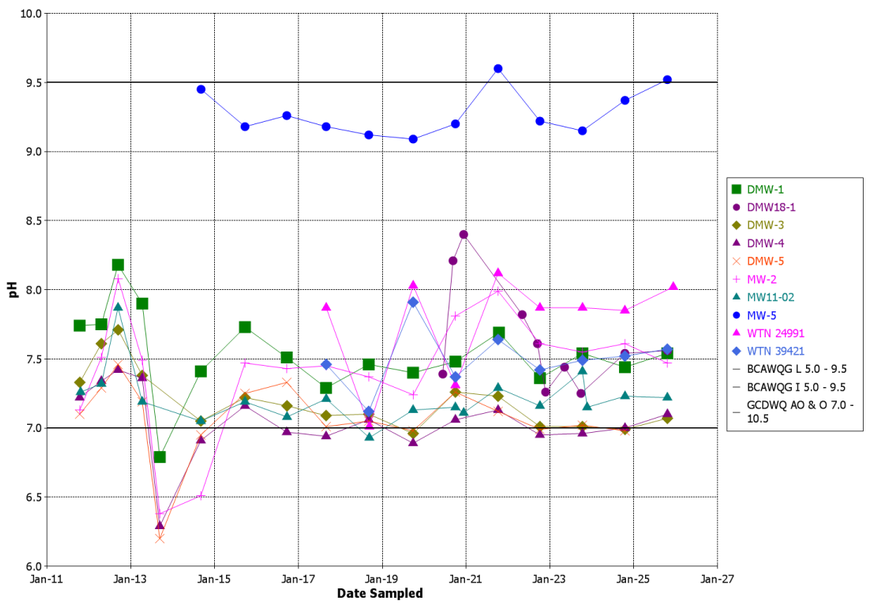


Figure C-2: Plot of field-measured pH in groundwater (all data since 2011)[1]

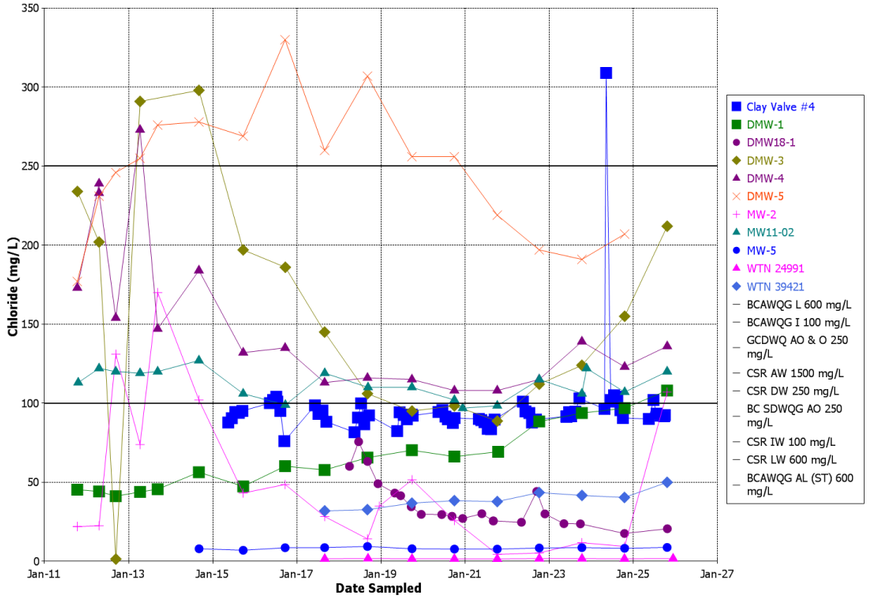


Figure C-3: Plot of chloride in groundwater and Clay Valve #4 (all data since 2011)

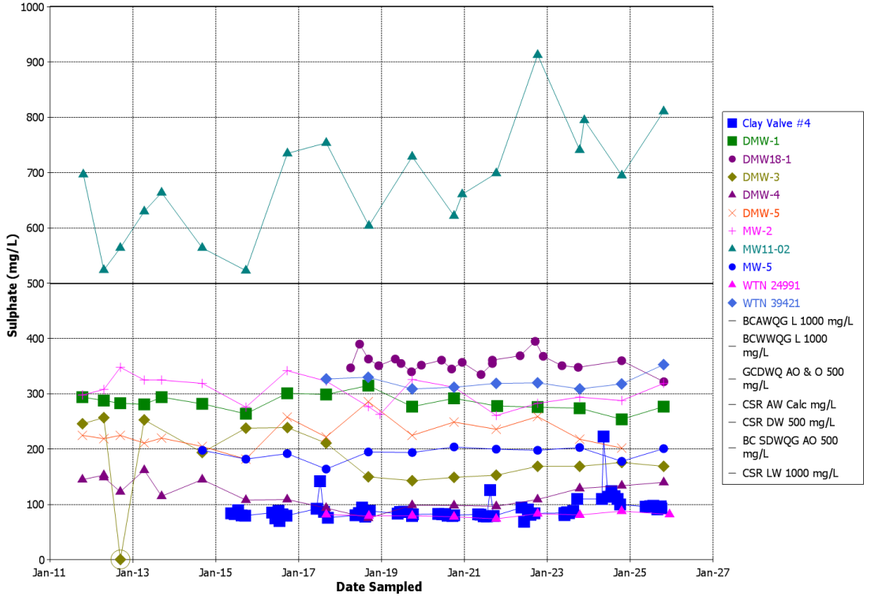


Figure C-4: Plot of sulphate in groundwater and Clay Valve #4 (all data since 2011)

[1] Conductivity and pH for Clay Valve #4 is not shown on Figures C-1 and C-2 because it is measured in the laboratory, and the figures show field-measured data only. Clay Valve #4 results from 2025 can be found in Appendix B.

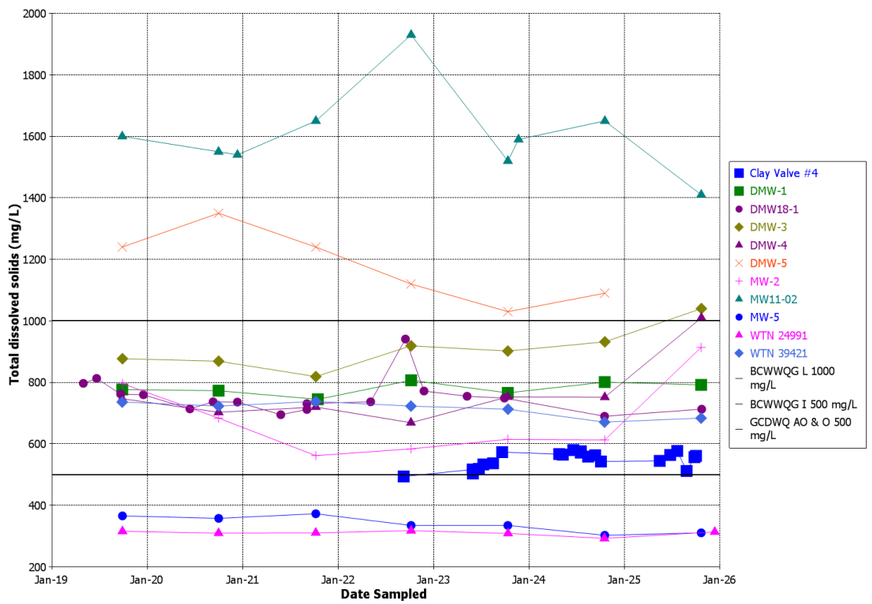


Figure C-5: Plot of TDS in groundwater and Clay Valve #4 since 2019 (i.e., since monitoring of TDS began)

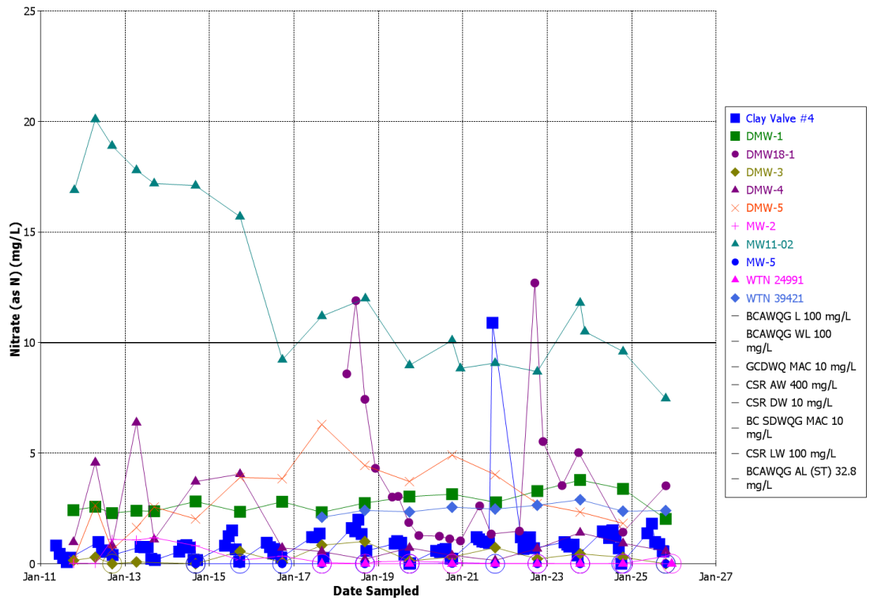


Figure C-6: Plot of nitrate-N in groundwater and Clay Valve #4 (all data since 2011)

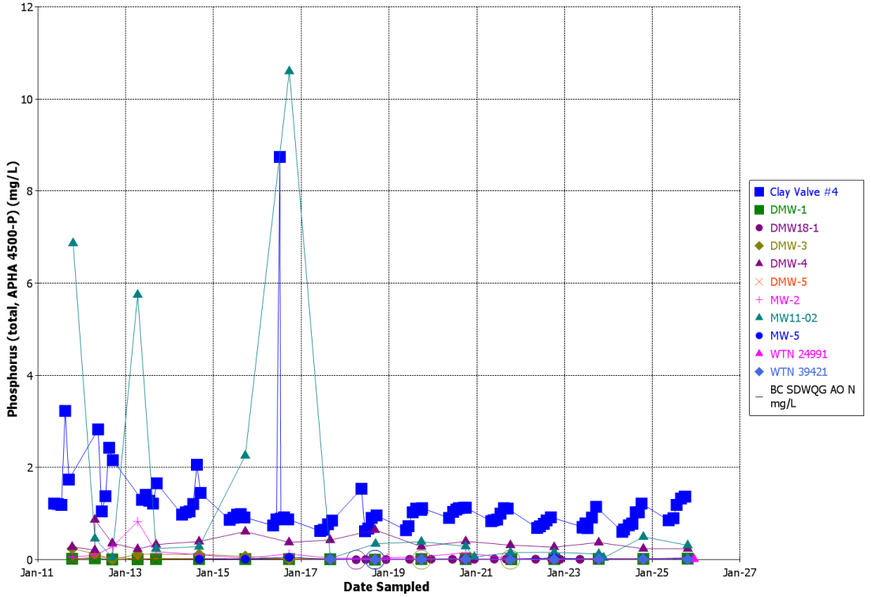


Figure C-7: Plot of total phosphorus in groundwater and Clay Valve #4 (all data since 2011)

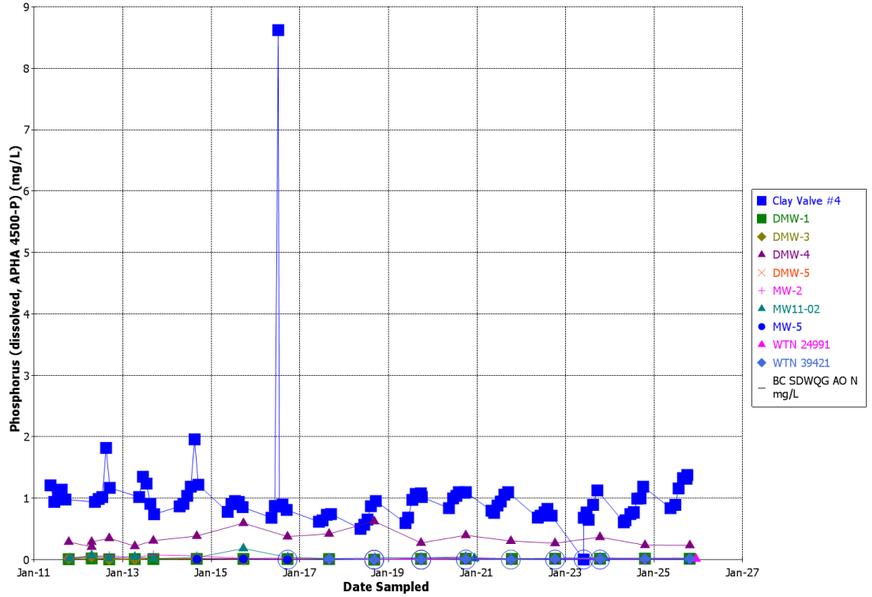


Figure C-8: Plot of total dissolved phosphorus in groundwater and Clay Valve #4 (all data since 2011)

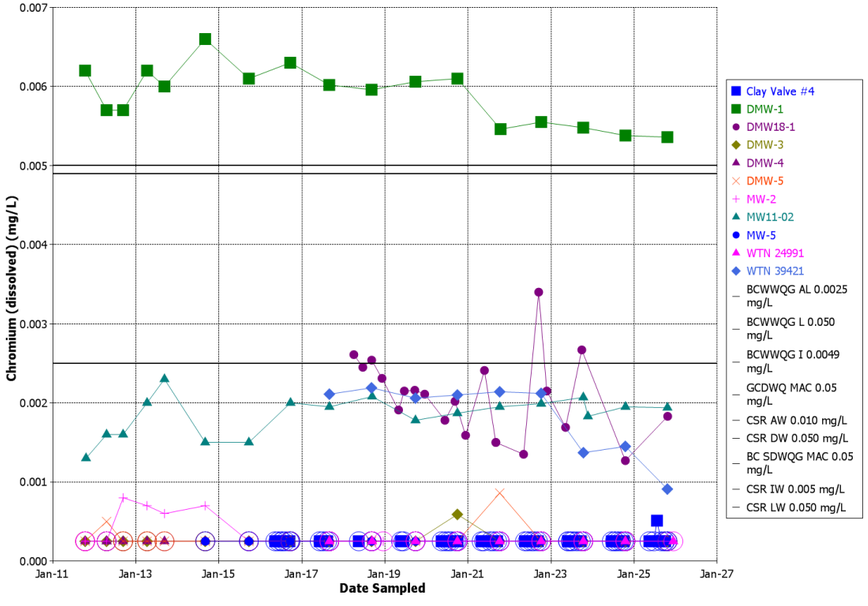


Figure C-9: Plot of dissolved chromium in groundwater and Clay Valve #4 (all data since 2011)

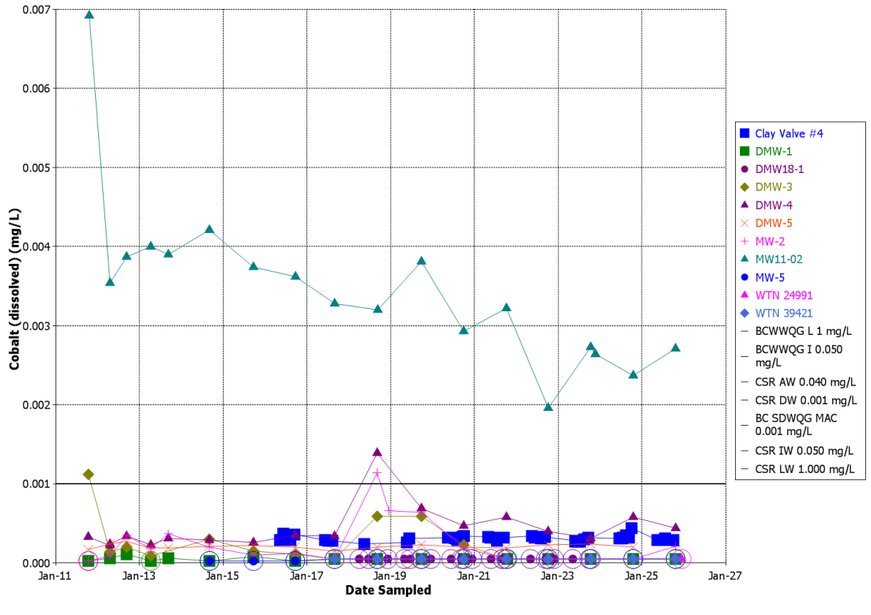


Figure C-10: Plot of dissolved cobalt in groundwater and Clay Valve #4 (all data since 2011)

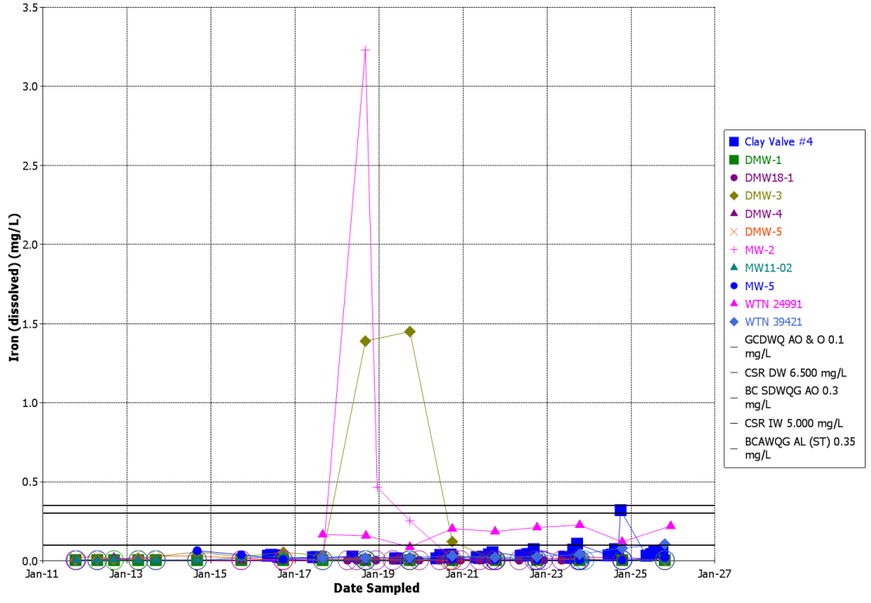


Figure C-11: Plot of dissolved iron in groundwater and Clay Valve #4 (all data since 2011)

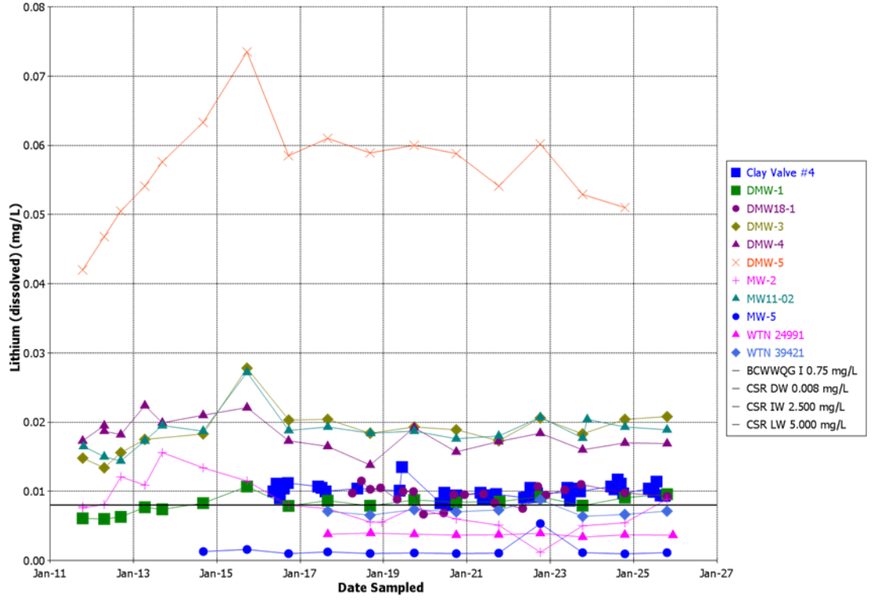


Figure C-12: Plot of dissolved lithium in groundwater and Clay Valve #4 (all data since 2011)

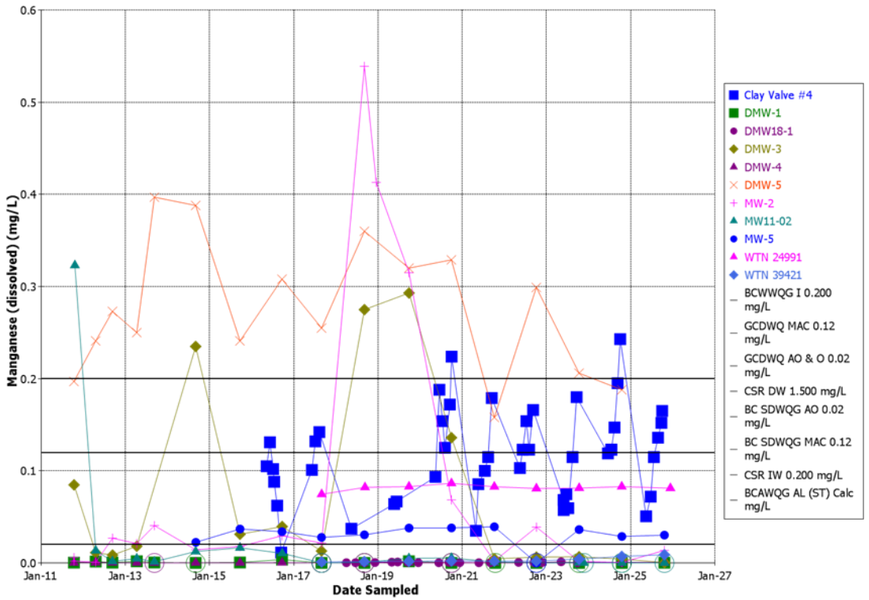


Figure C-13: Plot of dissolved manganese in groundwater and Clay Valve #4 (all data since 2011)

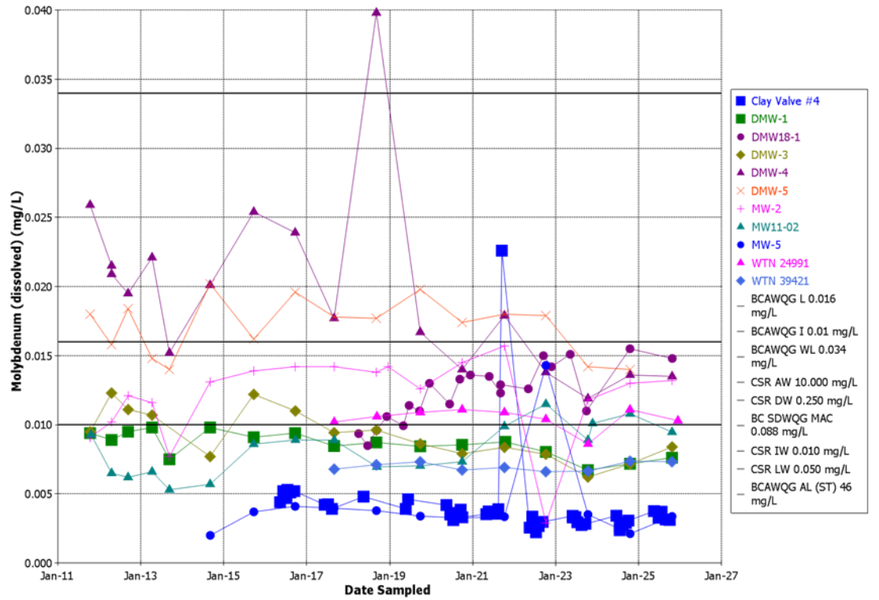


Figure C-14: Plot of dissolved molybdenum in groundwater and Clay Valve #4 (all data since 2011)

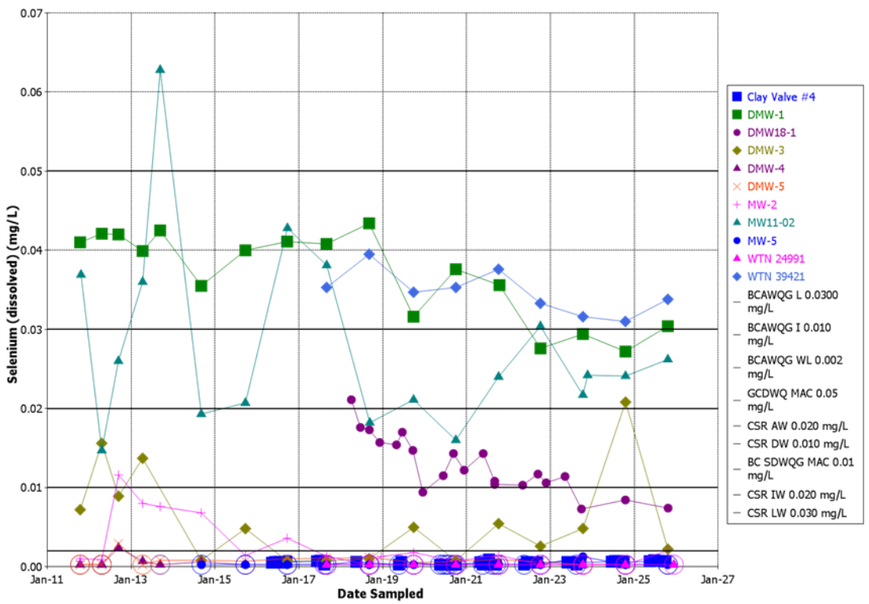


Figure C-15: Plot of dissolved selenium in groundwater and Clay Valve #4 (all data since 2011)

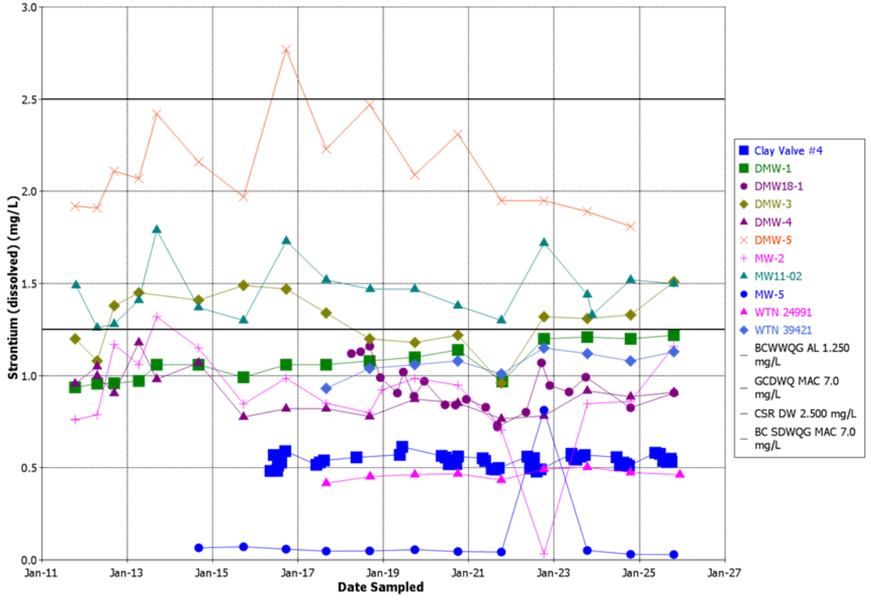


Figure C-16: Plot of dissolved strontium in groundwater and Clay Valve #4 (all data since 2011)

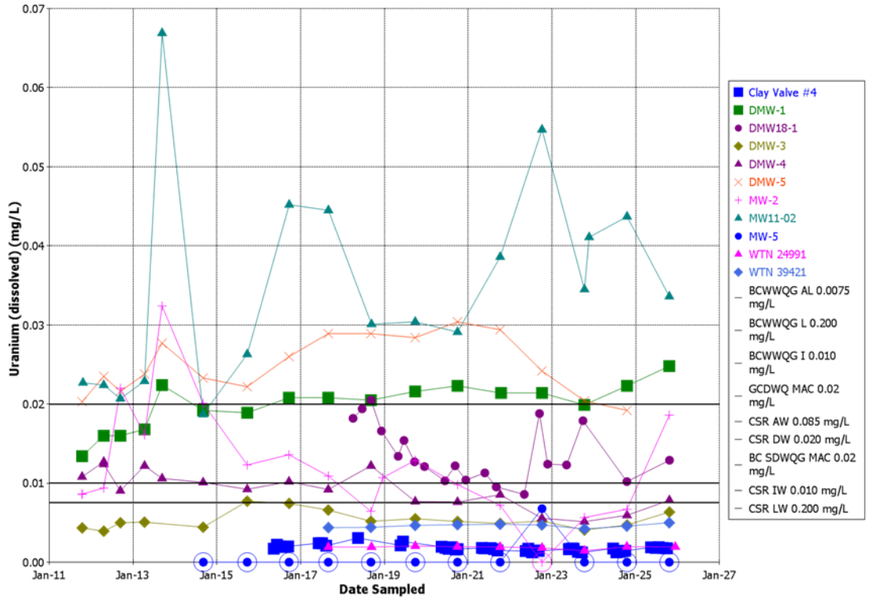


Figure C-17: Plot of dissolved uranium in groundwater and Clay Valve #4 (all data since 2011)

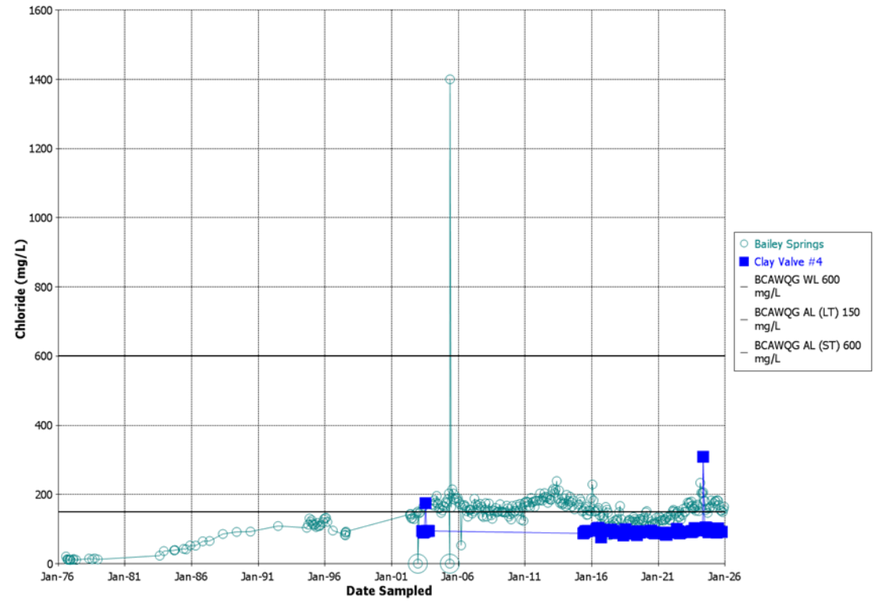


Figure C-18: Plot of chloride in Bailey Springs and Clay Valve #4 (all data)

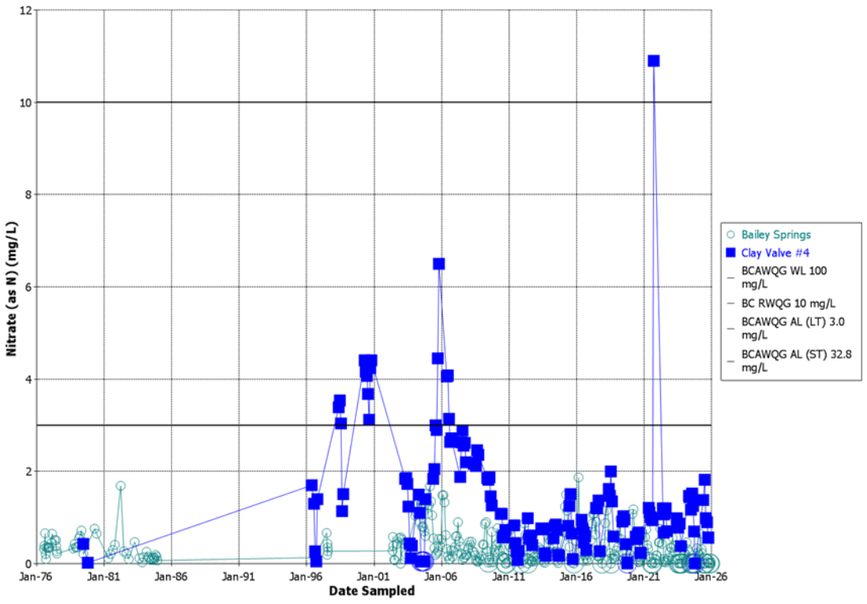


Figure C-19: Plot of nitrate -N in Bailey Springs and Clay Valve #4 (all data)

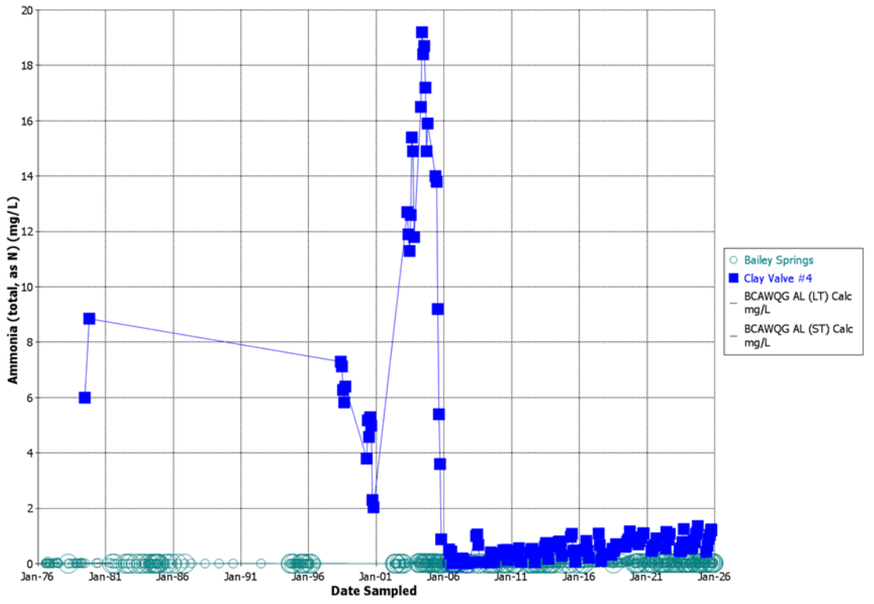


Figure C-20: Plot of ammonia-N in Bailey Springs and Clay Valve #4 (all data)

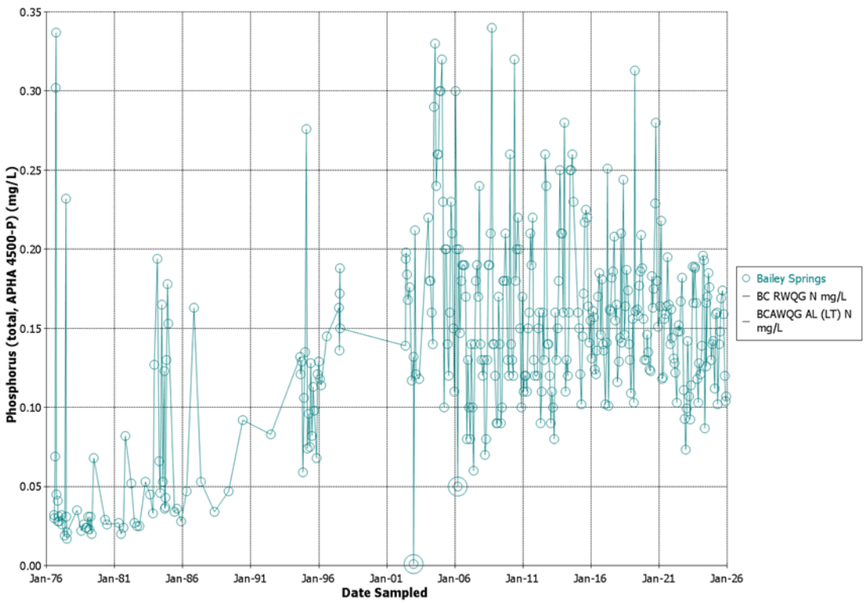


Figure C-21: Plot of total phosphorus in Bailey Springs (all data)

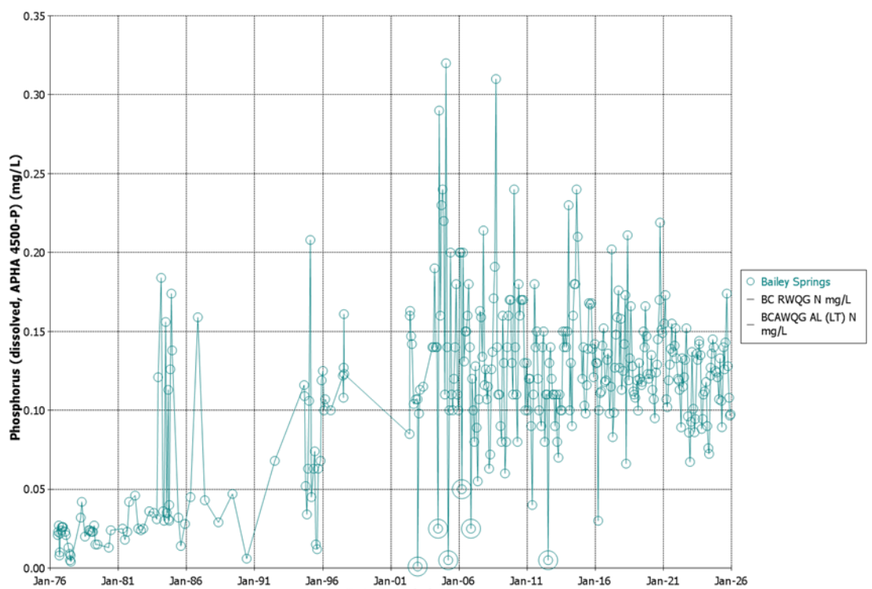


Figure C-22: Plot of dissolved phosphorus in Bailey Springs (all data)

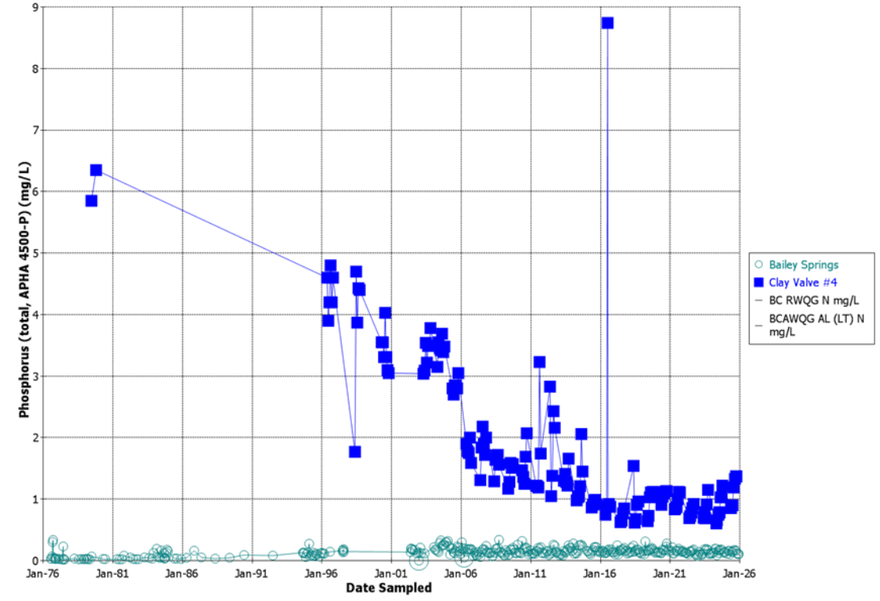


Figure C-23: Plot of total phosphorus in Bailey Springs and Clay Valve #4 (all data)

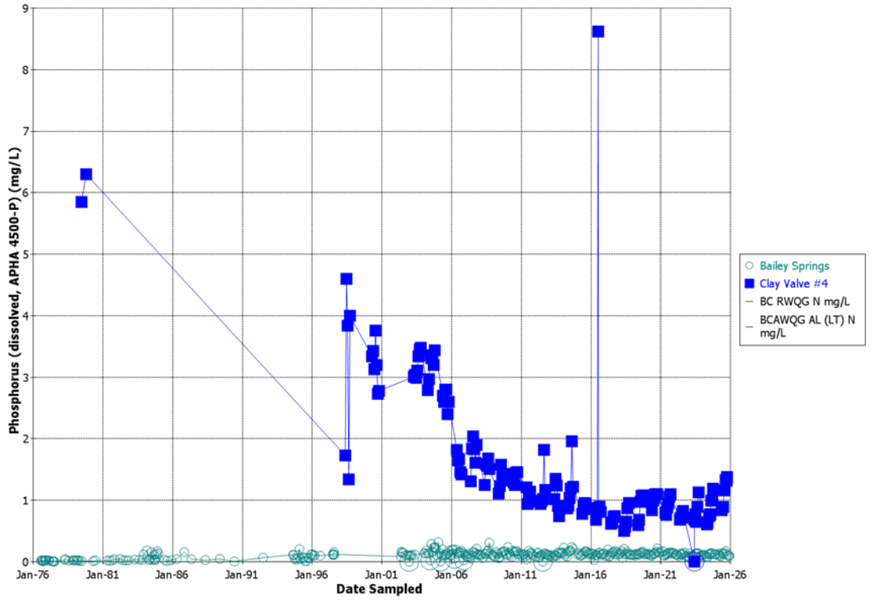


Figure C-24: Plot of dissolved phosphorus in Bailey Springs and Clay Valve #4 (all data)

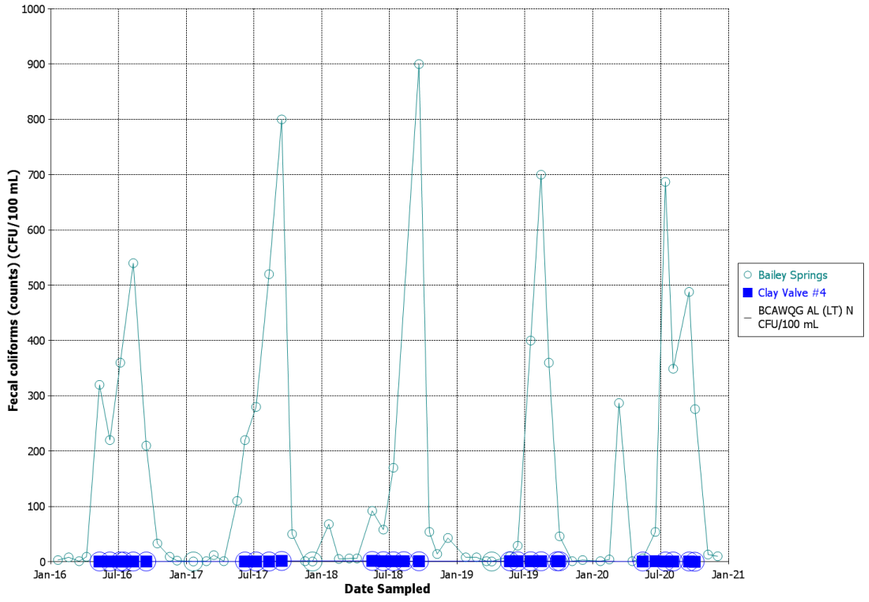


Figure C-25: Plot of fecal coliforms in Bailey Springs and Clay Valve #4 (data since 2016)[2]

[2] On Figure C-25, only data since 2016 is shown because the analytical method changed (MPN to CFU). Furthermore, a value of 8,700 CFU/100 mL was reported in Bailey Springs in August 2018 but is not shown on the above figure so as to not obscure trends from more recent data.

APPENDIX D – LABORATORY REPORTS

CERTIFICATE OF ANALYSIS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon) #200 - 2800 29th Street Vernon, BC V1T 9P9		
ATTENTION	Nicole Penner	**WORK ORDER**	25J2897
PO NUMBER	2025-8891	**RECEIVED / TEMP**	2025-10-21 14:53 / 5.8°C
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24
PROJECT INFO	COV Annual GW Monitoring 2025	**COC NUMBER**	No Number

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

By engaging our services, you are agreeing to CARO Analytical Service's Standard Terms and Conditions outlined here: https://www.caro.ca/terms-conditions

If you have any questions or concerns, please contact me at efex@caro.ca

Authorized By:

Echo Fex
Junior Account Manager

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW-2 (25J2897-01) | Matrix: Water | Sampled: 2025-10-20 14:25						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-22	
Chloride	**107**	AO ≤ 250	0.10	mg/L	2025-10-22	
Fluoride	**0.19**	MAC = 1.5	0.10	mg/L	2025-10-22	
Nitrate (as N)	**0.343**	MAC = 10	0.010	mg/L	2025-10-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-22	
Sulfate	**319**	AO ≤ 500	1.0	mg/L	2025-10-22	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**537**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**0.343**	400	0.0100	mg/L	N/A	
Nitrogen, Total	**0.691**	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.348**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-23	
Arsenic, dissolved	**0.00095**	0.05	0.00050	mg/L	2025-10-23	
Barium, dissolved	**0.0536**	5	0.0050	mg/L	2025-10-23	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-23	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Boron, dissolved	**0.0597**	0.5	0.0500	mg/L	2025-10-23	
Cadmium, dissolved	**0.000061**	0.0005	0.000010	mg/L	2025-10-23	
Calcium, dissolved	**102**	N/A	0.20	mg/L	2025-10-23	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Cobalt, dissolved	**0.00021**	0.04	0.00010	mg/L	2025-10-23	
Copper, dissolved	**0.00208**	0.02	0.00040	mg/L	2025-10-23	
Iron, dissolved	< 0.010	5	0.010	mg/L	2025-10-23	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-23	
Lithium, dissolved	**0.00888**	2.5	0.00010	mg/L	2025-10-23	
Magnesium, dissolved	**68.3**	N/A	0.010	mg/L	2025-10-23	
Manganese, dissolved	**0.0137**	0.2	0.00020	mg/L	2025-10-23	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-24	
Molybdenum, dissolved	**0.0132**	0.01	0.00010	mg/L	2025-10-23	
Nickel, dissolved	**0.00192**	0.2	0.00040	mg/L	2025-10-23	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-23	
Potassium, dissolved	**7.10**	N/A	0.10	mg/L	2025-10-23	
Selenium, dissolved	**0.00204**	0.02	0.00050	mg/L	2025-10-23	
Silicon, dissolved	**10.2**	N/A	1.0	mg/L	2025-10-23	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-23	
Sodium, dissolved	**87.6**	N/A	0.10	mg/L	2025-10-23	
Strontium, dissolved	**1.16**	N/A	0.0010	mg/L	2025-10-23	
Sulfur, dissolved	**121**	N/A	3.0	mg/L	2025-10-23	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-23	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW-2 (25J2897-01) | Matrix: Water | Sampled: 2025-10-20 14:25, Continued						
Dissolved Metals, Continued						
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-23	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-23	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-23	
Uranium, dissolved	**0.0186**	0.01	0.000020	mg/L	2025-10-23	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-23	
Zinc, dissolved	**0.0336**	0.075	0.0040	mg/L	2025-10-23	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
General Parameters						
Alkalinity, Total (as CaCO3)	**294**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Bicarbonate (as CaCO3)	**294**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-25	
Carbon, Dissolved Organic	**3.77**	N/A	0.50	mg/L	2025-10-22	
Nitrogen, Total Kjeldahl	**0.348**	N/A	0.050	mg/L	2025-10-24	
Phosphorus, Total (as P)	**0.0436**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Total Dissolved	**0.0272**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Dissolved Reactive	**0.0226**	N/A	0.0050	mg/L	2025-10-22	
Solids, Total Dissolved	**914**	AO ≤ 500	15	mg/L	2025-10-25	
MW-5 (25J2897-02) | Matrix: Water | Sampled: 2025-10-20 16:40						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-22	
Chloride	**8.68**	AO ≤ 250	0.10	mg/L	2025-10-22	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2025-10-22	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2025-10-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-22	
Sulfate	**201**	AO ≤ 500	1.0	mg/L	2025-10-22	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**162**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	400	0.0100	mg/L	N/A	
Nitrogen, Total	**0.392**	N/A	0.100	mg/L	N/A	
Nitrogen, Organic	**0.114**	N/A	0.100	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-23	
Arsenic, dissolved	< 0.00050	0.05	0.00050	mg/L	2025-10-23	
Barium, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW-5 (25J2897-02) | Matrix: Water | Sampled: 2025-10-20 16:40, Continued						
Dissolved Metals, Continued						
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-23	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Boron, dissolved	< 0.0500	0.5	0.0500	mg/L	2025-10-23	
Cadmium, dissolved	< 0.000010	0.0005	0.000010	mg/L	2025-10-23	
Calcium, dissolved	**4.86**	N/A	0.20	mg/L	2025-10-23	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Cobalt, dissolved	< 0.00010	0.04	0.00010	mg/L	2025-10-23	
Copper, dissolved	< 0.00040	0.02	0.00040	mg/L	2025-10-23	
Iron, dissolved	**0.022**	5	0.010	mg/L	2025-10-23	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-23	
Lithium, dissolved	**0.00114**	2.5	0.00010	mg/L	2025-10-23	
Magnesium, dissolved	**36.4**	N/A	0.010	mg/L	2025-10-23	
Manganese, dissolved	**0.0303**	0.2	0.00020	mg/L	2025-10-23	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-24	
Molybdenum, dissolved	**0.00337**	0.01	0.00010	mg/L	2025-10-23	
Nickel, dissolved	< 0.00040	0.2	0.00040	mg/L	2025-10-23	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-23	
Potassium, dissolved	**3.09**	N/A	0.10	mg/L	2025-10-23	
Selenium, dissolved	< 0.00050	0.02	0.00050	mg/L	2025-10-23	
Silicon, dissolved	< 1.0	N/A	1.0	mg/L	2025-10-23	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-23	
Sodium, dissolved	**48.4**	N/A	0.10	mg/L	2025-10-23	
Strontium, dissolved	**0.0295**	N/A	0.0010	mg/L	2025-10-23	
Sulfur, dissolved	**68.9**	N/A	3.0	mg/L	2025-10-23	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-23	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-23	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-23	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-23	
Uranium, dissolved	< 0.000020	0.01	0.000020	mg/L	2025-10-23	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-23	
Zinc, dissolved	< 0.0040	0.075	0.0040	mg/L	2025-10-23	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
General Parameters						
Alkalinity, Total (as CaCO3)	**85.5**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Phenolphthalein (as CaCO3)	**15.8**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Bicarbonate (as CaCO3)	**53.8**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Carbonate (as CaCO3)	**31.7**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Ammonia, Total (as N)	**0.278**	None Required	0.050	mg/L	2025-10-25	
Carbon, Dissolved Organic	**0.76**	N/A	0.50	mg/L	2025-10-22	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW-5 (25J2897-02) | Matrix: Water | Sampled: 2025-10-20 16:40, Continued						
General Parameters, Continued						
Nitrogen, Total Kjeldahl	**0.392**	N/A	0.050	mg/L	2025-10-24	
Phosphorus, Total (as P)	**0.0209**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Total Dissolved	**0.0054**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Dissolved Reactive	< 0.0050	N/A	0.0050	mg/L	2025-10-22	
Solids, Total Dissolved	**311**	AO ≤ 500	15	mg/L	2025-10-25	
DMW-1 (25J2897-03) | Matrix: Water | Sampled: 2025-10-20 11:55						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-22	
Chloride	**108**	AO ≤ 250	0.10	mg/L	2025-10-22	
Fluoride	**0.16**	MAC = 1.5	0.10	mg/L	2025-10-22	
Nitrate (as N)	**2.03**	MAC = 10	0.010	mg/L	2025-10-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-22	
Sulfate	**277**	AO ≤ 500	1.0	mg/L	2025-10-22	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**547**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**2.03**	400	0.0100	mg/L	N/A	
Nitrogen, Total	**2.23**	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.202**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-23	
Arsenic, dissolved	**0.00080**	0.05	0.00050	mg/L	2025-10-23	
Barium, dissolved	**0.0429**	5	0.0050	mg/L	2025-10-23	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-23	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Boron, dissolved	< 0.0500	0.5	0.0500	mg/L	2025-10-23	
Cadmium, dissolved	**0.000022**	0.0005	0.000010	mg/L	2025-10-23	
Calcium, dissolved	**109**	N/A	0.20	mg/L	2025-10-23	
Chromium, dissolved	**0.00536**	N/A	0.00050	mg/L	2025-10-23	
Cobalt, dissolved	< 0.00010	0.04	0.00010	mg/L	2025-10-23	
Copper, dissolved	< 0.00040	0.02	0.00040	mg/L	2025-10-23	
Iron, dissolved	< 0.010	5	0.010	mg/L	2025-10-23	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-23	
Lithium, dissolved	**0.00959**	2.5	0.00010	mg/L	2025-10-23	
Magnesium, dissolved	**66.4**	N/A	0.010	mg/L	2025-10-23	
Manganese, dissolved	**0.00026**	0.2	0.00020	mg/L	2025-10-23	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-24	
Molybdenum, dissolved	**0.00762**	0.01	0.00010	mg/L	2025-10-23	
Nickel, dissolved	**0.00118**	0.2	0.00040	mg/L	2025-10-23	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DMW-1 (25J2897-03) | Matrix: Water | Sampled: 2025-10-20 11:55, Continued						
Dissolved Metals, Continued						
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-23	
Potassium, dissolved	**6.79**	N/A	0.10	mg/L	2025-10-23	
Selenium, dissolved	**0.0304**	0.02	0.00050	mg/L	2025-10-23	
Silicon, dissolved	**11.0**	N/A	1.0	mg/L	2025-10-23	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-23	
Sodium, dissolved	**53.0**	N/A	0.10	mg/L	2025-10-23	
Strontium, dissolved	**1.22**	N/A	0.0010	mg/L	2025-10-23	
Sulfur, dissolved	**95.3**	N/A	3.0	mg/L	2025-10-23	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-23	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Tin, dissolved	**0.00062**	N/A	0.00020	mg/L	2025-10-23	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-23	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-23	
Uranium, dissolved	**0.0248**	0.01	0.000020	mg/L	2025-10-23	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-23	
Zinc, dissolved	< 0.0040	0.075	0.0040	mg/L	2025-10-23	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
General Parameters						
Alkalinity, Total (as CaCO3)	**257**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Bicarbonate (as CaCO3)	**257**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-25	
Carbon, Dissolved Organic	**1.72**	N/A	0.50	mg/L	2025-10-22	
Nitrogen, Total Kjeldahl	**0.202**	N/A	0.050	mg/L	2025-10-24	
Phosphorus, Total (as P)	**0.0262**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Total Dissolved	**0.0166**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Dissolved Reactive	**0.0127**	N/A	0.0050	mg/L	2025-10-22	
Solids, Total Dissolved	**792**	AO ≤ 500	15	mg/L	2025-10-25	
MW11-02 (25J2897-04) | Matrix: Water | Sampled: 2025-10-20 19:15						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-22	
Chloride	**120**	AO ≤ 250	0.10	mg/L	2025-10-22	
Fluoride	**0.16**	MAC = 1.5	0.10	mg/L	2025-10-22	
Nitrate (as N)	**7.48**	MAC = 10	0.010	mg/L	2025-10-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-22	
Sulfate	**811**	AO ≤ 500	1.0	mg/L	2025-10-22	

CARO ANALYTICAL SERVICES

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW11-02 (25J2897-04) | Matrix: Water | Sampled: 2025-10-20 19:15, Continued						
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**996**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**7.48**	400	0.250	mg/L	N/A	
Nitrogen, Total	**7.94**	N/A	0.250	mg/L	N/A	
Nitrogen, Organic	**0.466**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-23	
Arsenic, dissolved	**0.00065**	0.05	0.00050	mg/L	2025-10-23	
Barium, dissolved	**0.0308**	5	0.0050	mg/L	2025-10-23	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-23	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Boron, dissolved	**0.120**	0.5	0.0500	mg/L	2025-10-23	
Cadmium, dissolved	**0.000087**	0.0005	0.000010	mg/L	2025-10-23	
Calcium, dissolved	**210**	N/A	0.20	mg/L	2025-10-23	
Chromium, dissolved	**0.00194**	N/A	0.00050	mg/L	2025-10-23	
Cobalt, dissolved	**0.00271**	0.04	0.00010	mg/L	2025-10-23	
Copper, dissolved	**0.00145**	0.02	0.00040	mg/L	2025-10-23	
Iron, dissolved	< 0.010	5	0.010	mg/L	2025-10-23	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-23	
Lithium, dissolved	**0.0189**	2.5	0.00010	mg/L	2025-10-23	
Magnesium, dissolved	**114**	N/A	0.010	mg/L	2025-10-23	
Manganese, dissolved	< 0.00020	0.2	0.00020	mg/L	2025-10-23	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-24	
Molybdenum, dissolved	**0.00947**	0.01	0.00010	mg/L	2025-10-23	
Nickel, dissolved	**0.0125**	0.2	0.00040	mg/L	2025-10-23	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-23	
Potassium, dissolved	**9.41**	N/A	0.10	mg/L	2025-10-23	
Selenium, dissolved	**0.0262**	0.02	0.00050	mg/L	2025-10-23	
Silicon, dissolved	**13.6**	N/A	1.0	mg/L	2025-10-23	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-23	
Sodium, dissolved	**133**	N/A	0.10	mg/L	2025-10-23	
Strontium, dissolved	**1.50**	N/A	0.0010	mg/L	2025-10-23	
Sulfur, dissolved	**259**	N/A	3.0	mg/L	2025-10-23	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-23	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-23	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-23	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-23	
Uranium, dissolved	**0.0336**	0.01	0.000020	mg/L	2025-10-23	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-23	
Zinc, dissolved	< 0.0040	0.075	0.0040	mg/L	2025-10-23	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
MW11-02 (25J2897-04) | Matrix: Water | Sampled: 2025-10-20 19:15, Continued						
Dissolved Metals, Continued						
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
General Parameters						
Alkalinity, Total (as CaCO3)	**393**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Bicarbonate (as CaCO3)	**393**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-25	
Carbon, Dissolved Organic	**3.52**	N/A	0.50	mg/L	2025-10-22	
Nitrogen, Total Kjeldahl	**0.466**	N/A	0.050	mg/L	2025-10-24	
Phosphorus, Total (as P)	**0.314**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Total Dissolved	**0.0248**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Dissolved Reactive	**0.0177**	N/A	0.0050	mg/L	2025-10-22	
Solids, Total Dissolved	**1410**	AO ≤ 500	15	mg/L	2025-10-25	
WTN 39421 (25J2897-05) | Matrix: Water | Sampled: 2025-10-20 11:15						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-22	
Chloride	**49.9**	AO ≤ 250	0.10	mg/L	2025-10-22	
Fluoride	**0.15**	MAC = 1.5	0.10	mg/L	2025-10-22	
Nitrate (as N)	**2.41**	MAC = 10	0.010	mg/L	2025-10-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-22	
Sulfate	**353**	AO ≤ 500	1.0	mg/L	2025-10-22	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**480**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**2.41**	400	0.250	mg/L	N/A	
Nitrogen, Total	**2.55**	N/A	0.250	mg/L	N/A	
Nitrogen, Organic	**0.137**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-23	
Arsenic, dissolved	**0.00062**	0.05	0.00050	mg/L	2025-10-23	
Barium, dissolved	**0.0497**	5	0.0050	mg/L	2025-10-23	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-23	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Boron, dissolved	< 0.0500	0.5	0.0500	mg/L	2025-10-23	
Cadmium, dissolved	< 0.000010	0.0005	0.000010	mg/L	2025-10-23	
Calcium, dissolved	**109**	N/A	0.20	mg/L	2025-10-23	
Chromium, dissolved	**0.00091**	N/A	0.00050	mg/L	2025-10-23	
Cobalt, dissolved	< 0.00010	0.04	0.00010	mg/L	2025-10-23	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
WTN 39421 (25J2897-05) | Matrix: Water | Sampled: 2025-10-20 11:15, Continued						
Dissolved Metals, Continued						
Copper, dissolved	< 0.00040	0.02	0.00040	mg/L	2025-10-23	
Iron, dissolved	**0.107**	5	0.010	mg/L	2025-10-23	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-23	
Lithium, dissolved	**0.00714**	2.5	0.00010	mg/L	2025-10-23	
Magnesium, dissolved	**50.5**	N/A	0.010	mg/L	2025-10-23	
Manganese, dissolved	**0.00902**	0.2	0.00020	mg/L	2025-10-23	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-24	
Molybdenum, dissolved	**0.00733**	0.01	0.00010	mg/L	2025-10-23	
Nickel, dissolved	**0.00094**	0.2	0.00040	mg/L	2025-10-23	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-23	
Potassium, dissolved	**6.52**	N/A	0.10	mg/L	2025-10-23	
Selenium, dissolved	**0.0338**	0.02	0.00050	mg/L	2025-10-23	
Silicon, dissolved	**11.8**	N/A	1.0	mg/L	2025-10-23	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-23	
Sodium, dissolved	**44.0**	N/A	0.10	mg/L	2025-10-23	
Strontium, dissolved	**1.13**	N/A	0.0010	mg/L	2025-10-23	
Sulfur, dissolved	**111**	N/A	3.0	mg/L	2025-10-23	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-23	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-23	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-23	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-23	
Uranium, dissolved	**0.00500**	0.01	0.000020	mg/L	2025-10-23	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-23	
Zinc, dissolved	**0.0240**	0.075	0.0040	mg/L	2025-10-23	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
General Parameters						
Alkalinity, Total (as CaCO3)	**197**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Bicarbonate (as CaCO3)	**197**	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-25	
Carbon, Dissolved Organic	**2.82**	N/A	0.50	mg/L	2025-10-22	
Nitrogen, Total Kjeldahl	**0.137**	N/A	0.050	mg/L	2025-10-24	
Phosphorus, Total (as P)	**0.0128**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Total Dissolved	**0.0126**	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Dissolved Reactive	**0.0050**	N/A	0.0050	mg/L	2025-10-22	
Solids, Total Dissolved	**684**	AO ≤ 500	15	mg/L	2025-10-25	
Field Blank (25J2897-06) | Matrix: Water | Sampled: 2025-10-20 16:40						

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Field Blank (25J2897-06) | Matrix: Water | Sampled: 2025-10-20 16:40, Continued						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-22	
Chloride	< 0.10	AO ≤ 250	0.10	mg/L	2025-10-22	
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2025-10-22	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2025-10-22	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-22	
Sulfate	< 1.0	AO ≤ 500	1.0	mg/L	2025-10-22	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	< 0.500	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	400	0.0100	mg/L	N/A	
Nitrogen, Total	< 0.0500	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	< 0.0500	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-23	
Arsenic, dissolved	< 0.00050	0.05	0.00050	mg/L	2025-10-23	
Barium, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-23	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-23	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Boron, dissolved	< 0.0500	0.5	0.0500	mg/L	2025-10-23	
Cadmium, dissolved	< 0.000010	0.0005	0.000010	mg/L	2025-10-23	
Calcium, dissolved	< 0.20	N/A	0.20	mg/L	2025-10-23	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Cobalt, dissolved	< 0.00010	0.04	0.00010	mg/L	2025-10-23	
Copper, dissolved	< 0.00040	0.02	0.00040	mg/L	2025-10-23	
Iron, dissolved	< 0.010	5	0.010	mg/L	2025-10-23	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-23	
Lithium, dissolved	< 0.00010	2.5	0.00010	mg/L	2025-10-23	
Magnesium, dissolved	< 0.010	N/A	0.010	mg/L	2025-10-23	
Manganese, dissolved	< 0.00020	0.2	0.00020	mg/L	2025-10-23	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-24	
Molybdenum, dissolved	< 0.00010	0.01	0.00010	mg/L	2025-10-23	
Nickel, dissolved	< 0.00040	0.2	0.00040	mg/L	2025-10-23	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-23	
Potassium, dissolved	< 0.10	N/A	0.10	mg/L	2025-10-23	
Selenium, dissolved	< 0.00050	0.02	0.00050	mg/L	2025-10-23	
Silicon, dissolved	< 1.0	N/A	1.0	mg/L	2025-10-23	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-23	
Sodium, dissolved	< 0.10	N/A	0.10	mg/L	2025-10-23	
Strontium, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-23	
Sulfur, dissolved	< 3.0	N/A	3.0	mg/L	2025-10-23	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-23	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-23	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Field Blank (25J2897-06) | Matrix: Water | Sampled: 2025-10-20 16:40, Continued						
Dissolved Metals, Continued						
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-23	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-23	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-23	
Uranium, dissolved	< 0.000020	0.01	0.000020	mg/L	2025-10-23	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-23	
Zinc, dissolved	< 0.0040	0.075	0.0040	mg/L	2025-10-23	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-23	
General Parameters						
Alkalinity, Total (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-23	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-25	
Carbon, Dissolved Organic	< 0.50	N/A	0.50	mg/L	2025-10-22	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2025-10-24	
Phosphorus, Total (as P)	< 0.0050	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Total Dissolved	< 0.0050	N/A	0.0050	mg/L	2025-10-23	
Phosphorus, Dissolved Reactive	< 0.0050	N/A	0.0050	mg/L	2025-10-22	
Solids, Total Dissolved	< 15	AO ≤ 500	15	mg/L	2025-10-25	

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Carbon, Dissolved Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Mercury, dissolved in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Dissolved Reactive in Water	SM 4500-P F (2021)	Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Dissolved in Water	Solids in Water, Filtered / SM 2540 C* (2020)	Solids in Water, Filtered / Gravimetry (Dried at 103-105C)	✓	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

BC CSR Schedule 3.2 Aquatic Life
BC CSR Schedule 3.2 Irrigation
Guidelines for Canadian Drinking Water Quality (Health Canada)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

General Comments:

The results in this report apply to samples received by CARO and analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety and must not be modified. CARO is not responsible for losses or damages resulting directly or indirectly from errors or omissions in the conduct of the testing. Any liability is limited to the cost of analysis. CARO will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

Results in **Bold** indicate values that are above CARO's method reporting limits. Results in **red** indicate values above the regulatory limits where these have been included. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager: efex@caro.ca

Regulatory limits are added to test reports on request and are as a convenience only. While CARO makes every effort to ensure accuracy of regulatory limits, CARO assumes no liability for the use of this information. It remains the client's responsibility to ensure that regulatory limits are correct for their circumstances.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B5J4358										
Blank (B5J4358-BLK1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B5J4358-BS1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Bromide	4.05	0.10	mg/L	4.00		101	85-115			
Chloride	16.2	0.10	mg/L	16.0		101	90-110			
Fluoride	3.78	0.10	mg/L	4.00		95	88-108			
Nitrate (as N)	4.07	0.010	mg/L	4.00		102	90-110			
Nitrite (as N)	2.01	0.010	mg/L	2.00		100	85-115			
Sulfate	16.4	1.0	mg/L	16.0		102	90-110			
Dissolved Metals, Batch B5J4557										
Blank (B5J4557-BLK1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							
Arsenic, dissolved	< 0.00050	0.00050	mg/L							
Barium, dissolved	< 0.0050	0.0050	mg/L							
Beryllium, dissolved	< 0.00010	0.00010	mg/L							
Bismuth, dissolved	< 0.00010	0.00010	mg/L							
Boron, dissolved	< 0.0500	0.0500	mg/L							
Cadmium, dissolved	< 0.000010	0.000010	mg/L							
Calcium, dissolved	< 0.20	0.20	mg/L							
Chromium, dissolved	< 0.00050	0.00050	mg/L							
Cobalt, dissolved	< 0.00010	0.00010	mg/L							
Copper, dissolved	< 0.00040	0.00040	mg/L							
Iron, dissolved	< 0.010	0.010	mg/L							
Lead, dissolved	< 0.00020	0.00020	mg/L							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	mg/L							
Molybdenum, dissolved	< 0.00010	0.00010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B5J4557, Continued										
Blank (B5J4557-BLK1), Continued				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Nickel, dissolved	< 0.00040	0.00040	mg/L							
Phosphorus, dissolved	< 0.050	0.050	mg/L							
Potassium, dissolved	< 0.10	0.10	mg/L							
Selenium, dissolved	< 0.00050	0.00050	mg/L							
Silicon, dissolved	< 1.0	1.0	mg/L							
Silver, dissolved	< 0.000050	0.000050	mg/L							
Sodium, dissolved	< 0.10	0.10	mg/L							
Strontium, dissolved	< 0.0010	0.0010	mg/L							
Sulfur, dissolved	< 3.0	3.0	mg/L							
Tellurium, dissolved	< 0.00050	0.00050	mg/L							
Thallium, dissolved	< 0.000020	0.000020	mg/L							
Thorium, dissolved	< 0.00010	0.00010	mg/L							
Tin, dissolved	< 0.00020	0.00020	mg/L							
Titanium, dissolved	< 0.0050	0.0050	mg/L							
Tungsten, dissolved	< 0.0010	0.0010	mg/L							
Uranium, dissolved	< 0.000020	0.000020	mg/L							
Vanadium, dissolved	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B5J4557-BS1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Aluminum, dissolved	3.93	0.0050	mg/L	4.00		98	80-120			
Antimony, dissolved	0.0402	0.00020	mg/L	0.0400		101	80-120			
Arsenic, dissolved	0.393	0.00050	mg/L	0.400		98	80-120			
Barium, dissolved	0.0397	0.0050	mg/L	0.0400		99	80-120			
Beryllium, dissolved	0.0402	0.00010	mg/L	0.0400		100	80-120			
Bismuth, dissolved	0.0396	0.00010	mg/L	0.0400		99	80-120			
Boron, dissolved	0.387	0.0500	mg/L	0.400		97	80-120			
Cadmium, dissolved	0.0400	0.000010	mg/L	0.0400		100	80-120			
Calcium, dissolved	3.94	0.20	mg/L	4.00		98	80-120			
Chromium, dissolved	0.0397	0.00050	mg/L	0.0400		99	80-120			
Cobalt, dissolved	0.0396	0.00010	mg/L	0.0400		99	80-120			
Copper, dissolved	0.0400	0.00040	mg/L	0.0400		100	80-120			
Iron, dissolved	4.03	0.010	mg/L	4.00		101	80-120			
Lead, dissolved	0.0396	0.00020	mg/L	0.0400		99	80-120			
Lithium, dissolved	0.0400	0.00010	mg/L	0.0400		100	80-120			
Magnesium, dissolved	3.92	0.010	mg/L	4.00		98	80-120			
Manganese, dissolved	0.0397	0.00020	mg/L	0.0400		99	80-120			
Molybdenum, dissolved	0.0396	0.00010	mg/L	0.0400		99	80-120			
Nickel, dissolved	0.0403	0.00040	mg/L	0.0400		101	80-120			
Phosphorus, dissolved	3.95	0.050	mg/L	4.00		99	80-120			
Potassium, dissolved	3.93	0.10	mg/L	4.00		98	80-120			
Selenium, dissolved	0.392	0.00050	mg/L	0.400		98	80-120			
Silicon, dissolved	3.8	1.0	mg/L	4.00		96	80-120			
Silver, dissolved	0.0396	0.000050	mg/L	0.0400		99	80-120			
Sodium, dissolved	4.04	0.10	mg/L	4.00		101	80-120			
Strontium, dissolved	0.0405	0.0010	mg/L	0.0400		101	80-120			
Sulfur, dissolved	38.7	3.0	mg/L	40.0		97	80-120			
Tellurium, dissolved	0.0396	0.00050	mg/L	0.0400		99	80-120			
Thallium, dissolved	0.0402	0.000020	mg/L	0.0400		101	80-120			
Thorium, dissolved	0.0395	0.00010	mg/L	0.0400		99	80-120			
Tin, dissolved	0.0396	0.00020	mg/L	0.0400		99	80-120			
Titanium, dissolved	0.0391	0.0050	mg/L	0.0400		98	80-120			
Tungsten, dissolved	0.0401	0.0010	mg/L	0.0400		100	80-120			
Uranium, dissolved	0.0396	0.000020	mg/L	0.0400		99	80-120			
Vanadium, dissolved	0.0403	0.0050	mg/L	0.0400		101	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B5J4557, Continued										
LCS (B5J4557-BS1), Continued				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Zinc, dissolved	0.401	0.0040	mg/L	0.400		100	80-120			
Zirconium, dissolved	0.0404	0.00010	mg/L	0.0400		101	80-120			
Duplicate (B5J4557-DUP1)		**Source: 25J2897-01**		Prepared: 2025-10-23, Analyzed: 2025-10-23						
Aluminum, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Antimony, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Arsenic, dissolved	0.00099	0.00050	mg/L		0.00095				20	
Barium, dissolved	0.0535	0.0050	mg/L		0.0536			< 1	20	
Beryllium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Bismuth, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Boron, dissolved	0.0558	0.0500	mg/L		0.0597				20	
Cadmium, dissolved	0.000057	0.000010	mg/L		0.000061			6	20	
Calcium, dissolved	102	0.20	mg/L		102			< 1	20	
Chromium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Cobalt, dissolved	0.00021	0.00010	mg/L		0.00021				20	
Copper, dissolved	0.00208	0.00040	mg/L		0.00208			< 1	20	
Iron, dissolved	< 0.010	0.010	mg/L		< 0.010				20	
Lead, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Lithium, dissolved	0.00836	0.00010	mg/L		0.00888			6	20	
Magnesium, dissolved	67.2	0.010	mg/L		68.3			1	20	
Manganese, dissolved	0.0136	0.00020	mg/L		0.0137			< 1	20	
Molybdenum, dissolved	0.0130	0.00010	mg/L		0.0132			2	20	
Nickel, dissolved	0.00190	0.00040	mg/L		0.00192				20	
Phosphorus, dissolved	< 0.050	0.050	mg/L		< 0.050				20	
Potassium, dissolved	7.05	0.10	mg/L		7.10			< 1	20	
Selenium, dissolved	0.00193	0.00050	mg/L		0.00204				20	
Silicon, dissolved	9.7	1.0	mg/L		10.2			5	20	
Silver, dissolved	< 0.000050	0.000050	mg/L		< 0.000050				20	
Sodium, dissolved	87.7	0.10	mg/L		87.6			< 1	20	
Strontium, dissolved	1.15	0.0010	mg/L		1.16			< 1	20	
Sulfur, dissolved	115	3.0	mg/L		121			5	20	
Tellurium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Thallium, dissolved	< 0.000020	0.000020	mg/L		< 0.000020				20	
Thorium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Tin, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Titanium, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Tungsten, dissolved	< 0.0010	0.0010	mg/L		< 0.0010				20	
Uranium, dissolved	0.0187	0.000020	mg/L		0.0186			< 1	20	
Vanadium, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Zinc, dissolved	0.0327	0.0040	mg/L		0.0336			3	20	
Zirconium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Matrix Spike (B5J4557-MS1)		**Source: 25J2897-02**		Prepared: 2025-10-23, Analyzed: 2025-10-23						
Aluminum, dissolved	3.93	0.0050	mg/L	4.00	< 0.0050	98	70-130			
Antimony, dissolved	0.0425	0.00020	mg/L	0.0400	< 0.00020	106	70-130			
Arsenic, dissolved	0.414	0.00050	mg/L	0.400	< 0.00050	103	70-130			
Barium, dissolved	0.0430	0.0050	mg/L	0.0400	< 0.0050	104	70-130			
Beryllium, dissolved	0.0391	0.00010	mg/L	0.0400	< 0.00010	98	70-130			
Bismuth, dissolved	0.0381	0.00010	mg/L	0.0400	< 0.00010	95	70-130			
Boron, dissolved	0.378	0.0500	mg/L	0.400	< 0.0500	92	70-130			
Cadmium, dissolved	0.0418	0.000010	mg/L	0.0400	< 0.000010	104	70-130			
Calcium, dissolved	8.35	0.20	mg/L	4.00	4.86	87	70-130			
Chromium, dissolved	0.0407	0.00050	mg/L	0.0400	< 0.00050	102	70-130			
Cobalt, dissolved	0.0393	0.00010	mg/L	0.0400	< 0.00010	98	70-130			
Copper, dissolved	0.0386	0.00040	mg/L	0.0400	< 0.00040	97	70-130			
Iron, dissolved	4.06	0.010	mg/L	4.00	0.022	101	70-130			
Lead, dissolved	0.0402	0.00020	mg/L	0.0400	< 0.00020	101	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B5J4557, Continued										
Matrix Spike (B5J4557-MS1), Continued		**Source: 25J2897-02**		Prepared: 2025-10-23, Analyzed: 2025-10-23						
Lithium, dissolved	0.0398	0.00010	mg/L	0.0400	0.00114	97	70-130			
Magnesium, dissolved	38.3	0.010	mg/L	4.00	36.4	47	70-130			MS2
Manganese, dissolved	0.0672	0.00020	mg/L	0.0400	0.0303	92	70-130			
Molybdenum, dissolved	0.0447	0.00010	mg/L	0.0400	0.00337	103	70-130			
Nickel, dissolved	0.0389	0.00040	mg/L	0.0400	< 0.00040	97	70-130			
Phosphorus, dissolved	4.18	0.050	mg/L	4.00	< 0.050	105	70-130			
Potassium, dissolved	6.87	0.10	mg/L	4.00	3.09	95	70-130			
Selenium, dissolved	0.418	0.00050	mg/L	0.400	< 0.00050	104	70-130			
Silicon, dissolved	4.0	1.0	mg/L	4.00	< 1.0	95	70-130			
Silver, dissolved	0.0366	0.000050	mg/L	0.0400	< 0.000050	92	70-130			
Sodium, dissolved	49.6	0.10	mg/L	4.00	48.4	31	70-130			MS2
Strontium, dissolved	0.0676	0.0010	mg/L	0.0400	0.0295	95	70-130			
Sulfur, dissolved	105	3.0	mg/L	40.0	68.9	90	70-130			
Tellurium, dissolved	0.0426	0.00050	mg/L	0.0400	< 0.00050	107	70-130			
Thallium, dissolved	0.0413	0.000020	mg/L	0.0400	< 0.000020	103	70-130			
Thorium, dissolved	0.0415	0.00010	mg/L	0.0400	< 0.00010	104	70-130			
Tin, dissolved	0.0427	0.00020	mg/L	0.0400	< 0.00020	107	70-130			
Titanium, dissolved	0.0396	0.0050	mg/L	0.0400	< 0.0050	99	70-130			
Tungsten, dissolved	0.0414	0.0010	mg/L	0.0400	< 0.0010	103	70-130			
Uranium, dissolved	0.0416	0.000020	mg/L	0.0400	< 0.000020	104	70-130			
Vanadium, dissolved	0.0417	0.0050	mg/L	0.0400	< 0.0050	104	70-130			
Zinc, dissolved	0.413	0.0040	mg/L	0.400	< 0.0040	103	70-130			
Zirconium, dissolved	0.0420	0.00010	mg/L	0.0400	< 0.00010	105	70-130			
Dissolved Metals, Batch B5J4727										
Blank (B5J4727-BLK1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5J4727-BLK2)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5J4727-BLK3)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5J4727-BLK4)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B5J4727-BS1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	0.00261	0.000010	mg/L	0.00250		105	80-120			
LCS (B5J4727-BS2)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	0.00286	0.000010	mg/L	0.00250		114	80-120			
LCS (B5J4727-BS3)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	0.00283	0.000010	mg/L	0.00250		113	80-120			
LCS (B5J4727-BS4)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	0.00262	0.000010	mg/L	0.00250		105	80-120			
Matrix Spike (B5J4727-MS3)		**Source: 25J2897-03**		Prepared: 2025-10-24, Analyzed: 2025-10-24						
Mercury, dissolved	0.00214	0.000010	mg/L	0.00250	< 0.000010	86	70-130			
General Parameters, Batch B5J4291										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B5J4291, Continued										
Blank (B5J4291-BLK1)				Prepared: 2025-10-21, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B5J4291-BLK2)				Prepared: 2025-10-22, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B5J4291-BLK3)				Prepared: 2025-10-22, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
LCS (B5J4291-BS1)				Prepared: 2025-10-21, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	9.76	0.50	mg/L	10.0		98	78-116			
LCS (B5J4291-BS2)				Prepared: 2025-10-22, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	9.86	0.50	mg/L	10.0		99	78-116			
LCS (B5J4291-BS3)				Prepared: 2025-10-22, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	9.48	0.50	mg/L	10.0		95	78-116			
Duplicate (B5J4291-DUP3)		**Source: 25J2897-01**		Prepared: 2025-10-21, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	3.60	0.50	mg/L		3.77			5	15	
Matrix Spike (B5J4291-MS3)		**Source: 25J2897-01**		Prepared: 2025-10-21, Analyzed: 2025-10-22						
Carbon, Dissolved Organic	12.5	0.50	mg/L	10.0	3.77	87	70-130			
General Parameters, Batch B5J4432										
Blank (B5J4432-BLK1)				Prepared: 2025-10-22, Analyzed: 2025-10-22						
Phosphorus, Dissolved Reactive	< 0.0050	0.0050	mg/L							
LCS (B5J4432-BS1)				Prepared: 2025-10-22, Analyzed: 2025-10-22						
Phosphorus, Dissolved Reactive	0.0993	0.0050	mg/L	0.100		99	84-115			
Duplicate (B5J4432-DUP1)		**Source: 25J2897-03**		Prepared: 2025-10-22, Analyzed: 2025-10-22						
Phosphorus, Dissolved Reactive	0.0129	0.0050	mg/L		0.0127				14	
Matrix Spike (B5J4432-MS1)		**Source: 25J2897-03**		Prepared: 2025-10-22, Analyzed: 2025-10-22						
Phosphorus, Dissolved Reactive	0.113	0.0050	mg/L	0.100	0.0127	100	70-130			
General Parameters, Batch B5J4470										
Blank (B5J4470-BLK1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B5J4470-BLK2)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050	mg/L							
Blank (B5J4470-BLK3)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B5J4470-BS1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Total (as P)	0.111	0.0050	mg/L	0.100		111	85-115			
LCS (B5J4470-BS2)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Total (as P)	0.112	0.0050	mg/L	0.100		112	85-115			
Phosphorus, Total Dissolved	0.112	0.0050	mg/L	0.100		112	85-115			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B5J4470, Continued										
LCS (B5J4470-BS3)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Total (as P)	0.111	0.0050	mg/L	0.100		111	85-115			
General Parameters, Batch B5J4486										
Blank (B5J4486-BLK1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
Blank (B5J4486-BLK2)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
LCS (B5J4486-BS1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Alkalinity, Total (as CaCO3)	101	1.0	mg/L	100		101	80-120			
LCS (B5J4486-BS3)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Alkalinity, Total (as CaCO3)	97.2	1.0	mg/L	100		97	80-120			
General Parameters, Batch B5J4577										
Blank (B5J4577-BLK1)				Prepared: 2025-10-23, Analyzed: 2025-10-24						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B5J4577-BLK2)				Prepared: 2025-10-23, Analyzed: 2025-10-24						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B5J4577-BS1)				Prepared: 2025-10-23, Analyzed: 2025-10-24						
Nitrogen, Total Kjeldahl	0.956	0.050	mg/L	1.00		96	85-115			
LCS (B5J4577-BS2)				Prepared: 2025-10-23, Analyzed: 2025-10-24						
Nitrogen, Total Kjeldahl	0.960	0.050	mg/L	1.00		96	85-115			
General Parameters, Batch B5J4779										
Blank (B5J4779-BLK1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
Blank (B5J4779-BLK2)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
LCS (B5J4779-BS1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Ammonia, Total (as N)	0.998	0.050	mg/L	1.00		100	85-115			
LCS (B5J4779-BS2)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Ammonia, Total (as N)	1.00	0.050	mg/L	1.00		100	85-115			
General Parameters, Batch B5J4781										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J2897
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-28 08:24

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B5J4781, Continued										
Blank (B5J4781-BLK1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Solids, Total Dissolved	< 15	15	mg/L							
LCS (B5J4781-BS1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Solids, Total Dissolved	227	15	mg/L	240		95	85-115			
Duplicate (B5J4781-DUP1)		**Source: 25J2897-04**		Prepared: 2025-10-25, Analyzed: 2025-10-25						
Solids, Total Dissolved	1460	15	mg/L		1410			3	15	

QC Qualifiers:

MS2 The native sample concentration is greater than the spike concentration hence the matrix spike limits do not apply.

110-4011 Viking Way, Richmond, BC V6V 2
Tel: (604) 279-1499 Fax: (604) 279-1599

☒ 102-3677 Highway 97N, Kelowna, BC V1X 5C3
Tel: (250) 765-9646 Fax: (250) 765-3893

17225 109 Avenue NW, Edmonton, AB T5S 1H7
Tel: (780) 489-9100 Fax: (780) 489-9700

CAR COC, Rev 03/14

CHAIN OF CUSTODY RECORD

COC# _____ PAGE 1 OF 1

25J2897

RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:
AR	Oct 21/25	DM Ace	Oct 21, 25
	TIME: 07:30		TIME: 14:53

PROJECT: COV Annual GW Monitoring 2025

PROJECT INFO: 2025-8891 COV GW

TURNAROUND TIME REQUESTED:
Routine: (5-7 Days) ☒
Rush: 1 Day* ☐ 2 Day* ☐ 3 Day* ☐
Other* _____
*Contact Lab To Confirm. Surcharge May Apply

REGULATORY APPLICATION:
Canadian Drinking Water Quality Guidelines ☒ CCME ☐
BC Drinking Water Protection Act / Reg. ☐ ALBERTA TIER 1 ☐
BC CSR ☒ AL ☒ RL ☐ CL ☐ IL ☒ AW ☐
OTHER:

COMPANY:	Associated Environmental
ADDRESS:	200-2800 29th Street Vernon, BC V1T 9P9
CONTACT:	Nicole Penner
TEL/FAX:	250-545-3672 250-938-5537
EMAIL PDF ☒ EDD ☒	
EMAIL 1:	pennern@ae.ca; indrigoc@ae.ca
EMAIL 2:	support@ wirelesswater.com
MAIL HARDCOPY ☐ HOLD FOR P/U ☐ FAX ☐	

INVOICE TO: SAME AS REPORT TO ☐

COMPANY:	City of Vernon
ADDRESS:	2100-43rd Street Vernon BC V1T 6W8
CONTACT:	Serge Kozin
TEL/FAX:	(250) 550-3627
EMAIL PDF ☒	
EMAIL 1:	pennern@ae.ca
EMAIL 2:	
MAIL HARDCOPY ☐ HOLD FOR P/U ☐	

SAMLPLED BY: Anna Rice

PO #: Annual Groundwater Monitoring 2025

ANALYSES REQUESTED:

	CLIENT SAMPLE ID:	MATRIX: DRINKING WATER	OTHER WATER	SOIL	OTHER	# CONTAINERS	SAMPLING: DATE DD-MMM-YY	TIME HH:MM	COMMENTS: CHLORINATED	FILTERED	PRESERVED	(i.e. flow/volume media ID/notes)	BTEX ☐ VPH ☐ PHC F1 ☐	VOC ☐ VPH ☐	EPH ☐ PHC F2-F4 ☐	PAH ☐ L/HEPH ☐	PHENOLS Chlorinated ☐ Non-Chlor. ☐	PCB ☐ GLYCOLS ☐ HAA ☐	PESTICIDES ☐ ACID HERBICIDES ☐	METALS - WATER TOTAL Hg ☐	METALS - WATER DISSOLVED Hg ☒	METALS - SOIL (SALM) ☐ inc. pH ☐	pH ☐ EC ☐ ALK ☒	TSS ☐ VSS ☐ TDS ☒	BOD ☐ COD ☐	TOG ☐ MOG ☐	FECAL COLIFORMS ☐ HPC ☐	TOTAL COLIFORMS ☐ E.coli ☐	ASBESTOS	Chloride, bromide, fluoride, sodium	Sulphate	Total and organic nitrogen package	Total P, total dissolved P, ortho-P	Dissolved organic carbon	Hardness		HOLD
	MW-2	✔	✔			7	20-10-25	14:25		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	MW-5		✔			7	20-10-25	16:40		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	DMW-1	✔	✔			7	20-10-25	11:55		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	~~DMW-2~~	✔	✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	~~DMW-3~~	✔	✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	~~DMW-4~~		✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	~~DMW-5~~		✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	MW11-02		✔			7	20-10-25	19:15		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	WTN 39421		✔			7	20-10-25	11:15		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	~~Trip Blank~~		✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	Field Blank		✔			7	20-10-25	16:40		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	~~Duplicate~~		✔			(7)				✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		

SHIPPING INSTRUCTIONS: Return Cooler(s) ☐
Supplies Needed:

SAMPLE RETENTION INSTRUCTIONS (Discarded 30 days after Report unless otherwise specified):
60 Days ☐ 90 Days ☐ Longer Date (Surcharges will Apply): _____

OTHER INSTRUCTIONS:
Upload to Wireless Water. Low-level DL for metals. Ensure invoice includes 'Annual Groundwater Monitoring 2025' and send only to Nicole Penner (pennern@ae.ca) to pass to COV.
CB C10,S10,S39x2,S25,S06

PAYMENT:
CHEQUE ☐
CREDIT ☐
DEBIT ☐
CASH ☐
INVOICE ☐

SAMPLE RECEIPT TEMP (°C): 5,8
Work Order # _____
CUSTODY SEAL INTACT Y ☐ N ☐ NA ☐

CERTIFICATE OF ANALYSIS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon) #200 - 2800 29th Street Vernon, BC V1T 9P9		
ATTENTION	Nicole Penner	**WORK ORDER**	25J3205
PO NUMBER	2025-8899	**RECEIVED / TEMP**	2025-10-22 14:30 / 9.3°C
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13
PROJECT INFO	COV Annual GW Monitoring 2025	**COC NUMBER**	No Number

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

By engaging our services, you are agreeing to CARO Analytical Service's Standard Terms and Conditions outlined here: https://www.caro.ca/terms-conditions

If you have any questions or concerns, please contact me at efex@caro.ca

Authorized By:

Echo Fex
Junior Account Manager

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DMW-3 (25J3205-01) | Matrix: Water | Sampled: 2025-10-21 10:00						
Anions						
Bromide	**0.20**	N/A	0.10	mg/L	2025-10-23	
Chloride	**203**	AO ≤ 250	0.10	mg/L	2025-10-23	
Fluoride	**0.43**	MAC = 1.5	0.10	mg/L	2025-10-23	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2025-10-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-23	
Sulfate	**155**	AO ≤ 500	1.0	mg/L	2025-10-23	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**730**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	400	0.0100	mg/L	N/A	
Nitrogen, Total	**0.321**	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.321**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-25	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-25	
Arsenic, dissolved	**0.00054**	0.05	0.00050	mg/L	2025-10-25	
Barium, dissolved	**0.0349**	5	0.0050	mg/L	2025-10-25	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-25	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
Boron, dissolved	< 0.0500	0.5	0.0500	mg/L	2025-10-25	
Cadmium, dissolved	**0.000041**	0.0005	0.000010	mg/L	2025-10-25	
Calcium, dissolved	**202**	N/A	0.20	mg/L	2025-10-25	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-25	
Cobalt, dissolved	< 0.00010	0.04	0.00010	mg/L	2025-10-25	
Copper, dissolved	**0.00261**	0.02	0.00040	mg/L	2025-10-25	
Iron, dissolved	< 0.010	5	0.010	mg/L	2025-10-25	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-25	
Lithium, dissolved	**0.0206**	2.5	0.00010	mg/L	2025-10-25	
Magnesium, dissolved	**54.6**	N/A	0.010	mg/L	2025-10-25	
Manganese, dissolved	**0.00048**	0.2	0.00020	mg/L	2025-10-25	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-29	
Molybdenum, dissolved	**0.00840**	0.01	0.00010	mg/L	2025-10-25	
Nickel, dissolved	**0.00133**	0.2	0.00040	mg/L	2025-10-25	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-25	
Potassium, dissolved	**9.28**	N/A	0.10	mg/L	2025-10-25	
Selenium, dissolved	**0.00221**	0.02	0.00050	mg/L	2025-10-25	
Silicon, dissolved	**14.7**	N/A	1.0	mg/L	2025-10-25	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-25	
Sodium, dissolved	**84.4**	N/A	0.10	mg/L	2025-10-25	
Strontium, dissolved	**1.50**	N/A	0.0010	mg/L	2025-10-25	
Sulfur, dissolved	**58.2**	N/A	3.0	mg/L	2025-10-25	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-25	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-25	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DMW-3 (25J3205-01) | Matrix: Water | Sampled: 2025-10-21 10:00, Continued						
Dissolved Metals, Continued						
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-25	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-25	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-25	
Uranium, dissolved	**0.00621**	0.01	0.000020	mg/L	2025-10-25	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-25	
Zinc, dissolved	**0.0282**	0.075	0.0040	mg/L	2025-10-25	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
General Parameters						
Alkalinity, Total (as CaCO3)	**443**	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Bicarbonate (as CaCO3)	**443**	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-27	
Carbon, Dissolved Organic	**5.30**	N/A	0.50	mg/L	2025-10-24	
Nitrogen, Total Kjeldahl	**0.321**	N/A	0.050	mg/L	2025-10-25	
Phosphorus, Total (as P)	**0.0121**	N/A	0.0050	mg/L	2025-10-24	
Phosphorus, Total Dissolved	**0.0102**	N/A	0.0050	mg/L	2025-10-24	
Phosphorus, Dissolved Reactive	< 0.0050	N/A	0.0050	mg/L	2025-10-23	
Solids, Total Dissolved	**1030**	AO ≤ 500	15	mg/L	2025-10-25	
DUP (25J3205-02) | Matrix: Water | Sampled: 2025-10-21 10:00						
Anions						
Bromide	**0.19**	N/A	0.10	mg/L	2025-10-23	
Chloride	**212**	AO ≤ 250	0.10	mg/L	2025-10-23	
Fluoride	**0.45**	MAC = 1.5	0.10	mg/L	2025-10-23	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2025-10-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-23	
Sulfate	**169**	AO ≤ 500	1.0	mg/L	2025-10-23	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**727**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	400	0.0100	mg/L	N/A	
Nitrogen, Total	**0.319**	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.319**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-25	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-25	
Arsenic, dissolved	**0.00059**	0.05	0.00050	mg/L	2025-10-25	
Barium, dissolved	**0.0346**	5	0.0050	mg/L	2025-10-25	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DUP (25J3205-02) | Matrix: Water | Sampled: 2025-10-21 10:00, Continued						
Dissolved Metals, Continued						
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-25	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
Boron, dissolved	< 0.0500	0.5	0.0500	mg/L	2025-10-25	
Cadmium, dissolved	**0.000042**	0.0005	0.000010	mg/L	2025-10-25	
Calcium, dissolved	**200**	N/A	0.20	mg/L	2025-10-25	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-25	
Cobalt, dissolved	< 0.00010	0.04	0.00010	mg/L	2025-10-25	
Copper, dissolved	**0.00251**	0.02	0.00040	mg/L	2025-10-25	
Iron, dissolved	< 0.010	5	0.010	mg/L	2025-10-25	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-10-25	
Lithium, dissolved	**0.0208**	2.5	0.00010	mg/L	2025-10-25	
Magnesium, dissolved	**55.1**	N/A	0.010	mg/L	2025-10-25	
Manganese, dissolved	**0.00046**	0.2	0.00020	mg/L	2025-10-25	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-29	
Molybdenum, dissolved	**0.00828**	0.01	0.00010	mg/L	2025-10-25	
Nickel, dissolved	**0.00132**	0.2	0.00040	mg/L	2025-10-25	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-10-25	
Potassium, dissolved	**9.32**	N/A	0.10	mg/L	2025-10-25	
Selenium, dissolved	**0.00214**	0.02	0.00050	mg/L	2025-10-25	
Silicon, dissolved	**14.3**	N/A	1.0	mg/L	2025-10-25	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-25	
Sodium, dissolved	**85.0**	N/A	0.10	mg/L	2025-10-25	
Strontium, dissolved	**1.51**	N/A	0.0010	mg/L	2025-10-25	
Sulfur, dissolved	**57.3**	N/A	3.0	mg/L	2025-10-25	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-25	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-25	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-25	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-25	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-25	
Uranium, dissolved	**0.00635**	0.01	0.000020	mg/L	2025-10-25	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-25	
Zinc, dissolved	**0.0290**	0.075	0.0040	mg/L	2025-10-25	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
General Parameters						
Alkalinity, Total (as CaCO3)	**440**	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Bicarbonate (as CaCO3)	**440**	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-27	
Carbon, Dissolved Organic	**5.15**	N/A	0.50	mg/L	2025-10-24	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DUP (25J3205-02) | Matrix: Water | Sampled: 2025-10-21 10:00, Continued						
General Parameters, Continued						
Nitrogen, Total Kjeldahl	**0.319**	N/A	0.050	mg/L	2025-10-25	
Phosphorus, Total (as P)	**0.0124**	N/A	0.0050	mg/L	2025-10-24	
Phosphorus, Total Dissolved	**0.0109**	N/A	0.0050	mg/L	2025-10-24	
Phosphorus, Dissolved Reactive	< 0.0050	N/A	0.0050	mg/L	2025-10-23	
Solids, Total Dissolved	**1040**	AO ≤ 500	15	mg/L	2025-10-25	
Trip Blank (25J3205-03) | Matrix: Water | Sampled: 2025-10-21 10:00						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-23	RE2
Chloride	< 0.10	AO ≤ 250	0.10	mg/L	2025-10-23	RE2
Fluoride	< 0.10	MAC = 1.5	0.10	mg/L	2025-10-23	RE2
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2025-10-23	RE2
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-23	RE2
Sulfate	< 1.0	AO ≤ 500	1.0	mg/L	2025-10-23	RE2
Calculated Parameters						
Hardness, Total (as CaCO3)	< 0.500	None Required	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	400	0.0100	mg/L	N/A	
Nitrogen, Total	< 0.0500	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	< 0.0500	N/A	0.0500	mg/L	N/A	
General Parameters						
Alkalinity, Total (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Ammonia, Total (as N)	< 0.050	None Required	0.050	mg/L	2025-10-27	
Nitrogen, Total Kjeldahl	< 0.050	N/A	0.050	mg/L	2025-10-25	
Phosphorus, Total (as P)	< 0.0050	N/A	0.0050	mg/L	2025-10-24	
Phosphorus, Dissolved Reactive	< 0.0050	N/A	0.0050	mg/L	2025-10-23	
Solids, Total Dissolved	< 15	AO ≤ 500	15	mg/L	2025-10-25	
Total Metals						
Aluminum, total	< 0.0050	OG < 0.1	0.0050	mg/L	2025-10-24	
Antimony, total	< 0.00020	MAC = 0.006	0.00020	mg/L	2025-10-24	
Arsenic, total	< 0.00050	MAC = 0.01	0.00050	mg/L	2025-10-24	
Barium, total	< 0.0050	MAC = 2	0.0050	mg/L	2025-10-24	
Beryllium, total	< 0.00010	0.0015	0.00010	mg/L	2025-10-24	
Bismuth, total	< 0.00010	N/A	0.00010	mg/L	2025-10-24	
Boron, total	< 0.0500	MAC = 5	0.0500	mg/L	2025-10-24	
Cadmium, total	< 0.000010	MAC = 0.007	0.000010	mg/L	2025-10-24	
Calcium, total	< 0.20	None Required	0.20	mg/L	2025-10-24	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
Trip Blank (25J3205-03) | Matrix: Water | Sampled: 2025-10-21 10:00, Continued						
Total Metals, Continued						
Chromium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2025-10-24	
Cobalt, total	< 0.00010	0.04	0.00010	mg/L	2025-10-24	
Copper, total	< 0.00040	MAC = 2	0.00040	mg/L	2025-10-24	
Iron, total	< 0.010	AO ≤ 0.1	0.010	mg/L	2025-10-24	
Lead, total	< 0.00020	MAC = 0.005	0.00020	mg/L	2025-10-24	
Lithium, total	< 0.00010	2.5	0.00010	mg/L	2025-10-24	
Magnesium, total	< 0.010	None Required	0.010	mg/L	2025-10-24	
Manganese, total	< 0.00020	MAC = 0.12	0.00020	mg/L	2025-10-24	
Mercury, total	< 0.000010	MAC = 0.001	0.000010	mg/L	2025-10-29	
Molybdenum, total	< 0.00010	0.01	0.00010	mg/L	2025-10-24	
Nickel, total	< 0.00040	0.2	0.00040	mg/L	2025-10-24	
Phosphorus, total	< 0.050	N/A	0.050	mg/L	2025-10-24	
Potassium, total	< 0.10	N/A	0.10	mg/L	2025-10-24	
Selenium, total	< 0.00050	MAC = 0.05	0.00050	mg/L	2025-10-24	
Silicon, total	< 1.0	N/A	1.0	mg/L	2025-10-24	
Silver, total	< 0.000050	None Required	0.000050	mg/L	2025-10-24	
Sodium, total	< 0.10	AO ≤ 200	0.10	mg/L	2025-10-24	
Strontium, total	< 0.0010	MAC = 7	0.0010	mg/L	2025-10-24	
Sulfur, total	< 3.0	N/A	3.0	mg/L	2025-10-24	
Tellurium, total	< 0.00050	N/A	0.00050	mg/L	2025-10-24	
Thallium, total	< 0.000020	0.003	0.000020	mg/L	2025-10-24	
Thorium, total	< 0.00010	N/A	0.00010	mg/L	2025-10-24	
Tin, total	< 0.00020	N/A	0.00020	mg/L	2025-10-24	
Titanium, total	< 0.0050	1	0.0050	mg/L	2025-10-24	
Tungsten, total	< 0.0010	N/A	0.0010	mg/L	2025-10-24	
Uranium, total	< 0.000020	MAC = 0.02	0.000020	mg/L	2025-10-24	
Vanadium, total	< 0.0050	0.1	0.0050	mg/L	2025-10-24	
Zinc, total	< 0.0040	AO ≤ 5	0.0040	mg/L	2025-10-24	
Zirconium, total	< 0.00010	N/A	0.00010	mg/L	2025-10-24	
DMW-4 (25J3205-04) | Matrix: Water | Sampled: 2025-10-21 11:50						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-10-23	
Chloride	**136**	AO ≤ 250	0.10	mg/L	2025-10-23	
Fluoride	**0.38**	MAC = 1.5	0.10	mg/L	2025-10-23	
Nitrate (as N)	**0.570**	MAC = 10	0.010	mg/L	2025-10-23	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-10-23	
Sulfate	**140**	AO ≤ 500	1.0	mg/L	2025-10-23	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**355**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	**0.570**	400	0.0100	mg/L	N/A	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DMW-4 (25J3205-04) | Matrix: Water | Sampled: 2025-10-21 11:50, Continued						
Calculated Parameters, Continued						
Nitrogen, Total	**1.08**	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	**0.453**	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-10-25	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-10-25	
Arsenic, dissolved	**0.00191**	0.05	0.00050	mg/L	2025-10-25	
Barium, dissolved	**0.0342**	5	0.0050	mg/L	2025-10-25	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-10-25	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
Boron, dissolved	**0.200**	0.5	0.0500	mg/L	2025-10-25	
Cadmium, dissolved	**0.000234**	0.0005	0.000010	mg/L	2025-10-25	
Calcium, dissolved	**99.3**	N/A	0.20	mg/L	2025-10-25	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-25	
Cobalt, dissolved	**0.00044**	0.04	0.00010	mg/L	2025-10-25	
Copper, dissolved	**0.00893**	0.02	0.00040	mg/L	2025-10-25	
Iron, dissolved	**0.013**	5	0.010	mg/L	2025-10-25	
Lead, dissolved	**0.00022**	0.02	0.00020	mg/L	2025-10-25	
Lithium, dissolved	**0.0169**	2.5	0.00010	mg/L	2025-10-25	
Magnesium, dissolved	**25.9**	N/A	0.010	mg/L	2025-10-25	
Manganese, dissolved	**0.00030**	0.2	0.00020	mg/L	2025-10-26	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-10-29	
Molybdenum, dissolved	**0.0135**	0.01	0.00010	mg/L	2025-10-25	
Nickel, dissolved	**0.00167**	0.2	0.00040	mg/L	2025-10-25	
Phosphorus, dissolved	**0.255**	N/A	0.050	mg/L	2025-10-25	
Potassium, dissolved	**19.5**	N/A	0.10	mg/L	2025-10-25	
Selenium, dissolved	< 0.00050	0.02	0.00050	mg/L	2025-10-25	
Silicon, dissolved	**9.0**	N/A	1.0	mg/L	2025-10-25	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-10-25	
Sodium, dissolved	**137**	N/A	0.10	mg/L	2025-10-25	
Strontium, dissolved	**0.910**	N/A	0.0010	mg/L	2025-10-25	
Sulfur, dissolved	**49.0**	N/A	3.0	mg/L	2025-10-25	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-10-25	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-10-25	
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-10-25	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-10-25	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-10-25	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-10-25	
Uranium, dissolved	**0.00784**	0.01	0.000020	mg/L	2025-10-25	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-10-25	
Zinc, dissolved	**0.0236**	0.075	0.0040	mg/L	2025-10-25	
Zirconium, dissolved	**0.00010**	N/A	0.00010	mg/L	2025-10-25	
General Parameters						

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
DMW-4 (25J3205-04) | Matrix: Water | Sampled: 2025-10-21 11:50, Continued						
General Parameters, Continued						
Alkalinity, Total (as CaCO3)	**350**	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Bicarbonate (as CaCO3)	**350**	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-10-24	
Ammonia, Total (as N)	**0.058**	None Required	0.050	mg/L	2025-10-27	
Carbon, Dissolved Organic	**5.99**	N/A	0.50	mg/L	2025-10-24	
Nitrogen, Total Kjeldahl	**0.511**	N/A	0.050	mg/L	2025-10-25	
Phosphorus, Total (as P)	**0.239**	N/A	0.0050	mg/L	2025-10-24	
Phosphorus, Total Dissolved	**0.235**	N/A	0.0050	mg/L	2025-10-24	
Phosphorus, Dissolved Reactive	**0.214**	N/A	0.0050	mg/L	2025-10-23	
Solids, Total Dissolved	**1010**	AO ≤ 500	15	mg/L	2025-10-25	

Sample Qualifiers:

RE2 Result was confirmed by re-analysis prior to reporting.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Carbon, Dissolved Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Hardness in Water	SM 2340 B* (2021)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
Mercury, dissolved in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Dissolved Reactive in Water	SM 4500-P F (2021)	Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Dissolved in Water	Solids in Water, Filtered / SM 2540 C* (2020)	Solids in Water, Filtered / Gravimetry (Dried at 103-105C)	✓	Kelowna
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
OG	Operational Guideline (treated water)
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

BC CSR Schedule 3.2 Aquatic Life
BC CSR Schedule 3.2 Irrigation
Guidelines for Canadian Drinking Water Quality (Health Canada)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

General Comments:

The results in this report apply to samples received by CARO and analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety and must not be modified. CARO is not responsible for losses or damages resulting directly or indirectly from errors or omissions in the conduct of the testing. Any liability is limited to the cost of analysis. CARO will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

Results in **Bold** indicate values that are above CARO's method reporting limits. Results in **red** indicate values above the regulatory limits where these have been included. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager: efex@caro.ca

Regulatory limits are added to test reports on request and are as a convenience only. While CARO makes every effort to ensure accuracy of regulatory limits, CARO assumes no liability for the use of this information. It remains the client's responsibility to ensure that regulatory limits are correct for their circumstances.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in “batches” and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B5J4573										
Blank (B5J4573-BLK1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B5J4573-BS1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Bromide	4.06	0.10	mg/L	4.00		101	85-115			
Chloride	16.0	0.10	mg/L	16.0		100	90-110			
Fluoride	4.08	0.10	mg/L	4.00		102	88-108			
Nitrate (as N)	4.08	0.010	mg/L	4.00		102	90-110			
Nitrite (as N)	1.99	0.010	mg/L	2.00		99	85-115			
Sulfate	16.1	1.0	mg/L	16.0		101	90-110			
Dissolved Metals, Batch B5J4818										
Blank (B5J4818-BLK1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							
Arsenic, dissolved	< 0.00050	0.00050	mg/L							
Barium, dissolved	< 0.0050	0.0050	mg/L							
Beryllium, dissolved	< 0.00010	0.00010	mg/L							
Bismuth, dissolved	< 0.00010	0.00010	mg/L							
Boron, dissolved	< 0.0500	0.0500	mg/L							
Cadmium, dissolved	< 0.000010	0.000010	mg/L							
Calcium, dissolved	< 0.20	0.20	mg/L							
Chromium, dissolved	< 0.00050	0.00050	mg/L							
Cobalt, dissolved	< 0.00010	0.00010	mg/L							
Copper, dissolved	< 0.00040	0.00040	mg/L							
Iron, dissolved	< 0.010	0.010	mg/L							
Lead, dissolved	< 0.00020	0.00020	mg/L							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	mg/L							
Molybdenum, dissolved	< 0.00010	0.00010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B5J4818, Continued										
Blank (B5J4818-BLK1), Continued				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Nickel, dissolved	< 0.00040	0.00040	mg/L							
Phosphorus, dissolved	< 0.050	0.050	mg/L							
Potassium, dissolved	< 0.10	0.10	mg/L							
Selenium, dissolved	< 0.00050	0.00050	mg/L							
Silicon, dissolved	< 1.0	1.0	mg/L							
Silver, dissolved	< 0.000050	0.000050	mg/L							
Sodium, dissolved	< 0.10	0.10	mg/L							
Strontium, dissolved	< 0.0010	0.0010	mg/L							
Sulfur, dissolved	< 3.0	3.0	mg/L							
Tellurium, dissolved	< 0.00050	0.00050	mg/L							
Thallium, dissolved	< 0.000020	0.000020	mg/L							
Thorium, dissolved	< 0.00010	0.00010	mg/L							
Tin, dissolved	< 0.00020	0.00020	mg/L							
Titanium, dissolved	< 0.0050	0.0050	mg/L							
Tungsten, dissolved	< 0.0010	0.0010	mg/L							
Uranium, dissolved	< 0.000020	0.000020	mg/L							
Vanadium, dissolved	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B5J4818-BS1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Aluminum, dissolved	4.01	0.0050	mg/L	4.00		100	80-120			
Antimony, dissolved	0.0403	0.00020	mg/L	0.0400		101	80-120			
Arsenic, dissolved	0.395	0.00050	mg/L	0.400		99	80-120			
Barium, dissolved	0.0412	0.0050	mg/L	0.0400		103	80-120			
Beryllium, dissolved	0.0399	0.00010	mg/L	0.0400		100	80-120			
Bismuth, dissolved	0.0403	0.00010	mg/L	0.0400		101	80-120			
Boron, dissolved	0.400	0.0500	mg/L	0.400		100	80-120			
Cadmium, dissolved	0.0409	0.000010	mg/L	0.0400		102	80-120			
Calcium, dissolved	3.98	0.20	mg/L	4.00		100	80-120			
Chromium, dissolved	0.0394	0.00050	mg/L	0.0400		98	80-120			
Cobalt, dissolved	0.0395	0.00010	mg/L	0.0400		99	80-120			
Copper, dissolved	0.0390	0.00040	mg/L	0.0400		98	80-120			
Iron, dissolved	3.89	0.010	mg/L	4.00		97	80-120			
Lead, dissolved	0.0402	0.00020	mg/L	0.0400		101	80-120			
Lithium, dissolved	0.0396	0.00010	mg/L	0.0400		99	80-120			
Magnesium, dissolved	4.02	0.010	mg/L	4.00		100	80-120			
Manganese, dissolved	0.0400	0.00020	mg/L	0.0400		100	80-120			
Molybdenum, dissolved	0.0404	0.00010	mg/L	0.0400		101	80-120			
Nickel, dissolved	0.0403	0.00040	mg/L	0.0400		101	80-120			
Phosphorus, dissolved	3.93	0.050	mg/L	4.00		98	80-120			
Potassium, dissolved	3.91	0.10	mg/L	4.00		98	80-120			
Selenium, dissolved	0.392	0.00050	mg/L	0.400		98	80-120			
Silicon, dissolved	4.0	1.0	mg/L	4.00		100	80-120			
Silver, dissolved	0.0407	0.000050	mg/L	0.0400		102	80-120			
Sodium, dissolved	4.08	0.10	mg/L	4.00		102	80-120			
Strontium, dissolved	0.0397	0.0010	mg/L	0.0400		99	80-120			
Sulfur, dissolved	39.8	3.0	mg/L	40.0		99	80-120			
Tellurium, dissolved	0.0407	0.00050	mg/L	0.0400		102	80-120			
Thallium, dissolved	0.0401	0.000020	mg/L	0.0400		100	80-120			
Thorium, dissolved	0.0407	0.00010	mg/L	0.0400		102	80-120			
Tin, dissolved	0.0409	0.00020	mg/L	0.0400		102	80-120			
Titanium, dissolved	0.0398	0.0050	mg/L	0.0400		99	80-120			
Tungsten, dissolved	0.0399	0.0010	mg/L	0.0400		100	80-120			
Uranium, dissolved	0.0412	0.000020	mg/L	0.0400		103	80-120			
Vanadium, dissolved	0.0390	0.0050	mg/L	0.0400		98	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B5J4818, Continued										
LCS (B5J4818-BS1), Continued				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Zinc, dissolved	0.397	0.0040	mg/L	0.400		99	80-120			
Zirconium, dissolved	0.0410	0.00010	mg/L	0.0400		103	80-120			
Dissolved Metals, Batch B5J5195										
Blank (B5J5195-BLK1)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5J5195-BLK2)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B5J5195-BS1)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, dissolved	0.00268	0.000010	mg/L	0.00250		107	80-120			
LCS (B5J5195-BS2)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, dissolved	0.00261	0.000010	mg/L	0.00250		104	80-120			
Matrix Spike (B5J5195-MS1)		**Source: 25J3205-04**		Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, dissolved	0.00174	0.000010	mg/L	0.00250	< 0.000010	70	70-130			
General Parameters, Batch B5J4437										
Blank (B5J4437-BLK1)				Prepared: 2025-10-22, Analyzed: 2025-10-24						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B5J4437-BLK2)				Prepared: 2025-10-22, Analyzed: 2025-10-24						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B5J4437-BLK3)				Prepared: 2025-10-23, Analyzed: 2025-10-24						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
LCS (B5J4437-BS1)				Prepared: 2025-10-22, Analyzed: 2025-10-24						
Carbon, Dissolved Organic	9.61	0.50	mg/L	10.0		96	78-116			
LCS (B5J4437-BS2)				Prepared: 2025-10-22, Analyzed: 2025-10-24						
Carbon, Dissolved Organic	9.61	0.50	mg/L	10.0		96	78-116			
LCS (B5J4437-BS3)				Prepared: 2025-10-23, Analyzed: 2025-10-24						
Carbon, Dissolved Organic	9.60	0.50	mg/L	10.0		96	78-116			
General Parameters, Batch B5J4547										
Blank (B5J4547-BLK1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Dissolved Reactive	< 0.0050	0.0050	mg/L							
LCS (B5J4547-BS1)				Prepared: 2025-10-23, Analyzed: 2025-10-23						
Phosphorus, Dissolved Reactive	0.0992	0.0050	mg/L	0.100		99	84-115			
General Parameters, Batch B5J4622										
Blank (B5J4622-BLK1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050	mg/L							
Blank (B5J4622-BLK2)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B5J4622, Continued										
Blank (B5J4622-BLK2), Continued				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Phosphorus, Total Dissolved	< 0.0050	0.0050	mg/L							
Blank (B5J4622-BLK3)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
LCS (B5J4622-BS1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Phosphorus, Total (as P)	0.109	0.0050	mg/L	0.100		109	85-115			
Phosphorus, Total Dissolved	0.104	0.0050	mg/L	0.100		104	85-115			
LCS (B5J4622-BS2)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Phosphorus, Total (as P)	0.105	0.0050	mg/L	0.100		105	85-115			
Phosphorus, Total Dissolved	0.106	0.0050	mg/L	0.100		106	85-115			
LCS (B5J4622-BS3)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Phosphorus, Total (as P)	0.106	0.0050	mg/L	0.100		106	85-115			
General Parameters, Batch B5J4633										
Blank (B5J4633-BLK1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
LCS (B5J4633-BS1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Alkalinity, Total (as CaCO3)	101	1.0	mg/L	100		101	80-120			
General Parameters, Batch B5J4723										
Blank (B5J4723-BLK1)				Prepared: 2025-10-24, Analyzed: 2025-10-25						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B5J4723-BLK2)				Prepared: 2025-10-24, Analyzed: 2025-10-25						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B5J4723-BS1)				Prepared: 2025-10-24, Analyzed: 2025-10-25						
Nitrogen, Total Kjeldahl	0.933	0.050	mg/L	1.00		93	85-115			
LCS (B5J4723-BS2)				Prepared: 2025-10-24, Analyzed: 2025-10-25						
Nitrogen, Total Kjeldahl	0.921	0.050	mg/L	1.00		92	85-115			
General Parameters, Batch B5J4781										
Blank (B5J4781-BLK1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Solids, Total Dissolved	< 15	15	mg/L							
LCS (B5J4781-BS1)				Prepared: 2025-10-25, Analyzed: 2025-10-25						
Solids, Total Dissolved	227	15	mg/L	240		95	85-115			
General Parameters, Batch B5J4892										
Blank (B5J4892-BLK1)				Prepared: 2025-10-27, Analyzed: 2025-10-27						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B5J4892, Continued										
Blank (B5J4892-BLK2)				Prepared: 2025-10-27, Analyzed: 2025-10-27						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							
LCS (B5J4892-BS1)				Prepared: 2025-10-27, Analyzed: 2025-10-27						
Ammonia, Total (as N)	0.996	0.050	mg/L	1.00		100	85-115			
LCS (B5J4892-BS2)				Prepared: 2025-10-27, Analyzed: 2025-10-27						
Ammonia, Total (as N)	0.995	0.050	mg/L	1.00		100	85-115			
Total Metals, Batch B5J4739										
Blank (B5J4739-BLK1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							
Tungsten, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
Blank (B5J4739-BLK2)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B5J4739, Continued										
Blank (B5J4739-BLK2), Continued				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							
Tungsten, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0050	0.0050	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B5J4739-BS1)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Aluminum, total	3.86	0.0050	mg/L	4.00		96	80-120			
Antimony, total	0.0391	0.00020	mg/L	0.0400		98	80-120			
Arsenic, total	0.380	0.00050	mg/L	0.400		95	80-120			
Barium, total	0.0391	0.0050	mg/L	0.0400		98	80-120			
Beryllium, total	0.0380	0.00010	mg/L	0.0400		95	80-120			
Bismuth, total	0.0391	0.00010	mg/L	0.0400		98	80-120			
Boron, total	0.393	0.0500	mg/L	0.400		98	80-120			
Cadmium, total	0.0391	0.000010	mg/L	0.0400		98	80-120			
Calcium, total	3.99	0.20	mg/L	4.00		100	80-120			
Chromium, total	0.0391	0.00050	mg/L	0.0400		98	80-120			
Cobalt, total	0.0382	0.00010	mg/L	0.0400		96	80-120			
Copper, total	0.0381	0.00040	mg/L	0.0400		95	80-120			
Iron, total	3.84	0.010	mg/L	4.00		96	80-120			
Lead, total	0.0394	0.00020	mg/L	0.0400		98	80-120			
Lithium, total	0.0384	0.00010	mg/L	0.0400		96	80-120			
Magnesium, total	3.86	0.010	mg/L	4.00		96	80-120			
Manganese, total	0.0389	0.00020	mg/L	0.0400		97	80-120			
Molybdenum, total	0.0391	0.00010	mg/L	0.0400		98	80-120			
Nickel, total	0.0388	0.00040	mg/L	0.0400		97	80-120			
Phosphorus, total	3.92	0.050	mg/L	4.00		98	80-120			
Potassium, total	3.95	0.10	mg/L	4.00		99	80-120			
Selenium, total	0.389	0.00050	mg/L	0.400		97	80-120			
Silicon, total	3.8	1.0	mg/L	4.00		96	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B5J4739, Continued										
LCS (B5J4739-BS1), Continued				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Silver, total	0.0392	0.000050	mg/L	0.0400		98	80-120			
Sodium, total	4.01	0.10	mg/L	4.00		100	80-120			
Strontium, total	0.0395	0.0010	mg/L	0.0400		99	80-120			
Sulfur, total	40.0	3.0	mg/L	40.0		100	80-120			
Tellurium, total	0.0378	0.00050	mg/L	0.0400		94	80-120			
Thallium, total	0.0392	0.000020	mg/L	0.0400		98	80-120			
Thorium, total	0.0399	0.00010	mg/L	0.0400		100	80-120			
Tin, total	0.0403	0.00020	mg/L	0.0400		101	80-120			
Titanium, total	0.0375	0.0050	mg/L	0.0400		94	80-120			
Tungsten, total	0.0379	0.0010	mg/L	0.0400		95	80-120			
Uranium, total	0.0396	0.000020	mg/L	0.0400		99	80-120			
Vanadium, total	0.0390	0.0050	mg/L	0.0400		97	80-120			
Zinc, total	0.376	0.0040	mg/L	0.400		94	80-120			
Zirconium, total	0.0386	0.00010	mg/L	0.0400		97	80-120			
LCS (B5J4739-BS2)				Prepared: 2025-10-24, Analyzed: 2025-10-24						
Aluminum, total	3.88	0.0050	mg/L	4.00		97	80-120			
Antimony, total	0.0385	0.00020	mg/L	0.0400		96	80-120			
Arsenic, total	0.382	0.00050	mg/L	0.400		96	80-120			
Barium, total	0.0384	0.0050	mg/L	0.0400		96	80-120			
Beryllium, total	0.0382	0.00010	mg/L	0.0400		95	80-120			
Bismuth, total	0.0389	0.00010	mg/L	0.0400		97	80-120			
Boron, total	0.384	0.0500	mg/L	0.400		96	80-120			
Cadmium, total	0.0384	0.000010	mg/L	0.0400		96	80-120			
Calcium, total	4.07	0.20	mg/L	4.00		102	80-120			
Chromium, total	0.0388	0.00050	mg/L	0.0400		97	80-120			
Cobalt, total	0.0386	0.00010	mg/L	0.0400		96	80-120			
Copper, total	0.0384	0.00040	mg/L	0.0400		96	80-120			
Iron, total	3.83	0.010	mg/L	4.00		96	80-120			
Lead, total	0.0391	0.00020	mg/L	0.0400		98	80-120			
Lithium, total	0.0384	0.00010	mg/L	0.0400		96	80-120			
Magnesium, total	3.90	0.010	mg/L	4.00		98	80-120			
Manganese, total	0.0390	0.00020	mg/L	0.0400		98	80-120			
Molybdenum, total	0.0389	0.00010	mg/L	0.0400		97	80-120			
Nickel, total	0.0390	0.00040	mg/L	0.0400		97	80-120			
Phosphorus, total	3.95	0.050	mg/L	4.00		99	80-120			
Potassium, total	3.94	0.10	mg/L	4.00		99	80-120			
Selenium, total	0.393	0.00050	mg/L	0.400		98	80-120			
Silicon, total	3.8	1.0	mg/L	4.00		96	80-120			
Silver, total	0.0392	0.000050	mg/L	0.0400		98	80-120			
Sodium, total	4.02	0.10	mg/L	4.00		100	80-120			
Strontium, total	0.0391	0.0010	mg/L	0.0400		98	80-120			
Sulfur, total	39.7	3.0	mg/L	40.0		99	80-120			
Tellurium, total	0.0375	0.00050	mg/L	0.0400		94	80-120			
Thallium, total	0.0392	0.000020	mg/L	0.0400		98	80-120			
Thorium, total	0.0397	0.00010	mg/L	0.0400		99	80-120			
Tin, total	0.0394	0.00020	mg/L	0.0400		99	80-120			
Titanium, total	0.0384	0.0050	mg/L	0.0400		96	80-120			
Tungsten, total	0.0383	0.0010	mg/L	0.0400		96	80-120			
Uranium, total	0.0399	0.000020	mg/L	0.0400		100	80-120			
Vanadium, total	0.0389	0.0050	mg/L	0.0400		97	80-120			
Zinc, total	0.380	0.0040	mg/L	0.400		95	80-120			
Zirconium, total	0.0386	0.00010	mg/L	0.0400		96	80-120			
Total Metals, Batch B5J5195										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25J3205
PROJECT	2025-8891 COV GW	**REPORTED**	2025-10-29 12:13

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B5J5195, Continued										
Blank (B5J5195-BLK1)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B5J5195-BLK2)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, total	< 0.000010	0.000010	mg/L							
LCS (B5J5195-BS1)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, total	0.00268	0.000010	mg/L	0.00250		107	80-120			
LCS (B5J5195-BS2)				Prepared: 2025-10-29, Analyzed: 2025-10-29						
Mercury, total	0.00261	0.000010	mg/L	0.00250		104	80-120			

25J3205

SERVICES

☐ 110-4011 Viking Way, Richmond, BC V6V 2
Tel: (604) 279-1499 Fax: (604) 279-1599

☒ 102-3677 Highway 97N, Kelowna, BC V1X 5C3
Tel: (250) 765-9646 Fax: (250) 765-3893

☐ 17225 109 Avenue NW, Edmonton, AB T5S 1H7
Tel: (780) 489-9100 Fax: (780) 489-9700

CAR COC, Rev 03/14

CHAIN OF CUSTODY RECORD

COC# _____ PAGE 1 OF 1

RELINQUISHED BY:	DATE: Oct 22/25	RECEIVED BY:	DATE: Oct 22,
Anna Rice	TIME: 07:30	DM Ace	TIME: 14:30

PROJECT: COV Annual GW Monitoring 2025

PROJECT INFO: 2025-8891 COV GW

REPORT TO:

COMPANY: Associated Environmental
ADDRESS: 200-2800 29th Street
Vernon, BC V1T 9P9
CONTACT: Nicole Penner
TEL/FAX: 250-545-3672 250-938-5537
EMAIL PDF ☒ EDD ☒
EMAIL 1: pennern@ae.ca; indrigoc@ae.ca
EMAIL 2: support@ wirelesswater.com
MAIL HARDCOPY ☐ HOLD FOR P/U ☐ FAX ☐

INVOICE TO: SAME AS REPORT TO ☐

COMPANY: City of Vernon
ADDRESS: 2100-43rd Street
Vernon BC V1T 6W8
CONTACT: Serge Kozin
TEL/FAX: (250) 550-3627
EMAIL PDF ☒
EMAIL 1: pennern@ae.ca
EMAIL 2:
MAIL HARDCOPY ☐ HOLD FOR P/U ☐

SAMLPLED BY: Anna Rice

PO #: Annual Groundwater Monitoring 2025

TURNAROUND TIME REQUESTED:
Routine: (5-7 Days) ☒
Rush: 1 Day* ☐ 2 Day* ☐ 3 Day* ☐
Other* _____
*Contact Lab To Confirm. Surcharge May Apply

REGULATORY APPLICATION:
Canadian Drinking Water Quality Guidelines ☒ CCME ☐
BC Drinking Water Protection Act / Reg. ☐ ALBERTA TIER 1 ☐
BC CSR ☒ AL ☒ RL ☐ CL ☐ IL ☒ AW ☐
OTHER:

ANALYSES REQUESTED:

	CLIENT SAMPLE ID:	MATRIX: DRINKING WATER	OTHER WATER	SOIL	OTHER	# CONTAINERS	SAMPLING: DATE DD-MMM-YY	TIME HH:MM	COMMENTS: CHLORINATED	FILTERED	PRESERVED	(i.e. flow/volume media ID/notes)	BTEX ☐ VPH ☐ PHC F1 ☐	VOC ☐ VPH ☐	EPH ☐ PHC F2-F4 ☐	PAH ☐ L/HEPH ☐	PHENOLS ☐ Chlorinated ☐ Non-Chlor. ☐	PCB ☐ GLYCOLS ☐ HAA ☐	PESTICIDES ☐ ACID HERBICIDES ☐	METALS - WATER TOTAL Hg ☐	METALS - WATER DISSOLVED Hg ☒	METALS - SOIL (SALM) ☐ inc. pH ☐	pH ☐ EC ☐ ALK ☒	TSS ☐ VSS ☐ TDS ☒	BOD ☐ COD ☐	TOG ☐ MOG ☐	FECAL COLIFORMS ☐ HPC ☐	TOTAL COLIFORMS ☐ E.coli ☐	ASBESTOS	Chloride, bromide, fluoride, sodium	Sulphate	Total and organic nitrogen package	Total P, total dissolved P, ortho-P	Dissolved organic carbon	Hardness		HOLD
	DMW-3		✔			7	21-10-25	10:00		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	DUP		✔			7	21-10-25	10:00		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	Trip Blank		✔			6	21-10-25	10:00		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
	DMW-4		✔			7	21-10-25	11:50		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			

SHIPPING INSTRUCTIONS: Return Cooler(s) ☐
Supplies Needed:

SAMPLE RETENTION INSTRUCTIONS (Discarded 30 days after Report unless otherwise specified):
60 Days ☐ 90 Days ☐ Longer Date (Surcharges will Apply): _____

OTHER INSTRUCTIONS:
Upload to Wireless Water. Low-level DL for metals. Ensure invoice includes 'Annual Groundwater Monitoring 2025' and send only to Nicole Penner (pennern@ae.ca) to pass to COV.

PAYMENT:
CHEQUE ☐
CREDIT ☐
DEBIT ☐
CASH ☐
INVOICE ☐

SAMPLE RECEIPT TEMP (°C): 9.3
Work Order # _____
CUSTODY SEAL INTACT Y ☐ N ☐ NA ☐

CERTIFICATE OF ANALYSIS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon) #200 - 2800 29th Street Vernon, BC V1T 9P9		
ATTENTION	Nicole Penner	**WORK ORDER**	25L1784
PO NUMBER	Annual Groundwater Monitoring 2025	**RECEIVED / TEMP**	2025-12-12 14:50 / 4.2°C
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05
PROJECT INFO	COV Annual GW Monitoring 2025	**COC NUMBER**	No Number

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

By engaging our services, you are agreeing to CARO Analytical Service's Standard Terms and Conditions outlined here: https://www.caro.ca/terms-conditions

If you have any questions or concerns, please contact me at efex@caro.ca

Authorized By:

Echo Fex
Junior Account Manager

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
WTN 24991 (25L1784-01) | Matrix: Water | Sampled: 2025-12-11 13:20						
Anions						
Bromide	< 0.10	N/A	0.10	mg/L	2025-12-14	
Chloride	**1.60**	AO ≤ 250	0.10	mg/L	2025-12-14	
Fluoride	**0.26**	MAC = 1.5	0.10	mg/L	2025-12-14	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	2025-12-14	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	2025-12-14	
Sulfate	**82.0**	AO ≤ 500	1.0	mg/L	2025-12-14	
Calculated Parameters						
Hardness, Dissolved (as CaCO3)	**193**	N/A	0.500	mg/L	N/A	
Nitrate+Nitrite (as N)	< 0.0100	400	0.0100	mg/L	N/A	
Nitrogen, Total	**0.194**	N/A	0.0500	mg/L	N/A	
Nitrogen, Organic	< 0.0500	N/A	0.0500	mg/L	N/A	
Dissolved Metals						
Aluminum, dissolved	< 0.0050	5	0.0050	mg/L	2025-12-17	
Antimony, dissolved	< 0.00020	0.09	0.00020	mg/L	2025-12-17	
Arsenic, dissolved	**0.00114**	0.05	0.00050	mg/L	2025-12-17	
Barium, dissolved	**0.0199**	5	0.0050	mg/L	2025-12-17	
Beryllium, dissolved	< 0.00010	0.0015	0.00010	mg/L	2025-12-17	
Bismuth, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-12-17	
Boron, dissolved	< 0.0500	0.5	0.0500	mg/L	2025-12-17	
Cadmium, dissolved	< 0.000010	0.0005	0.000010	mg/L	2025-12-17	
Calcium, dissolved	**43.5**	N/A	0.20	mg/L	2025-12-17	
Chromium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-12-17	
Cobalt, dissolved	< 0.00010	0.04	0.00010	mg/L	2025-12-17	
Copper, dissolved	< 0.00040	0.02	0.00040	mg/L	2025-12-17	
Iron, dissolved	**0.221**	5	0.010	mg/L	2025-12-17	
Lead, dissolved	< 0.00020	0.02	0.00020	mg/L	2025-12-17	
Lithium, dissolved	**0.00366**	2.5	0.00010	mg/L	2025-12-17	
Magnesium, dissolved	**20.5**	N/A	0.010	mg/L	2025-12-17	
Manganese, dissolved	**0.0812**	0.2	0.00020	mg/L	2025-12-17	
Mercury, dissolved	< 0.000010	0.00025	0.000010	mg/L	2025-12-18	
Molybdenum, dissolved	**0.0103**	0.01	0.00010	mg/L	2025-12-17	
Nickel, dissolved	< 0.00040	0.2	0.00040	mg/L	2025-12-17	
Phosphorus, dissolved	< 0.050	N/A	0.050	mg/L	2025-12-17	
Potassium, dissolved	**3.43**	N/A	0.10	mg/L	2025-12-17	
Selenium, dissolved	< 0.00050	0.02	0.00050	mg/L	2025-12-17	
Silicon, dissolved	**10.3**	N/A	1.0	mg/L	2025-12-17	
Silver, dissolved	< 0.000050	0.0005	0.000050	mg/L	2025-12-17	
Sodium, dissolved	**30.4**	N/A	0.10	mg/L	2025-12-17	
Strontium, dissolved	**0.463**	N/A	0.0010	mg/L	2025-12-17	
Sulfur, dissolved	**26.8**	N/A	3.0	mg/L	2025-12-17	
Tellurium, dissolved	< 0.00050	N/A	0.00050	mg/L	2025-12-17	
Thallium, dissolved	< 0.000020	0.003	0.000020	mg/L	2025-12-17	

TEST RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

Analyte	Result	Guideline	RL	Units	Analyzed	Qualifier
WTN 24991 (25L1784-01) | Matrix: Water | Sampled: 2025-12-11 13:20, Continued						
Dissolved Metals, Continued						
Thorium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-12-17	
Tin, dissolved	< 0.00020	N/A	0.00020	mg/L	2025-12-17	
Titanium, dissolved	< 0.0050	1	0.0050	mg/L	2025-12-17	
Tungsten, dissolved	< 0.0010	N/A	0.0010	mg/L	2025-12-17	
Uranium, dissolved	**0.00195**	0.01	0.000020	mg/L	2025-12-17	
Vanadium, dissolved	< 0.0050	0.1	0.0050	mg/L	2025-12-17	
Zinc, dissolved	< 0.0040	0.075	0.0040	mg/L	2025-12-17	
Zirconium, dissolved	< 0.00010	N/A	0.00010	mg/L	2025-12-17	
General Parameters						
Alkalinity, Total (as CaCO3)	**197**	N/A	1.0	mg/L	2025-12-15	
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-12-15	
Alkalinity, Bicarbonate (as CaCO3)	**197**	N/A	1.0	mg/L	2025-12-15	
Alkalinity, Carbonate (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-12-15	
Alkalinity, Hydroxide (as CaCO3)	< 1.0	N/A	1.0	mg/L	2025-12-15	
Ammonia, Total (as N)	**0.161**	None Required	0.050	mg/L	2025-12-15	
Carbon, Dissolved Organic	**0.88**	N/A	0.50	mg/L	2025-12-16	
Nitrogen, Total Kjeldahl	**0.194**	N/A	0.050	mg/L	2025-12-17	
Phosphorus, Total (as P)	**0.0148**	N/A	0.0050	mg/L	2025-12-17	
Phosphorus, Total Dissolved	**0.0135**	N/A	0.0050	mg/L	2025-12-17	
Phosphorus, Dissolved Reactive	**0.0093**	N/A	0.0050	mg/L	2025-12-14	
Solids, Total Dissolved	**314**	AO ≤ 500	15	mg/L	2025-12-15	

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

Analysis Description	Method Ref.	Technique	Accredited	Location
Alkalinity in Water	SM 2320 B* (2021)	Titration with H2SO4	✓	Kelowna
Ammonia, Total in Water	SM 4500-NH3 G* (2021)	Automated Colorimetry (Phenate)	✓	Kelowna
Anions in Water	SM 4110 B (2020)	Ion Chromatography	✓	Kelowna
Carbon, Dissolved Organic in Water	SM 5310 B (2022)	Combustion, Infrared CO2 Detection	✓	Kelowna
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water	SM 2340 B (2021)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Mercury, dissolved in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Nitrogen, Total Kjeldahl in Water	SM 4500-Norg D* (2021)	Block Digestion and Flow Injection Analysis	✓	Kelowna
Phosphorus, Dissolved Reactive in Water	SM 4500-P F (2021)	Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total Dissolved in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Phosphorus, Total in Water	SM 4500-P B.5* (2011) / SM 4500-P F (2021)	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	✓	Kelowna
Solids, Total Dissolved in Water	Solids in Water, Filtered / SM 2540 C* (2020)	Solids in Water, Filtered / Gravimetry (Dried at 103-105C)	✓	Kelowna

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
AO	Aesthetic Objective
MAC	Maximum Acceptable Concentration (health based)
mg/L	Milligrams per litre
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

Guidelines Referenced in this Report:

BC CSR Schedule 3.2 Aquatic Life
BC CSR Schedule 3.2 Irrigation
Guidelines for Canadian Drinking Water Quality (Health Canada)

Note: In some cases, the values displayed on the report represent the lowest guideline and are to be verified by the end user

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

General Comments:

The results in this report apply to samples received by CARO and analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety and must not be modified. CARO is not responsible for losses or damages resulting directly or indirectly from errors or omissions in the conduct of the testing. Any liability is limited to the cost of analysis. CARO will dispose of all samples within 30 days of sample receipt, unless otherwise agreed.

Results in **Bold** indicate values that are above CARO's method reporting limits. Results in **red** indicate values above the regulatory limits where these have been included. Any Bold and/or highlighted results do not take into account method uncertainty. If you would like method uncertainty or regulatory limits to be included on your report, please contact your Account Manager: efex@caro.ca

Regulatory limits are added to test reports on request and are as a convenience only. While CARO makes every effort to ensure accuracy of regulatory limits, CARO assumes no liability for the use of this information. It remains the client's responsibility to ensure that regulatory limits are correct for their circumstances.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Anions, Batch B5L3079										
Blank (B5L3079-BLK1)				Prepared: 2025-12-14, Analyzed: 2025-12-14						
Bromide	< 0.10	0.10	mg/L							
Chloride	< 0.10	0.10	mg/L							
Fluoride	< 0.10	0.10	mg/L							
Nitrate (as N)	< 0.010	0.010	mg/L							
Nitrite (as N)	< 0.010	0.010	mg/L							
Sulfate	< 1.0	1.0	mg/L							
LCS (B5L3079-BS1)				Prepared: 2025-12-14, Analyzed: 2025-12-14						
Bromide	4.08	0.10	mg/L	4.00		102	85-115			
Chloride	16.0	0.10	mg/L	16.0		100	90-110			
Fluoride	4.02	0.10	mg/L	4.00		101	88-108			
Nitrate (as N)	4.13	0.010	mg/L	4.00		103	90-110			
Nitrite (as N)	2.04	0.010	mg/L	2.00		102	85-115			
Sulfate	16.0	1.0	mg/L	16.0		100	90-110			
Duplicate (B5L3079-DUP1)		**Source: 25L1784-01**		Prepared: 2025-12-14, Analyzed: 2025-12-14						
Bromide	< 0.10	0.10	mg/L		< 0.10				10	
Chloride	1.64	0.10	mg/L		1.60			3	10	
Fluoride	0.26	0.10	mg/L		0.26				10	
Nitrate (as N)	< 0.010	0.010	mg/L		< 0.010				10	
Nitrite (as N)	< 0.010	0.010	mg/L		< 0.010				15	
Sulfate	82.5	1.0	mg/L		82.0			< 1	10	
Matrix Spike (B5L3079-MS1)		**Source: 25L1784-01**		Prepared: 2025-12-14, Analyzed: 2025-12-14						
Bromide	4.31	0.10	mg/L	4.00	< 0.10	107	80-120			
Chloride	17.4	0.10	mg/L	16.0	1.60	99	75-125			
Fluoride	4.12	0.10	mg/L	4.00	0.26	96	75-125			
Nitrate (as N)	4.09	0.010	mg/L	4.00	< 0.010	102	75-125			
Nitrite (as N)	1.95	0.010	mg/L	2.00	< 0.010	97	75-115			
Sulfate	99.7	1.0	mg/L	16.0	82.0	110	75-125			
Dissolved Metals, Batch B5L3320										
Blank (B5L3320-BLK1)				Prepared: 2025-12-18, Analyzed: 2025-12-19						
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B5L3320, Continued										
Blank (B5L3320-BLK1), Continued				Prepared: 2025-12-18, Analyzed: 2025-12-19						
Arsenic, dissolved	< 0.00050	0.00050	mg/L							
Barium, dissolved	< 0.0050	0.0050	mg/L							
Beryllium, dissolved	< 0.00010	0.00010	mg/L							
Bismuth, dissolved	< 0.00010	0.00010	mg/L							
Boron, dissolved	< 0.0500	0.0500	mg/L							
Cadmium, dissolved	< 0.000010	0.000010	mg/L							
Calcium, dissolved	< 0.20	0.20	mg/L							
Chromium, dissolved	< 0.00050	0.00050	mg/L							
Cobalt, dissolved	< 0.00010	0.00010	mg/L							
Copper, dissolved	< 0.00040	0.00040	mg/L							
Iron, dissolved	< 0.010	0.010	mg/L							
Lead, dissolved	< 0.00020	0.00020	mg/L							
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	mg/L							
Molybdenum, dissolved	< 0.00010	0.00010	mg/L							
Nickel, dissolved	< 0.00040	0.00040	mg/L							
Phosphorus, dissolved	< 0.050	0.050	mg/L							
Potassium, dissolved	< 0.10	0.10	mg/L							
Selenium, dissolved	< 0.00050	0.00050	mg/L							
Silicon, dissolved	< 1.0	1.0	mg/L							
Silver, dissolved	< 0.000050	0.000050	mg/L							
Sodium, dissolved	< 0.10	0.10	mg/L							
Strontium, dissolved	< 0.0010	0.0010	mg/L							
Sulfur, dissolved	< 3.0	3.0	mg/L							
Tellurium, dissolved	< 0.00050	0.00050	mg/L							
Thallium, dissolved	< 0.000020	0.000020	mg/L							
Thorium, dissolved	< 0.00010	0.00010	mg/L							
Tin, dissolved	< 0.00020	0.00020	mg/L							
Titanium, dissolved	< 0.0050	0.0050	mg/L							
Tungsten, dissolved	< 0.0010	0.0010	mg/L							
Uranium, dissolved	< 0.000020	0.000020	mg/L							
Vanadium, dissolved	< 0.0050	0.0050	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B5L3320-BS1)				Prepared: 2025-12-16, Analyzed: 2025-12-16						
Aluminum, dissolved	3.99	0.0050	mg/L	4.00		100	80-120			
Antimony, dissolved	0.0417	0.00020	mg/L	0.0400		104	80-120			
Arsenic, dissolved	0.401	0.00050	mg/L	0.400		100	80-120			
Barium, dissolved	0.0412	0.0050	mg/L	0.0400		103	80-120			
Beryllium, dissolved	0.0404	0.00010	mg/L	0.0400		101	80-120			
Bismuth, dissolved	0.0404	0.00010	mg/L	0.0400		101	80-120			
Boron, dissolved	0.392	0.0500	mg/L	0.400		98	80-120			
Cadmium, dissolved	0.0398	0.000010	mg/L	0.0400		100	80-120			
Calcium, dissolved	3.78	0.20	mg/L	4.00		95	80-120			
Chromium, dissolved	0.0388	0.00050	mg/L	0.0400		97	80-120			
Cobalt, dissolved	0.0393	0.00010	mg/L	0.0400		98	80-120			
Copper, dissolved	0.0393	0.00040	mg/L	0.0400		98	80-120			
Iron, dissolved	3.95	0.010	mg/L	4.00		99	80-120			
Lead, dissolved	0.0404	0.00020	mg/L	0.0400		101	80-120			
Lithium, dissolved	0.0404	0.00010	mg/L	0.0400		101	80-120			
Magnesium, dissolved	3.86	0.010	mg/L	4.00		96	80-120			
Manganese, dissolved	0.0395	0.00020	mg/L	0.0400		99	80-120			
Molybdenum, dissolved	0.0407	0.00010	mg/L	0.0400		102	80-120			
Nickel, dissolved	0.0398	0.00040	mg/L	0.0400		100	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B5L3320, Continued										
LCS (B5L3320-BS1), Continued				Prepared: 2025-12-16, Analyzed: 2025-12-16						
Phosphorus, dissolved	3.96	0.050	mg/L	4.00		99	80-120			
Potassium, dissolved	3.83	0.10	mg/L	4.00		96	80-120			
Selenium, dissolved	0.382	0.00050	mg/L	0.400		95	80-120			
Silicon, dissolved	4.0	1.0	mg/L	4.00		99	80-120			
Silver, dissolved	0.0393	0.000050	mg/L	0.0400		98	80-120			
Sodium, dissolved	3.84	0.10	mg/L	4.00		96	80-120			
Strontium, dissolved	0.0405	0.0010	mg/L	0.0400		101	80-120			
Sulfur, dissolved	39.0	3.0	mg/L	40.0		97	80-120			
Tellurium, dissolved	0.0418	0.00050	mg/L	0.0400		105	80-120			
Thallium, dissolved	0.0401	0.000020	mg/L	0.0400		100	80-120			
Thorium, dissolved	0.0393	0.00010	mg/L	0.0400		98	80-120			
Tin, dissolved	0.0419	0.00020	mg/L	0.0400		105	80-120			
Titanium, dissolved	0.0405	0.0050	mg/L	0.0400		101	80-120			
Tungsten, dissolved	0.0404	0.0010	mg/L	0.0400		101	80-120			
Uranium, dissolved	0.0389	0.000020	mg/L	0.0400		97	80-120			
Vanadium, dissolved	0.0387	0.0050	mg/L	0.0400		97	80-120			
Zinc, dissolved	0.394	0.0040	mg/L	0.400		99	80-120			
Zirconium, dissolved	0.0414	0.00010	mg/L	0.0400		103	80-120			
Dissolved Metals, Batch B5L3591										
Blank (B5L3591-BLK1)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5L3591-BLK2)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5L3591-BLK3)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5L3591-BLK4)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5L3591-BLK5)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Blank (B5L3591-BLK6)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
LCS (B5L3591-BS1)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	0.00227	0.000010	mg/L	0.00250		91	80-120			
LCS (B5L3591-BS2)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	0.00261	0.000010	mg/L	0.00250		105	80-120			
LCS (B5L3591-BS3)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	0.00237	0.000010	mg/L	0.00250		95	80-120			
LCS (B5L3591-BS4)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	0.00250	0.000010	mg/L	0.00250		100	80-120			
LCS (B5L3591-BS5)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	0.00259	0.000010	mg/L	0.00250		104	80-120			
LCS (B5L3591-BS6)				Prepared: 2025-12-18, Analyzed: 2025-12-18						
Mercury, dissolved	0.00249	0.000010	mg/L	0.00250		99	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B5L3090										
Blank (B5L3090-BLK1)				Prepared: 2025-12-13, Analyzed: 2025-12-14						
Phosphorus, Dissolved Reactive	< 0.0050	0.0050	mg/L							
LCS (B5L3090-BS1)				Prepared: 2025-12-13, Analyzed: 2025-12-14						
Phosphorus, Dissolved Reactive	0.104	0.0050	mg/L	0.100		104	84-115			
General Parameters, Batch B5L3122										
Blank (B5L3122-BLK1)				Prepared: 2025-12-15, Analyzed: 2025-12-16						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
Blank (B5L3122-BLK2)				Prepared: 2025-12-15, Analyzed: 2025-12-16						
Carbon, Dissolved Organic	< 0.50	0.50	mg/L							
LCS (B5L3122-BS1)				Prepared: 2025-12-15, Analyzed: 2025-12-16						
Carbon, Dissolved Organic	9.28	0.50	mg/L	10.0		93	78-116			
LCS (B5L3122-BS2)				Prepared: 2025-12-15, Analyzed: 2025-12-16						
Carbon, Dissolved Organic	9.31	0.50	mg/L	10.0		93	78-116			
Duplicate (B5L3122-DUP2)		**Source: 25L1784-01**		Prepared: 2025-12-15, Analyzed: 2025-12-16						
Carbon, Dissolved Organic	0.85	0.50	mg/L		0.88				15	
Matrix Spike (B5L3122-MS2)		**Source: 25L1784-01**		Prepared: 2025-12-15, Analyzed: 2025-12-16						
Carbon, Dissolved Organic	9.59	0.50	mg/L	10.0	0.88	87	70-130			
General Parameters, Batch B5L3142										
Blank (B5L3142-BLK1)				Prepared: 2025-12-15, Analyzed: 2025-12-15						
Alkalinity, Total (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Phenolphthalein (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Bicarbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Carbonate (as CaCO3)	< 1.0	1.0	mg/L							
Alkalinity, Hydroxide (as CaCO3)	< 1.0	1.0	mg/L							
LCS (B5L3142-BS1)				Prepared: 2025-12-15, Analyzed: 2025-12-15						
Alkalinity, Total (as CaCO3)	97.6	1.0	mg/L	100		98	80-120			
General Parameters, Batch B5L3143										
Blank (B5L3143-BLK1)				Prepared: 2025-12-15, Analyzed: 2025-12-15						
Solids, Total Dissolved	< 15	15	mg/L							
LCS (B5L3143-BS1)				Prepared: 2025-12-15, Analyzed: 2025-12-15						
Solids, Total Dissolved	231	15	mg/L	240		96	85-115			
General Parameters, Batch B5L3153										
Blank (B5L3153-BLK1)				Prepared: 2025-12-15, Analyzed: 2025-12-15						
Ammonia, Total (as N)	< 0.050	0.050	mg/L							BLK
LCS (B5L3153-BS1)				Prepared: 2025-12-15, Analyzed: 2025-12-15						
Ammonia, Total (as N)	1.00	0.050	mg/L	1.00		100	85-115			
General Parameters, Batch B5L3321										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon)	**WORK ORDER**	25L1784
PROJECT	2025-8891 COV GW	**REPORTED**	2025-12-19 09:05

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
General Parameters, Batch B5L3321, Continued										
Blank (B5L3321-BLK1)				Prepared: 2025-12-16, Analyzed: 2025-12-17						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
Blank (B5L3321-BLK2)				Prepared: 2025-12-16, Analyzed: 2025-12-17						
Nitrogen, Total Kjeldahl	< 0.050	0.050	mg/L							
LCS (B5L3321-BS1)				Prepared: 2025-12-16, Analyzed: 2025-12-17						
Nitrogen, Total Kjeldahl	0.990	0.050	mg/L	1.00		99	85-115			
LCS (B5L3321-BS2)				Prepared: 2025-12-16, Analyzed: 2025-12-17						
Nitrogen, Total Kjeldahl	1.00	0.050	mg/L	1.00		100	85-115			
General Parameters, Batch B5L3404										
Blank (B5L3404-BLK1)				Prepared: 2025-12-17, Analyzed: 2025-12-17						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Blank (B5L3404-BLK2)				Prepared: 2025-12-17, Analyzed: 2025-12-17						
Phosphorus, Total (as P)	< 0.0050	0.0050	mg/L							
Phosphorus, Total Dissolved	< 0.0050	0.0050	mg/L							
LCS (B5L3404-BS1)				Prepared: 2025-12-17, Analyzed: 2025-12-17						
Phosphorus, Total (as P)	0.0957	0.0050	mg/L	0.100		96	85-115			
LCS (B5L3404-BS2)				Prepared: 2025-12-17, Analyzed: 2025-12-17						
Phosphorus, Total (as P)	0.0977	0.0050	mg/L	0.100		98	85-115			
Phosphorus, Total Dissolved	0.0977	0.0050	mg/L	0.100		98	85-115			

QC Qualifiers:

BLK Analyte concentration in the Method Blank is above the Reporting Limit (RL).

25L1784

ANALYTICAL SERVICES

☐ 110-4011 Viking Way, Richmond, BC V6V 2K9
Tel: (604) 279-1499 Fax: (604) 279-1599

☒ 102-3677 Highway 97N, Kelowna, BC V1X 5C3
Tel: (250) 765-9646 Fax: (250) 765-3893

☐ 17225 109 Avenue NW, Edmonton, AB T5S 1H7
Tel: (780) 489-9100 Fax: (780) 489-9700

CARO BC COC, Rev 03/14

CHAIN OF CUSTODY RECORD

COC# _____ PAGE 1 OF 1

RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:
ANNA OLIVEIRA	TIME: 14:00	DM Ace	TIME: 14:50

PROJECT: COV Annual GW Monitoring 2025

PROJECT INFO: 2025-8891 COV GW

REPORT TO:

COMPANY: Associated Environmental
ADDRESS: 200-2800 29th Street
Vernon, BC V1T 9P9
CONTACT: Nicole Penner
TEL/FAX: 250-545-3672 250-938-5537
EMAIL PDF ☒ EDD ☒
EMAIL 1: pennern@ae.ca; indrigoc@ae.ca
EMAIL 2: support@ wirelesswater.com
MAIL HARDCOPY ☐ HOLD FOR P/U ☐ FAX ☐

INVOICE TO: SAME AS REPORT TO ☐

COMPANY: City of Vernon
ADDRESS: 2100-43rd Street
Vernon BC V1T 6W8
CONTACT: Serge Kozin
TEL/FAX: (250) 550-3627
EMAIL PDF ☒
EMAIL 1: pennern@ae.ca
EMAIL 2:
MAIL HARDCOPY ☐ HOLD FOR P/U ☐

SAMLPLED BY: Anna Rice

PO #: Annual Groundwater Monitoring 2025

TURNAROUND TIME REQUESTED:
Routine: (5-7 Days) ☒
Rush: 1 Day* ☐ 2 Day* ☐ 3 Day* ☐
Other* _____
*Contact Lab To Confirm. Surcharge May Apply

REGULATORY APPLICATION:
Canadian Drinking Water Quality Guidelines ☒ CCME ☐
BC Drinking Water Protection Act / Reg. ☐ ALBERTA TIER 1 ☐
BC CSR ☒ AL ☒ RL ☐ CL ☐ IL ☒ AW ☐
OTHER:

ANALYSES REQUESTED:

	CLIENT SAMPLE ID:	MATRIX: DRINKING WATER	OTHER WATER	SOIL	OTHER	# CONTAINERS	SAMPLING: DATE DD-MMM-YY	TIME HH:MM	COMMENTS: CHLORINATED	FILTERED	PRESERVED	(i.e. flow/volume media ID/notes)	BTEX ☐ VPH ☐ PHC F1 ☐	VOC ☐ VPH ☐	EPH ☐ PHC F2-F4 ☐	PAH ☐ L/HEPH ☐	PHENOLS Chlorinated ☐ Non-Chlor. ☐	PCB ☐ GLYCOLS ☐ HAA ☐	PESTICIDES ☐ ACID HERBICIDES ☐	METALS - WATER TOTAL Hg ☐	METALS - WATER DISSOLVED Hg ☒	METALS - SOIL (SALM) ☐ inc. pH ☐	pH ☐ EC ☐ ALK ☒	TSS ☐ VSS ☐ TDS ☒	BOD ☐ COD ☐	TOG ☐ MOG ☐	FECAL COLIFORMS ☐ HPC ☐	TOTAL COLIFORMS ☐ E.coli ☐	ASBESTOS	Chloride, bromide, fluoride, sodium	Sulphate	Total and organic nitrogen package	Total P, total dissolved P, ortho-P	Dissolved organic carbon	Hardness		HOLD
	WTN 24991		✔				11-Dec-25	13:20		✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔	✔		
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
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			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			
			✔							✔	✔										✔		✔	✔						✔	✔	✔	✔	✔			

SHIPPING INSTRUCTIONS: Return Cooler(s) ☐
Supplies Needed:

SAMPLE RETENTION INSTRUCTIONS (Discarded 30 days after Report unless otherwise specified):
60 Days ☐ 90 Days ☐ Longer Date (Surcharges will Apply): _____

OTHER INSTRUCTIONS:
Upload to Wireless Water. Low-level DL for metals. Ensure invoice includes 'Annual Groundwater Monitoring 2025' and send only to Nicole Penner (pennern@ae.ca) to pass to COV.

PAYMENT:
CHEQUE ☐
CREDIT ☐
DEBIT ☐
CASH ☐
INVOICE ☐

SAMPLE RECEIPT TEMP (°C): 4.2
Work Order # _____
CUSTODY SEAL INTACT Y ☐ N ☐ NA ☐

Appendix H

Sanitary Use Bylaw

THE CORPORATION OF THE CITY OF VERNON

SANITARY USE BYLAW #4863

Consolidated for convenience

THE CORPORATION OF THE CITY OF VERNON

BYLAW NUMBER 4863

BYLAW NO.	ADOPTION	AMENDMENT
5100	September 10, 2007	Section 4.01 be deleted in its entirety.
		▪
		▪

BYLAW NUMBER 4863

THE CORPORATION OF THE CITY OF VERNON

BYLAW NUMBER 4863

A bylaw to regulate discharges
into the Sanitary Sewer System

WHEREAS pursuant to Section 8 of the Community Charter and amendments thereto, Council may, by bylaw, provide for the establishment of a system of sanitary sewer works and regulate the use of the sanitary sewer works of the City;

AND WHEREAS there are compounds in waste that in various concentrations are detrimental to the operation of the sanitary sewer works whose discharge must be regulated.

NOW THEREFORE BE IT RESOLVED that the Council of The Corporation of the City of Vernon, in open meeting assembled, enact as follows:

1.00 CITATION

1.01 This bylaw may be cited as the "City of Vernon Sanitary Sewer Use Bylaw Number 4863, 2005".

2.00 SCOPE

2.01 This bylaw regulates the use of the sanitary sewer system within the City of Vernon.

2.02 The provisions of this bylaw apply to all direct and indirect discharges to any part of the City of Vernon sanitary sewer system.

2.03 This bylaw regulates the quantity and quality of wastes that may be discharged to the City of Vernon sanitary sewer system and the degree of pre-treatment required.

2.04 All applicable fees associated with this bylaw are charged in accordance with the City's current Fees and Charges Bylaw, and all subsequent amendments.

2.05 Nothing in this bylaw relieves any person or organization from complying with any provision of any Federal or Provincial legislation or any other bylaw of the City of Vernon.

3.00 DEFINITIONS

3.01 In this bylaw, the following words and terms shall have the meanings hereinafter assigned to them:

"Adverse Effect" means impairment of or damage to the environment, human health or safety.

"Biosolids" means solids derived from primary, secondary, or advanced treatment of domestic wastewater which have been treated through one or more controlled processes that reduce pathogens, reduce volatile solids or chemically stabilize.

"B.O.D." or "Biochemical Oxygen Demand" means the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory conditions in five (5) days at 20℃, expressed in milligrams per liter as determined by the appropriate procedure in "Standard Methods".

"BTEX" means the total of benzene, toluene, ethyl benzene, and xylene.

"Building Sanitary Sewer" means all pipes, conduits, drains and other equipment and facilities owned and maintained by the Owner for the purpose of collecting and transporting waste to the City of Vernon sanitary sewer.

"City" means the Corporation of the City of Vernon, in the Province of British Columbia.

"C.O.D." or "Chemical Oxygen Demand" means the measure of the oxygen consuming capacity of organic and inorganic matter present in wastewater as determined by the appropriate procedure described in "Standard Methods".

"Cooling Water" means untreated water originating from uses such as air conditioning, cooling or refrigeration where the only pollutant added to the water is heat.

"Compatible Pollutant" means B.O.D., S.S., pH and fecal coliform bacteria and such additional pollutants as are now, or may be in the future, specified and controlled in the City of Vernon Operational Certificate as issued by the Ministry of Water, Land and Air Protection, for its wastewater treatment works where said works have been designed and used to reduce or remove such pollutants.

"Composite Sample" means a sample which is composed of equal portions of a specified number of Grab Samples collected at the same sampling point at specified time intervals during a specified sampling period.

"Contaminant" means any substance, whether gaseous, liquid or solids, whether dissolved or suspended that:

a. injures, or is capable of injuring, the health or safety of a person;

b. injures, or is capable of injuring, property or any life form;

c. interferes, or is capable of interfering, with the operation of a Sewer or Sewage Facility;

d. causes, or is capable of causing, material physical discomfort to a person;

e. damages, or is capable of damaging, the environment.

"Domestic Wastewater" means wastewater that is composed of liquid and water carried wastes associated with the use of water for drinking, cooking, cleaning, washing, hygiene, sanitation or other domestic purposes.

"Effluent" means the liquid outflow of any facility designed to treat or convey wastewater.

"Garbage" means solid wastes from domestic and commercial preparation, cooking and dispensing of food, and from handling, storage and sale of food as well as any other refuse not normally associated with typical domestic wastewater.

"Grab Sample" means an aliquot of a sampled stream or discharge collected at one particular place and time.

"High Strength Wastes" means wastewater having;

a. B.O.D. in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample or;

b. C.O.D. in excess of 750 mg/l as analyzed in a twenty-four-hour composite sample, 1500 mg/l as analyzed in a two-hour composite sample, or 3000 mg/l as analyzed in a grab sample or;

c. Suspended Solids (S.S.) in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample.

"Holding Tank" means a device or structure designed for the temporary storage of wastewater.

"Incompatible Pollutant" means any pollutant that is not a compatible pollutant as defined in this section.

"Industrial Wastewater" means wastewater that is composed of liquid and water carried wastes associated with processes employed in industrial manufacturing, trade, or commercial and business establishments, as distinct from domestic wastewater.

"mg/l" or "mg/litre" means milligrams per liter.

"Non Polluted Water" means water that does not contain any compatible pollutants or contaminants such as rainwater, groundwater, swimming pool water or any other non sewage wastewater.

"Oil and Grease" means organic substance including, but not limited to, hydrocarbons, esters, fats, oils, waxes and high molecular weight carboxylic acids.

"Owner" shall have the same meaning as assigned to it under the Community Charter.

"pH" means the logarithm of the reciprocal of the concentration of hydrogen ions in a solution.

"Pesticide" means an organism or material that is represented, sold, used or intended to be used to prevent, destroy, repel or mitigate a pest and includes a plant growth regulator, plant defoliator or plant desiccant and a control product, other than a device that is a control product under the Pest Control Products Act (Canada).

"Plumbing Fixture" means a receptacle, appliance, apparatus or device that discharges wastewater to the sanitary sewer.

"Pool" means any man made structure with a water depth exceeding 450 mm.

"Premises" means any residential, commercial or industrial structure that has a building sanitary sewer connected to the City of Vernon Sanitary Sewer System.

"Pretreatment" means application of physical, chemical and/or biological processes to reduce the amount of pollutants in, or alter the nature of the pollutant properties in a wastewater prior to discharging such wastewater to the sanitary sewer.

"Sanitary Sewer" means a Sewer which carries Domestic or Industrial Wastewater but is not intended to carry stormwater, cooling water, groundwater, or unpolluted water.

"Sanitary Sewer System" means all pipes, conduits, drains and other equipment and facilities owned or otherwise under the control of the City for collecting, pumping and transporting wastewater including all such pipes, conduits, drains and other equipment and facilities which connect to those owned or otherwise under the control of the City.

"Septic Tank" means a device or structure in which the solids contained in wastewater are decomposed by anaerobic bacteria and the effluent is disposed of to an infiltration field.

"Sewage Facility" means any works owned by or under the control or jurisdiction of the City that collects, transports, stores, treats, utilizes or discharges wastewater.

"Sewer Connection" means the sanitary sewer or storm sewer connecting pipe from the property line to the sewer.

"Significant User" means any User of the City's Sanitary Sewer whose flow exceeds 125 m^3 per day (27,500 imperial gallons per day) or whose discharge to the sanitary sewer system typically has a strength of 500 mg/l S.S. or 500 mg/l B.O.D.

"Special Waste" means special waste as defined in the *Environmental Management Act* of British Columbia.

"Special Waste Regulation" means the Hazardous Waste Regulation pursuant to the *Environmental Management Act* of British Columbia.

"Standard Methods" means the latest edition of Standard Methods for the Examination of Water and Wastewater as published by the American Public Health Association, American Waterworks Association and the Water Environment Federation.

"S.S." means the solids matter, expressed in mg/l, in a liquid as determined according to Standard Methods.

"Stormwater" means water originating from rainwater, snowmelt or groundwater, including roof drain water.

"Twenty-Four-Hour Composite Sample" means a composite sample consisting of equal portions of 24 grab samples collected a 1 hour intervals.

"Two-Hour Composite Sample" means a composite sample consisting of equal portions of 8 grab samples collected at 15 minute intervals.

"Trucked Waste" means any waste that is collected and transported off site by means of a tank truck and discharged to the sanitary sewer system and includes septic tank waste (septage), holding tank waste and portable toilet waste.

"Unpolluted Water" is water not containing any pollutants limited or prohibited by the water quality standards in effect, or water whose discharge will not cause any violation of receiving water quality standards as established in Federal or Provincial legislation.

"User" means any person who discharges, causes or permits the discharge of wastewater into the City's Sanitary Sewer system.

"Waste" or "Wastes" means any substance, whether gaseous, liquid or solid, that is discharged or discarded, directly or indirectly to a sanitary sewer or wastewater treatment facility.

"Wastewater" means domestic wastewater or industrial wastewater.

"Wastewater Treatment System" means all facilities and equipment owned or otherwise under the control of the City of Vernon to treat domestic and industrial wastewater such that following treatment the effluent is suitable for reuse by the City's reclaimed water irrigation program or for discharge to Okanagan Lake via the deep lake outfall.

4.00 CONNECTION TO THE SANITARY SEWER

4.01 Every sanitary sewer connection shall be installed in accordance with the standards contained in the City's current Subdivision and Development Servicing Bylaw, and all subsequent amendments, and shall be installed prior to the installation of the building sanitary sewer.

4.02 The owner or occupier of any premises upon which a new commercial or industrial facility will be operated and where, on average, it is projected that more than $300m^3$ of

non domestic wastewater will be discharged to the sanitary sewer system in any 30 day period, must obtain a Sewer Use Permit from the City of Vernon by completing a Sewer Use Permit Application prior to connection to the sanitary sewer system.

4.03 The owner or occupier of any premises upon which an existing commercial or industrial facility is operated and where, on average, more than $300m^3$ of non domestic wastewater is discharged to the sanitary sewer system in a 30 day period, must obtain a Sewer Use Permit from the City of Vernon by completing a Sewer Use Permit Application prior to any alteration or expansion of the facility.

4.04 Grease and oil interceptors shall be installed for all food preparation facilities sufficient to prevent the discharge of grease and oil to the sanitary sewer system.

4.05 Grease, oil and sand interceptors shall be installed at all vehicle repair and maintenance establishments sufficient to prevent the discharge of grease, oil and sand to the sanitary sewer system.

4.06 All interceptors shall be installed upstream of the sanitary sewer system service connection and shall be located so as to be readily accessible for inspection and maintenance.

4.07 The owner or occupier of any premises upon which an interceptor is installed shall maintain the interceptor in a serviceable condition at all times.

4.08 The City of Vernon may, at its sole discretion, request that the owner or occupier of any premises upon which a grease, oil or sand interceptor is installed to provide records of maintenance of the interceptor.

4.09 The control manhole shall be installed and maintained by the owner or occupier of the premises and shall be accessible to the City of Vernon at all times to inspect and sample material entering the sanitary sewer system.

4.010 The control manhole and flowmeter specification must be approved by the City of Vernon prior to connection to the sanitary sewer system.

5.00 MONITORING OF DISCHARGE TO THE SANITARY SEWER SYSTEM

5.01 Should it be determined through sampling and analysis that the discharge to the sanitary sewer system from a premises is in violation of this bylaw, the City of Vernon may direct the owner or occupier of the premises to take steps to comply with the bylaw and may require the owner or occupier to install monitoring equipment as necessary to demonstrate compliance with this bylaw.

5.02 All test, measurements, analysis and examinations of wastewater required to demonstrate compliance with this bylaw shall be at the cost of the owner or occupier of the premises where a discharge occurs.

6.00 PENALTIES

Any person who violates any provision of this bylaw will be deemed to have committed an offence and shall be liable upon summary conviction to the following penalties:

a. a minimum fine of $500.00;
b. a maximum fine of $10,000;
c. in the case of a continuing offense, for each day that the offense continues, either or both of:
    1. a minimum fine under paragraph a.
    2. a maximum fine under paragraph b;
d. in a prosecution of an offense against a municipal bylaw, the justice or court may impose all or part of the penalties applicable in relation to the offense, together with the costs of prosecution.

7.00 WASTE DISCHARGE

7.01 Prohibited Wastes

Except as otherwise provided in this bylaw, no person shall release or discharge, or permit the releasing or discharge into the sanitary sewer system of any Prohibited Waste as described in Schedule A.

7.02 Restricted Wastes

Except as otherwise provided in this bylaw, no person shall release or discharge, or permit the releasing or discharge into the sanitary sewer system of any Restricted Waste as described in Schedule B.

7.03 High Strength Wastes

The City may accept High Strength Wastes as defined in this bylaw into the sanitary sewer system at its sole discretion where the wastewater is not such that it can damage the sanitary sewer system or the wastewater treatment system. The City will impose a sewer service surcharge on High Strength Wastes as contained in the City's current Fees and Charges Bylaw, and all subsequent amendments.

7.04 Trucked Waste

All provisions in this bylaw apply to all trucked waste discharged to the sanitary sewer, with the exception of the limits for B.O.D. and S.S. contained in Schedule B, Section 1 and Section 3.

The City of Vernon will accept Trucked Waste from haulers holding a valid City of Vernon business license into the sanitary sewer system at the designated discharge location(s) and during the times designated by the City of Vernon. The location and times may vary at the discretion of the City of Vernon. The City of Vernon reserves the

right, at its sole discretion, to refuse to accept any load of trucked waste that it considers to be of questionable origin or quality.

The discharge of trucked waste to the sanitary sewer system at any location(s) other than those authorized by the City of Vernon are strictly prohibited and are subject to the penalties contained in this bylaw.

A properly completed load manifest for every load of trucked waste discharged to the City of Vernon sanitary sewer must be provided to the City of Vernon or its designated representative by the trucked waste hauler prior to discharge to the sanitary sewer. Failure to provide a properly completed load manifest will result in the refusal to accept the load of trucked waste.

Only trucked waste originating in the Regional District of the North Okanagan will be accepted.

Waste from commercial oil and grease separators and commercial car wash catch basins will not be accepted into the sanitary sewer.

In addition to the penalties described in this bylaw, the City of Vernon may, at its sole discretion, suspend or revoke access to the designated discharge location should a trucked waste hauler be found in violation of any of the provisions of this bylaw.

7.05 Non Polluted Water

No person shall release or discharge, or permit the releasing or discharge into the sanitary sewer system any non polluted water.

7.06 Pretreatment Requirements

Where wastewater discharged into the sanitary sewer collection system is found to have been deleterious to the sanitary sewer collection system or wastewater treatment plant, the City of Vernon may, by notice in writing to the owner or occupier of any premises:

a. Refuse to allow any additional wastes to be discharged to the sanitary sewer system.

b. Require the owner or occupier of any premises to construct, operate and maintain wastewater pre-treatment facilities to ensure compliance with this bylaw.

c. Require the owner or occupier of any premises to construct, operate and maintain facilities to control the rate of discharge to the sanitary sewer system.

d. Require the owner or occupier to pay additional charges to cover the added cost of treating the wastes discharged to the sanitary sewer system as contained in the City's current Fees and Charges Bylaw, and all subsequent amendments.

8.00 TEMPORARY DISCHARGE TO THE SANITARY SEWER

8.01 Any person who wishes to discharge wastewater to the sanitary sewer system on a temporary basis, must obtain a Temporary Sewer Use Permit from the City of Vernon by completing a Sewer Use Permit Application prior to any discharge to the sanitary sewer.

8.02 Charges for temporary discharges to the sanitary sewer system are as described in the City's current Fees and Charges Bylaw, and all subsequent amendments.

READ A FIRST TIME this 27 day of June, 2005.

READ A SECOND TIME this 27 day of June, 2005.

READ A THIRD TIME this 27 day of June, 2005.

ADOPTED this 11 day of July, 2005.

_____ _____

Mayor: City Clerk:

SCHEDULE "A"
Attached hereto and forming
Part of Bylaw No.4863

PROHIBITED WASTE

The following are designated as Prohibited Waste:

1. Any material which causes or will cause an adverse effect.

2. Any stormwater or unpolluted water.

3. Any flammable or explosive material.

4. Any pesticides, insecticides, herbicides, or fungicides save and except chemicals contained in stormwater emanating from trees or vegetation treated in accordance with the Pesticide Control Act.

5. Any material capable of obstructing wastewater flow or interfering with the operation of any part of the sewage collection or treatment system. These materials include, but are not limited to, ashes, cinders, sand, mud, straw, grass clippings, insoluble shavings, metal, glass, rags, feathers, tar, asphalt, creosote, plastics, wood, animal paunch contents, offal, blood, bones, meat trimmings and waste, fish or fowl head, shrimp, crab or clam shells, fish scales, entrails, lard, mushrooms, tallow, baking dough, chemical residues, cannery or wine waste, bulk solids, hair and fleshings, spent grain and hops, whole or ground food or beverage containers, garbage, paint residues, cat box litter, slurries of concrete, cement, lime or mortar.

6. Any material, other than domestic wastewater, which by itself or in combination with another substance is capable of creating odours related to but not limited to hydrogen sulfide, carbon disulfide, other reduced sulfur compounds, amines or ammonia outside or in and around the wastewater collection system.

7. Any noxious or malodorous material which by itself or in combination with another material is capable of creating a public nuisance or hazard to life or may be prevent entry into a sewer or pump station for its maintenance or repair.

8. Any material with corrosive properties which by itself or in combination with another material may cause damage to any part of the sewage collection or wastewater treatment system.

9. Any infectious material which by itself or in combination with another material may create a contaminant in any part of the sewage collection or wastewater treatment system.

10. Grit removed from commercial or industrial premises including but not limited to grit removed from car washing establishments, automobile garages, restaurant sumps or interceptors.

11. Any material classified as a Special Waste.

12. Any material that may cause biosolids from the Water Reclamation Plant to fail to meet the criteria outlined in the British Columbia Organic Matter Recycling Regulation for any end use that the city may choose to undertake at any given time.

SCHEDULE "B"
Attached hereto and forming
Part of Bylaw No.4863

RESTRICTED WASTE

The following are designated as Restricted Waste:

1. Any wastewater having a B.O.D. in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample.

2. Any wastewater having a C.O.D. in excess of 750 mg/l as analyzed in a twenty-four-hour composite sample, 1500 mg/l as analyzed in a two-hour composite sample, or 3000 mg/l as analyzed in a grab sample.

3. Any wastewater having a S.S. in excess of 500 mg/l as analyzed in a twenty-four-hour composite sample, 1000 mg/l as analyzed in a two-hour composite sample, or 2000 mg/l as analyzed in a grab sample.

4. Any wastewater which contains oil and grease in a concentration that is in excess of 100 mg/l as analyzed in a twenty-four-hour composite sample, 200 mg/l as analyzed in a two-hour composite sample, or 400 mg/l as analyzed in a grab sample.

5. Any wastewater which contains oil and grease derived from a petroleum source in a concentration that is in excess of 15 mg/l as analyzed in a twenty-four-hour composite sample, 30 mg/l as analyzed in a two-hour composite sample, or 60 mg/l as analyzed in a grab sample.

6. Any material which may solidify or become viscous at temperatures above 0℃.

7. Any wastewater having a temperature greater than 65° C.

8. Any wastewater having a pH lower than 5.0 or higher than 11.0 as determined by a grab sample, or less than 5.5 or higher than 10.5 as determined by a two-hour composite sample.

9. Any wastes from the preparation, cooking and dispensing of food that has not been property comminuted to 12mm or less in any dimension. Such waste must be shredded to such a degree that all particles will be freely carried under the flow conditions prevailing in the sanitary sewer collection system.

10. Any wastewater containing a hazardous, toxic or poisonous substance in sufficient quantity to injure or interfere with any sanitary sewer system or wastewater treatment system which could constitute a hazard to humans or animals, or create a hazard in areas receiving treated effluent from the wastewater treatment plant.

11. Any wastewater containing dyes or colouring material which pass through the sanitary sewer or wastewater treatment system and discolour any part of the sanitary sewer, wastewater treatment system or the treated effluent from wastewater treatment plant.

12. Any wastewater containing substances in concentrations that are not amenable to treatment or reduction in the wastewater treatment process being employed by the City at any given time or that cannot be treated to such a degree during the normal wastewater treatment process to meet the requirements of the City of Vernon’s Ministry of Water, Land and air Protection Operational Certificate or any other applicable provincial or federal legislation that may be in effect.

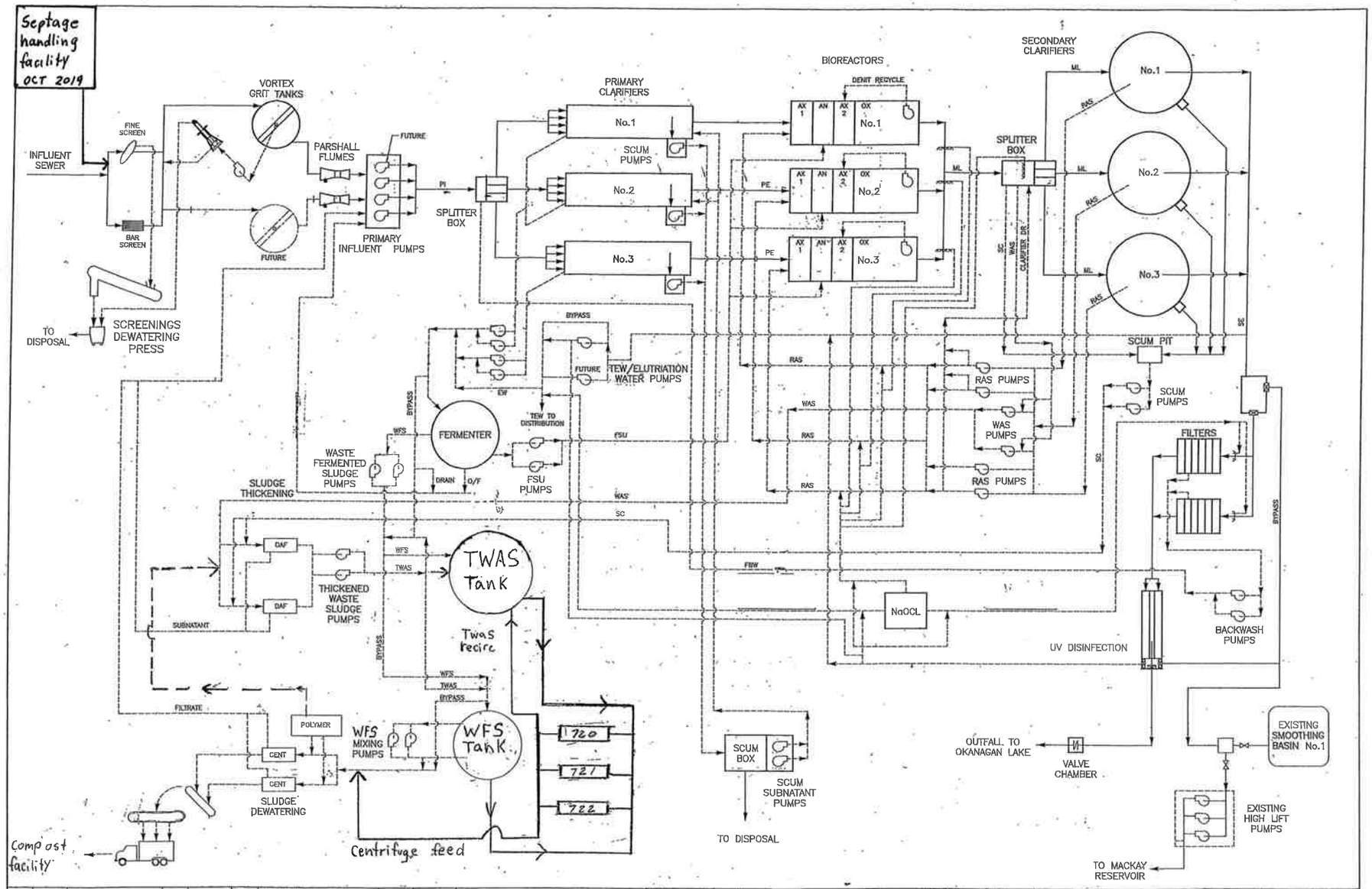
13. Any wastewater with a concentration, in a combined or uncombined form, in excess of the levels set out below:

Substance	**Expressed As**	**Concentration in mg/l**		
		A	**B**	**C**
Aluminum	Al	50	100	200
Arsenic	As	1	2	4
Boron	B	50	100	200
Cadmium	Cd	0.2	0.4	0.8
Chromium	Cr	4	8	16
Cobalt	Co	5	10	20
Copper	Cu	2	4	8
Cyanide	Cn	1	2	4
Iron	Fe	10	20	40
Lead	Pb	1	2	4
Manganese	Mn	5	10	20
Mercury	Hg	0.05	0.1	0.2
Molybdenum	Mo	1	2	4
Nickel	Ni	2	4	8
Phenols		1	2	4
Phosphorus	P	12.5	25	50
Silver	Ag	1	2	4
Sulphate	SO_4	1500	3000	6000
Sulphide	S	1	2	4
Tin	Sn	5	10	20
Zinc	Zn	3	6	12
A:	24 hour composite sample			
B:	2 hour composite sample			
C:	Grab sample			

14. Any wastewater which contains additional water added solely for the purpose of diluting waste which would otherwise exceed the applicable maximum concentrations.

Appendix I

VWRC Process Schematic



No.	DATE	REVISIONS DESCRIPTION	BY	APPROVED
4	11.15.04	ADD BLEND TANK, REVISE SLUDGE PIPING, REVISE FILTER, UV, DISCHARGE PIPING, REVISE NaOCL	WAE	RJ
3	03.07.03	FOR REVIEW	WAE	RJ
2	11.29.02	95% SUBMISSION	WAE	RJ
1	08.02.02	FOR INFORMATION ONLY	WAE	RJ

No.	DRAWING STATUS DESCRIPTION	DATE	APPROVED
6	MICROFILMED		
5	PLAN OF RECORD	03.17.06	RJ
4	APPROVAL FOR CONSTRUCTION	08.28.03	RJ
3	FOR TENDER	05.16.03	RJ
2	FOR APPROVAL		
1	PRELIMINARY		

THE CORPORATION OF THE CITY OF VERNON

SEAL:

Stantec Consulting Ltd.
200, 2141 Springfield Road
Kelowna, BC V1Y 7X1
Tel: (250) 860 3225
Fax: (250) 860 3357
email: kelowna@stantec.com
www.stantec.com
Stantec

DESIGNED: JLI | DRAWN: WAE
CHECKED: JLI | APPROVED: RAF
SCALE: NTS

CLIENT: THE CORPORATION OF THE CITY OF VERNON

TITLE: WATER RECLAMATION PLANT REPLACEMENT & ADDITION PROCESS SCHEMATIC & MASS BALANCE

DATE: JULY 2002 | SHEET:
JOB No. 116-22902
REVISION: 4 | DRAWING: G005
STATUS: 5

Xrefs: COV_LOGO.DWG
Drawing: V:\1\VER\CIT\116220\00\DRAWINGS\CONSTR\G005.DWG
Layout: 1 Plotted: 22 Jul 02 - 2:47p

Appendix J

VWRC Process Schematic

Associated Environmental Consultants Inc.
Suite 200, 2800 29 Street
Vernon, B.C., Canada, V1T 9P9

TEL: 250.545.3672
FAX: 250.545.3654
www.ae.ca | ISO 9001 & 14001 Certified

November 18, 2022
File: 2021-8917.000

Serge Kozin
Manager
Vernon Water Reclamation Centre
City of Vernon
1900 48th Ave
Vernon, BC V1T 8Y7

Re: PROJECTED WATER LEVELS OF MACKAY RESERVOIR PRIOR TO 2023 IRRIGATION SEASON AND PLANNED DISCHARGE TO OKANAGAN LAKE (OC#12215)

Dear Serge Kozin:

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- exceeds 1,935 feet above mean sea level (fasl); and
- is projected to exceed 1,939 fasl prior to the start of the next irrigation season.

Under this scenario, the City must notify ENV by providing a discharge plan at least 60 days in advance of any lake discharge. Therefore, the purpose of this letter is to project the reservoir levels for the start of the irrigation season to support a notification of a planned release to Okanagan Lake. Levels are projected through a simplified water balance, following the approach adopted in previous years (Urban Systems 2019; City of Vernon 2019; Associated 2020).

CANADA BEST MANAGED COMPANIES Platinum member

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The irrigation season start date varies by year, but typically begins in May (between 2017 and 2022, irrigation start dates ranged from May 1 to May 31). The current projections indicate that 1,939 fasl will be reached just prior to the start of the next irrigation season. However, there is a significant amount of uncertainty in these projections, and it is important to note that the City has no mechanism to reduce the reservoir levels other than through irrigation. Preventing the reservoir from exceeding 1,939 fasl can only be achieved proactively by diverting flow away from the reservoir.

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When the Mackay Reservoir elevation criteria are both met, OC Section 3.3b authorizes the City to discharge '*150% of the volume of reclaimed water necessary to prevent MacKay Reservoir from exceeding 1,939 feet prior to the start of the irrigation season'*. Following the City's agreed approach with ENV in 2019, which is based on the trigger levels of 1,935 and 1,939 fasl in the OC, and using the stage-storage curve provided by Urban Systems (2019), we understand that the ENV calculates the allowable discharge volume to be the following (S. Kozin, personal communication, 2020):

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Following the above calculations and discussions with the City, the City's proposed discharge plan is as follows:

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Associated Environmental Consultants Inc.
Yours truly,

Nicole Penner, P.Ag.
Environmental Scientist

Reviewed by:

Drew Lejbak, M.Sc.
Senior Hydrologist

CANADA BEST MANAGED COMPANIES Platinum member

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Suite 200, 2800 29 Street
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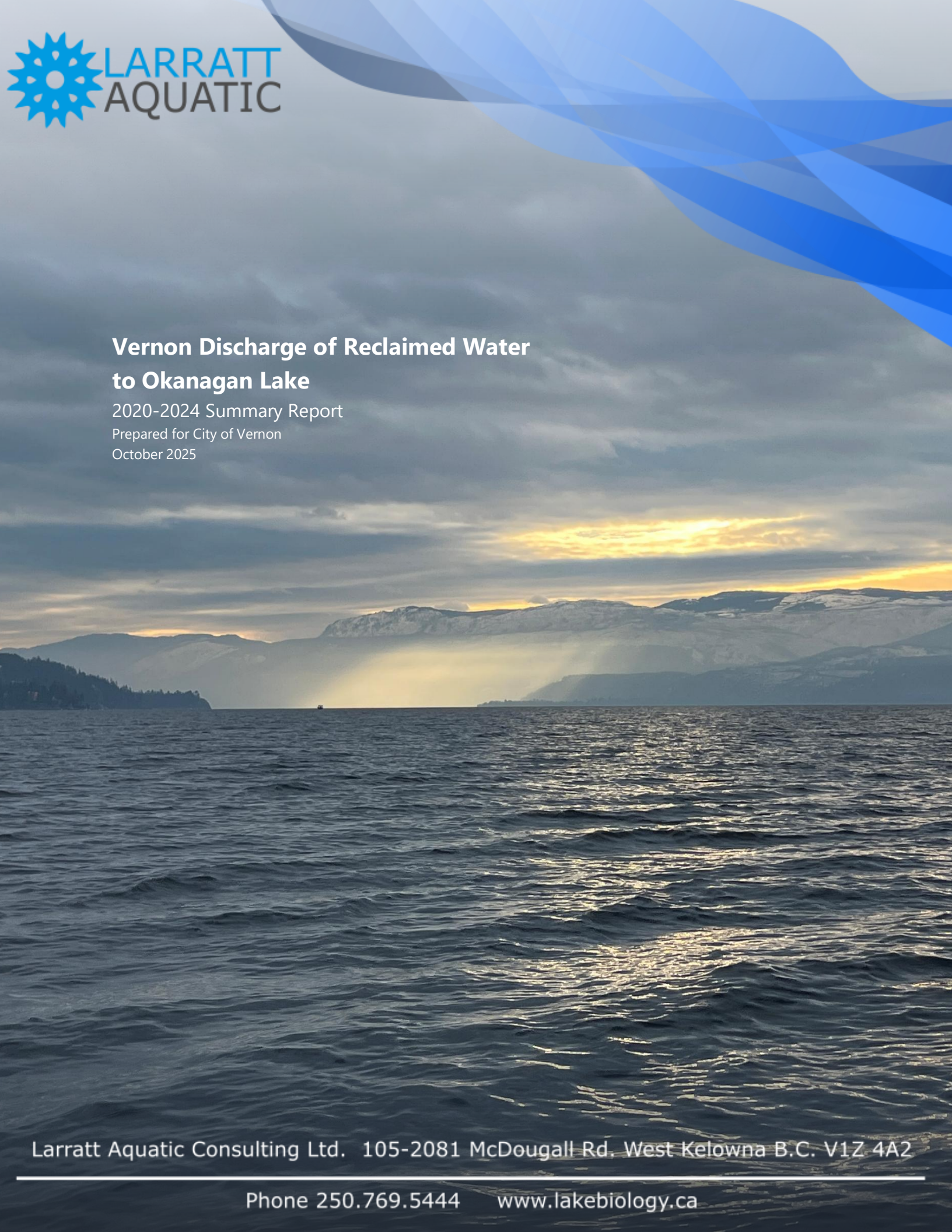
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Appendix K

VWRC Discharge of Reclaimed Water to Okanagan Lake 2020-2024 Summary Report



Vernon Discharge of Reclaimed Water to Okanagan Lake

2020-2024 Summary Report

Prepared for City of Vernon

October 2025

Larratt Aquatic Consulting Ltd. 105-2081 McDougall Rd. West Kelowna B.C. V1Z 4A2

Phone 250.769.5444 www.lakebiology.ca

Executive Summary

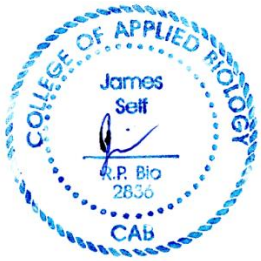
The City of Vernon operates a reclaimed water outfall in the north basin of Okanagan Lake. This outfall discharged water during 2020, 2021, 2023, and 2024. Lake monitoring programs captured data before, during, and after each discharge event and the results are summarized in this report.

- There were no statistically significant changes in lake limnology, general water chemistry, or nutrient concentrations between the sample sites that could be related to the reclaimed water.
- The north basin of Okanagan Lake fails to meet some objectives during some years. In particular, the total nitrogen objective is rarely met throughout the entire lake. The discharge of reclaimed water to Okanagan Lake does present a minor nutrient source to Okanagan Lake but, nitrogen concentrations declined while phosphorus was stable in the north basin from 2020-2024.
- Phytoplankton and zooplankton abundance and community composition were not statistically different between the sample sites.
- Comparing the estimated nutrient fluctuations from natural sources to the treated effluent discharge revealed that the existing periodic discharge regime should not exceed the assimilative capacity of the north basin Okanagan Lake.
- The Okanagan basin is experiencing rapid change through climate change, wildfire damage, population growth, and widespread watershed degradation. These reduce watershed resiliency such that the assimilative capacity of Okanagan Lake is gradually reduced leading to unpredictable responses to nutrient inputs in the future.

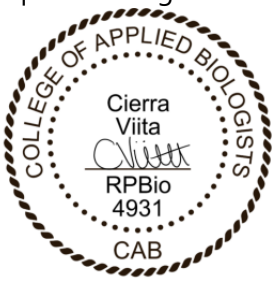
Preferred Citation

Self, J. (2025). Vernon Discharge of Reclaimed Water to Okanagan Lake 2020-2024 Summary Report. Prepared by Larratt Aquatic Consulting Ltd. for City of Vernon

Report prepared by: Larratt Aquatic Consulting Ltd.
Author: Jamie Self: BSc, R.P. Bio.
Senior Aquatic Biologist



Reviewed by:
Cierra Viita: BSc, RP Bio
Aquatic Biologist



Special Thanks to Serge Kozin and Carlee Heater of City of Vernon for their assistance in preparing this report.

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Definitions

The following terms are defined as they are used in this report.

Term	Definition
Algae bloom	A superabundant growth of algae
Anoxic	Devoid of oxygen
Bioavailable	Available for use by plants or animals
Chlorophyll-a	Primary photosynthetic pigment in algae; used as a measure of photosynthetic activity
Cyanobacteria	Bacteria-like algae having cyanochrome as the main photosynthetic pigment
Diatoms	Algae that have hard, silica-based cell walls called frustules
Discharge window	The period from Feb 17 – Jun 1 when reclaimed water was released into Okanagan Lake
Spring/Fall overturn	Point when lake becomes uniform density from surface to sediment and mixes, removing stratification
Effluent/Reclaimed Water	Fully treated and disinfected liquid released from the wastewater treatment facility
Eutrophic/hypereutrophic	Nutrient-rich, biologically productive water body
Macronutrient	The major constituents of cells: nitrogen, phosphorus, carbon, sulphate, H
Microflora	The sum of algae, bacteria, fungi, *Actinomycetes,* etc., in water or biofilms
Nutrient limitation	A nutrient will limit or control the potential growth of organisms e.g. P or N
Phytoplankton	Algae that float, drift or swim in water columns of reservoirs and lakes
Plankton	Those organisms that float or swim in water
Secchi depth	Depth where a 20 cm Secchi disk can be seen; measures water transparency
Statistical significance	Use of a statistical test (e.g. ANOVA) was used to determine with >95% certainty that data supports a statement
Thermocline	The lake zone of greatest change in water temperature with depth (> 1°C/m); it separates the surface water (epilimnion) from the cold hypolimnion below
Zooplankton	Minute animals that graze algae, bacteria and detritus in water bodies

Term	Definition
Chl-a	Chlorophyll-a units µg/L
DO	Dissolved oxygen units mg/L
EMS	British Columbia Environmental Monitoring System (a database of water chemistry data)
ENV	British Columbia Ministry of Environment and Climate Change Strategy
FASL	Feet above sea level
N	Nitrogen units mg/L as N
Ortho-P	Orthophosphate ≈ SRP monomeric inorganic phosphorus units mg/L as N
P	Phosphorus units mg/L as P
DIN	Dissolved inorganic nitrogen = ammonia + nitrate + nitrite units mg/L as N
TDN	Total dissolved nitrogen = ammonia + nitrate + nitrite + dissolved organic N units mg/L as N
TDP/DP	Total dissolved phosphorus units mg/L as P
TN	Total nitrogen: organic + dissolved units mg/L as N
TP	Total phosphorus: organic + dissolved units mg/L as P

Lake Classification by Trophic Status Indicators (Nordin, 1985)

Trophic Status	chlorophyll-a (µg/L)	Total P (µg/L)	Total N (µg/L)	Secchi disc (m)	primary production (mg C/m^2/day)
Oligotrophic	0 – 2	1 – 10	<100	> 6	50- 300
Mesotrophic	2 – 5	10 – 20	100 – 500	3 – 6	250 – 1000
Eutrophic	>5	> 20	500-1000	< 3	>1000

Nutrient Balance Definitions for Microflora (Dissolved Inorganic N : Dissolved Inorganic P) (Nordin,1985)

Phosphorus Limitation	Co-Limitation of N and P	Nitrogen Limitation
> 15 : 1	15 : 1 – 5 : 1	< 5 : 1

Project Background

City of Vernon (herein called Vernon) discharges reclaimed water from the Vernon Water Reclamation Centre (VWRC) to MacKay Reservoir (Figure 1). MacKay Reservoir is a temporary storage and balancing reservoir for the spray irrigation system. Vernon also has a large outfall pipe in Okanagan Lake at a depth of 60 m (Figure 1) that is utilized when all applicable regulatory requirements are met and the MacKay Reservoir elevation exceeds 1935 FASL. City of Vernon discharged reclaimed water during four of the past five years to an average of nearly one million cubic meters per discharge event (Table 1).

Table 1: Discharge volume by year

Year	Discharge Volume (m^3)	Discharge Dates
2020	1,343,409	Feb 10 – Jul
2021	1,252,511	Feb 17 – Jun 1
2023	1,055,018	Mar 14- Jun 16
2024	26,766	Apr 23 – 25

Sampling Program

British Columbia Ministry of Environment (ENV) requires City of Vernon to engage in a detailed sampling program that captures before, during, and after conditions within Okanagan Lake at a number of sample points (Table 2, Appendix 1). The sampling conducted during each discharge was consistent with the requirements under the OC at the time of the discharge (Appendix 7).

Table 2: Description of sample sites

Site Name	Description	Latitude	Longitude	Years Sampled
Outfall	-Location of outfall within Okanagan Lake -This site captures the most concentrated effluent results within the lake	50.2107	-119.4247	2021, 2023-2024
Edge of IDZ	-270 m from the outfall sample location -Captures the concentration of relevant parameters at the edge of the IDZ; this is where regulatory limits are compared	50.2131	-119.4241	2020-2021, 2023-2024
Upgradient	-4.1 km north of outfall location -Represents expected background concentration of Okanagan Lake, unaffected by outfall	50.2471	-119.4378	2021, 2023-2024
Background	-ENV sample site 0500730 (Okanagan Lake N of Okanagan Centre) -Original site used to compare outfall results to (sampled only in 2020)	50.0905	-119.4783	2020*

* BC ENV has sampled this site regularly since the 1970s and continues to sample as of 2025. This date only refers to extra samples collected for this study.



Figure 1: Map of sampling points and City of Vernon reclaimed water distribution system

The sampling program involved collection of numerous parameters:

- in-situ field profiles at 1 m intervals from the surface to 60 m at each site
- water chemistry samples from epilimnion (1, 5, 10 m) and hypolimnion (30, 45, 60 m) of Okanagan Lake at each site (Table 3)[1]
- phytoplankton samples from the epilimnion (composite of 0.5 m, the secchi depth and twice the secchi depth)
- zooplankton samples from the water column (0-45 m deep plankton net vertical pull)

Table 3: Water chemistry parameters

Parameter	Units
Alkalinity	mg/L
Ammonia	mg/L as N
Chloride	mg/L
Chlorophyll-a	µg/L
E. coli	MPN/100mL
Fecal coliforms	MPN/100mL
Hardness	mg/L
Nitrate	mg/L as N
Nitrite	mg/L as N
NO3+NO2	mg/L as N
Organic nitrogen	mg/L as N
Orthophosphate	mg/L as P
SO4	mg/L
Total dissolved phosphorus	mg/L as P
Total nitrogen	mg/L as N
Total phosphorus	mg/L as P
Total sodium	mg/L

Study Questions

The purpose of this report is to interpret the combined results from the four years of data.

1. Are there detectable impacts of treated effluent discharges on Okanagan Lake?
2. Are there detectable changes in the phytoplankton community – a sensitive indicator of nutrients?
3. What are the risks of water quality guideline exceedances within and outside the initial dilution zone (IDZ)?
4. How is the variable assimilative capacity of Okanagan Lake and its water quality affected by the predictable range of scenarios: flood years, wildfire impacts, watershed disturbance, and potential discharge scenarios?
5. What are the primary drivers of changes in nutrient status for the North Basin of Okanagan Lake?

[1] Sampling was more frequent during 2020 with samples collected at 10 m intervals instead of composited into epilimnion and hypolimnion samples.

Results

Data were collected across a suite of parameters including field data, chemistry samples, and biological samples. The results are summarized below.

Physical Conditions

Water Temperature

Water column temperature was similar between the three lake sampling sites (Figure 2; KW-Test, p=0.99), averaging 4.5 ± 0.7 °C at 50 m (maximum depth of meter cable) during the four discharges. Water column temperature profiles did not indicate a difference between sampling sites that could be attributed to impacts from the reclaimed water discharge.

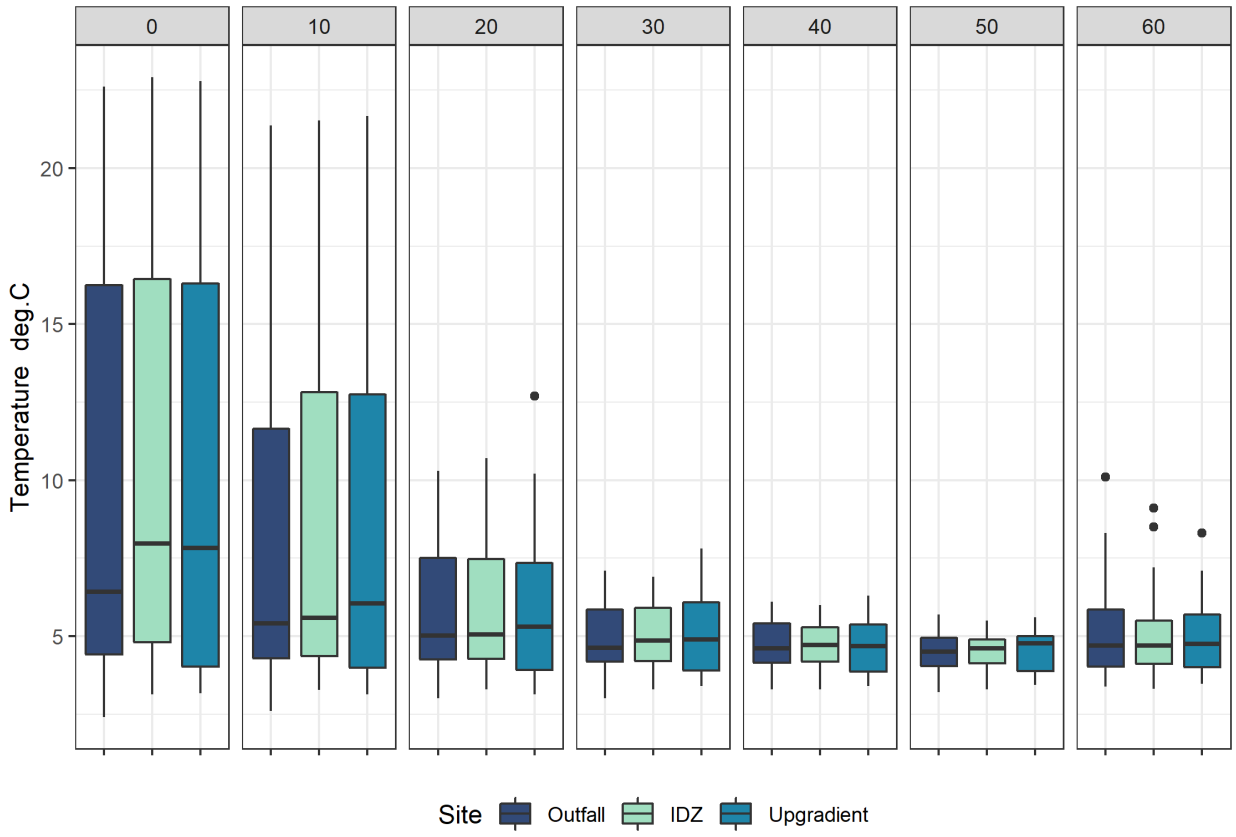


Figure 2: Comparison of temperature between sample sites at various depths, 2020-2024
Note: Maximum cable length of 50 m, drawing samples up for read through bottle sampler introduces significant temperature error through warming

pH

pH decreased with depth at all sites (Figure 3). This is a common and normal feature of lakes where photosynthesis in the surface increases pH while decomposition in the bottom water lowers pH. There were no significant differences between the three sites when comparing depths but the outfall site had the lowest overall average pH, possibly related to a general N-S decline in pH (KW-Test, p=0.03, Figure 4).

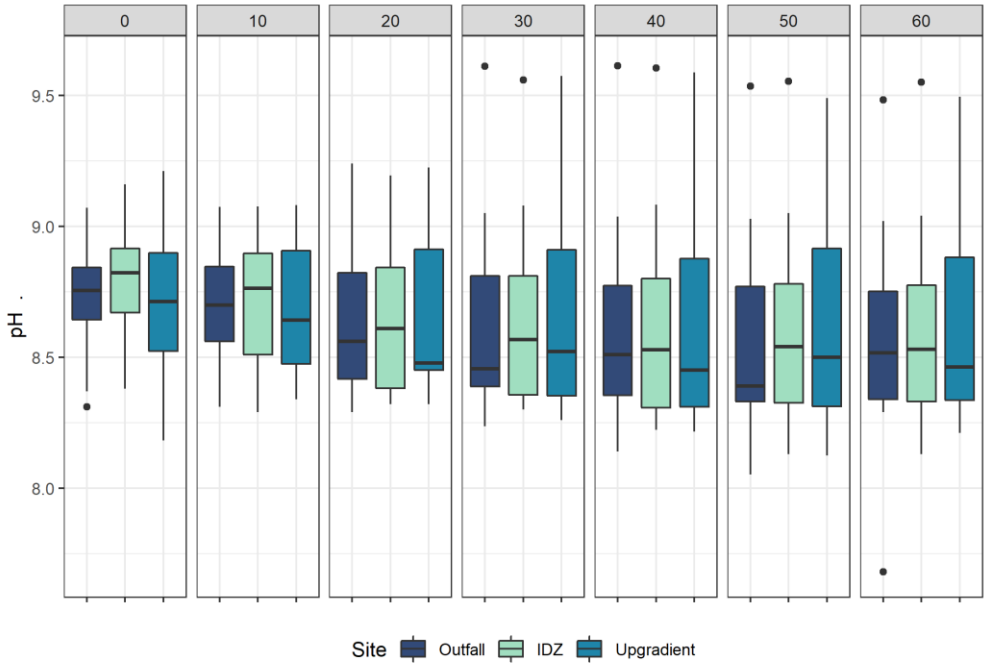


Figure 3: Comparison of pH between sample sites at various depths, 2020-2024

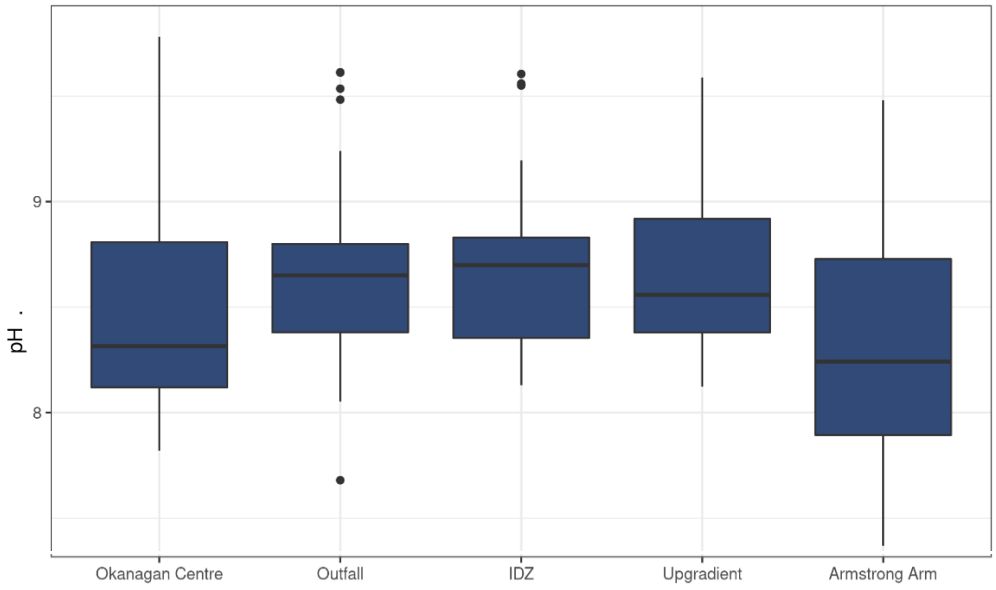


Figure 4: Comparison of field pH at Vernon and ENV long term sample sites, 2020-2024

Dissolved Oxygen

Dissolved oxygen concentrations were similar between the sites averaging 11.0 ± 0.9 mg/L throughout the water column (Figure 5).

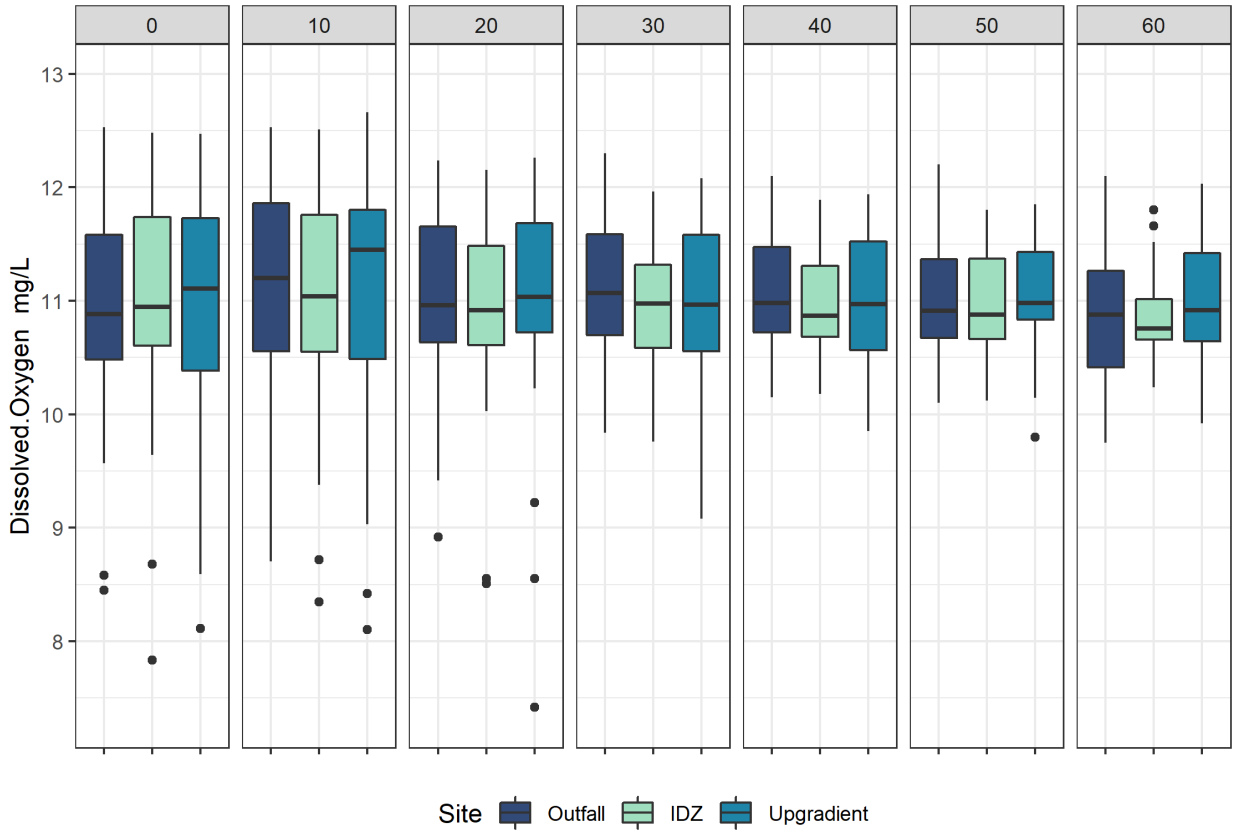


Figure 5: Comparison of dissolved oxygen concentration between sample sites at various depths, 2020-2024

Conductivity

Conductivity was also similar between the three sample sites averaging 304 ± 11 µS/cm throughout the water column (Figure 6).

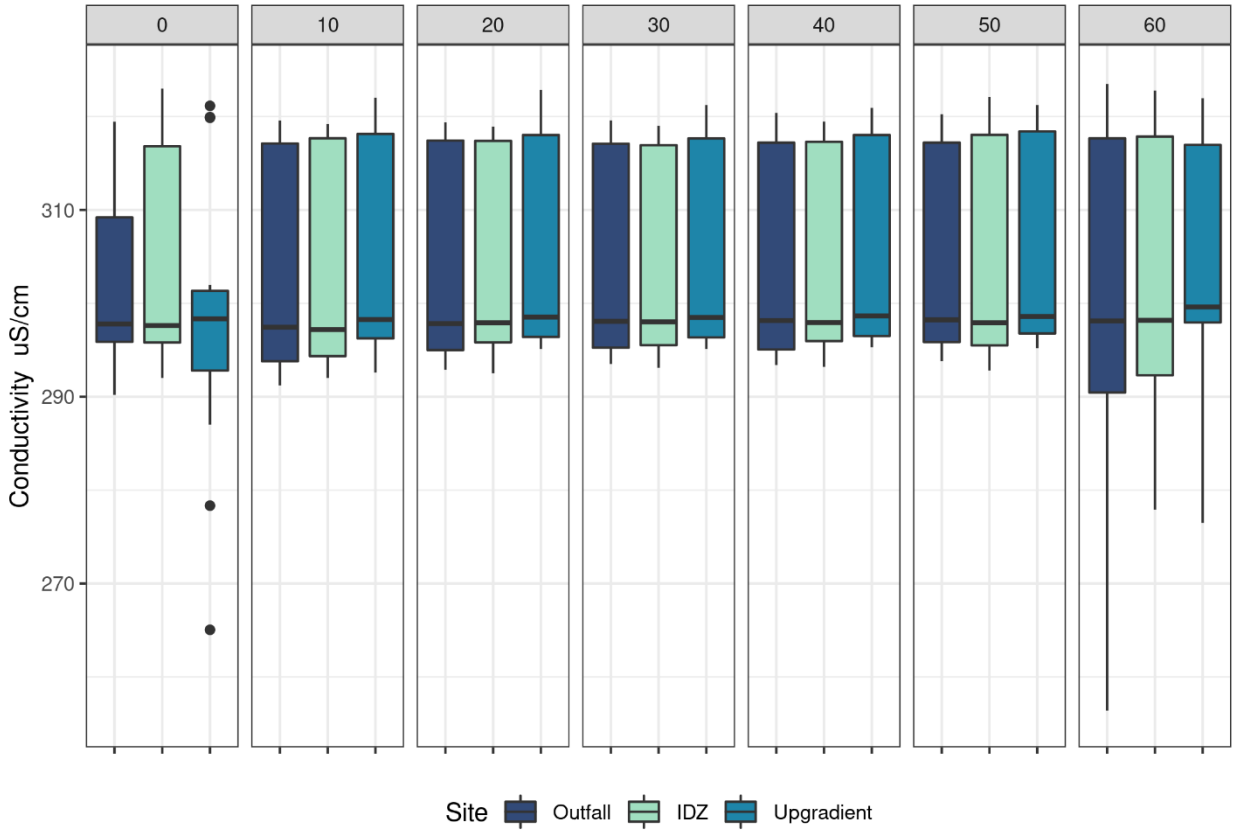


Figure 6: Comparison of conductivity between sample sites at various depths, 2020-2024

Water Clarity

Secchi depth at the sample sites trended downwards moving from the outfall towards the Armstrong Arm with the outfall having the highest water clarity (7.2 ± 2.9 m), while the edge of IDZ (6.8 ± 2.8 m) and upgradient (5.4 ± 2.0 m) locations were had progressively lower water clarity (Figure 7). The lower water clarity at the upgradient site is related to the influence of the very productive Armstrong Arm where water clarity is consistently poorer than the rest of Okanagan Lake (avg secchi of 3.3 ± 1.1 m during 2020-2024, ENV 0500239).

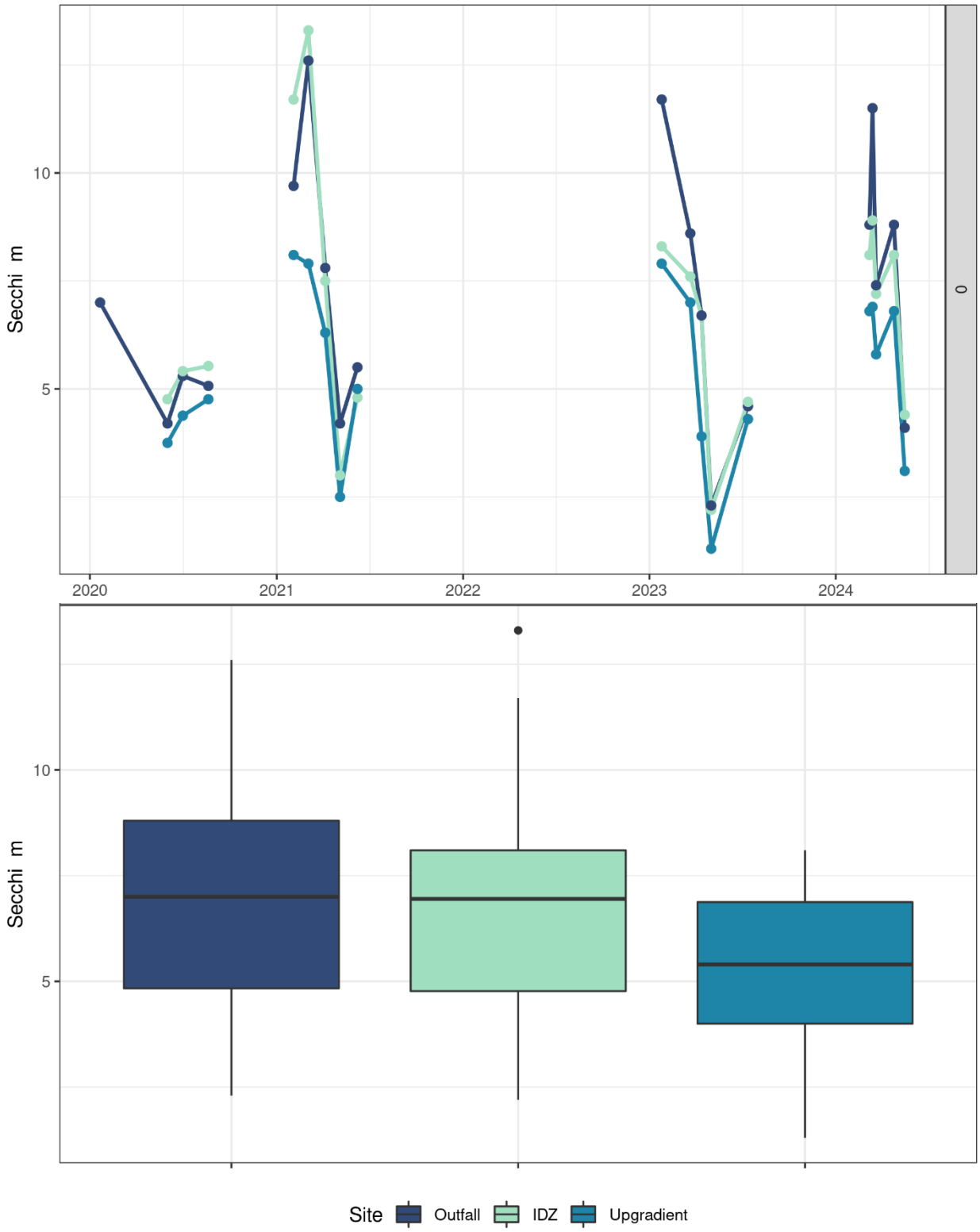


Figure 7: Comparison of secchi depth at sample sites, 2020-2024

Chemistry Samples

General Parameters

Water chemistry samples were collected from the three Okanagan Lake locations and from the reclaimed water before entering Okanagan Lake. If an impact of the reclaimed water on Okanagan Lake occurred, we would expect a gradient away from the outfall site towards the background concentrations (ENV sites).

Chloride

Chloride, a common marker of human impacts, averaged 5.8 ± 0.4 mg/L in the hypolimnion samples at the outfall (Figure 8). There was also a subtle north to south gradient where the Armstrong Arm had the highest and Okanagan Centre had the lowest but there were no indications of the outfall affecting this pattern (Figure 8). The direct effluent averaged 85.8 ± 8.9 mg/L across the four discharge events.

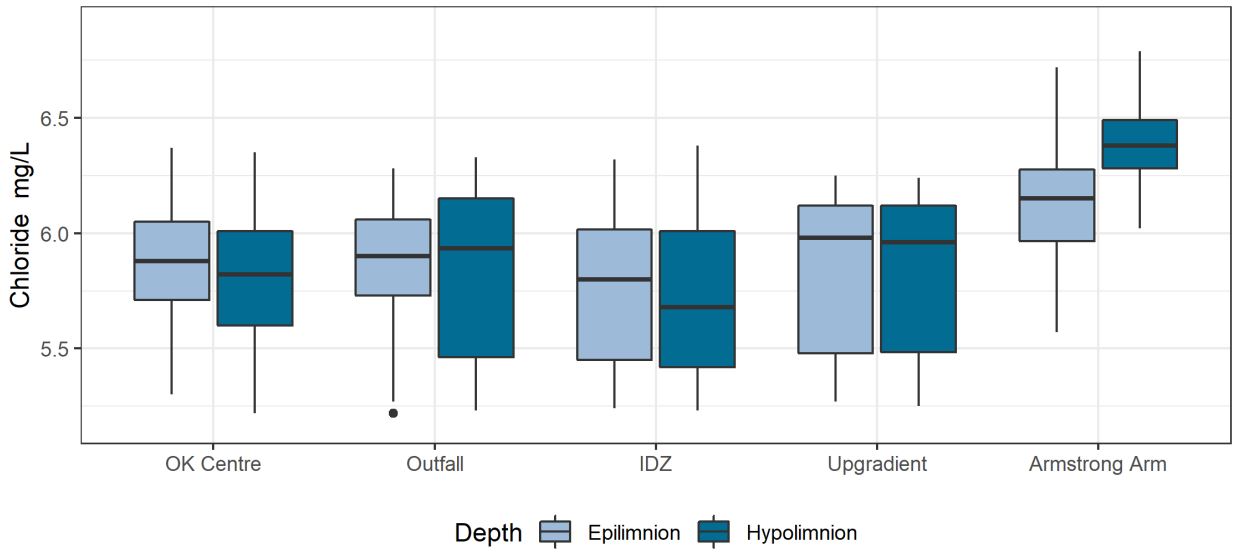


Figure 8: Chloride concentration in Okanagan Lake at sample locations, 2020-2024
Note: Chloride concentration in VWRC outflow samples is above the scale of this graph and not displayed

Hardness/Alkalinity

Hardness and alkalinity were statistically similar between the sites except Armstrong Arm. Alkalinity averaged 118 ± 5 mg/L in the epilimnion and 116 ± 7 mg/L in the hypolimnion at the outfall site from 2021-2024[2] (Figure 9). The hardness and alkalinity data did not detect an impact from the reclaimed water on Okanagan Lake even though the reclaimed water was more alkaline (203 ± 21 mg/L).

[2] Outfall site was not monitored in 2020.

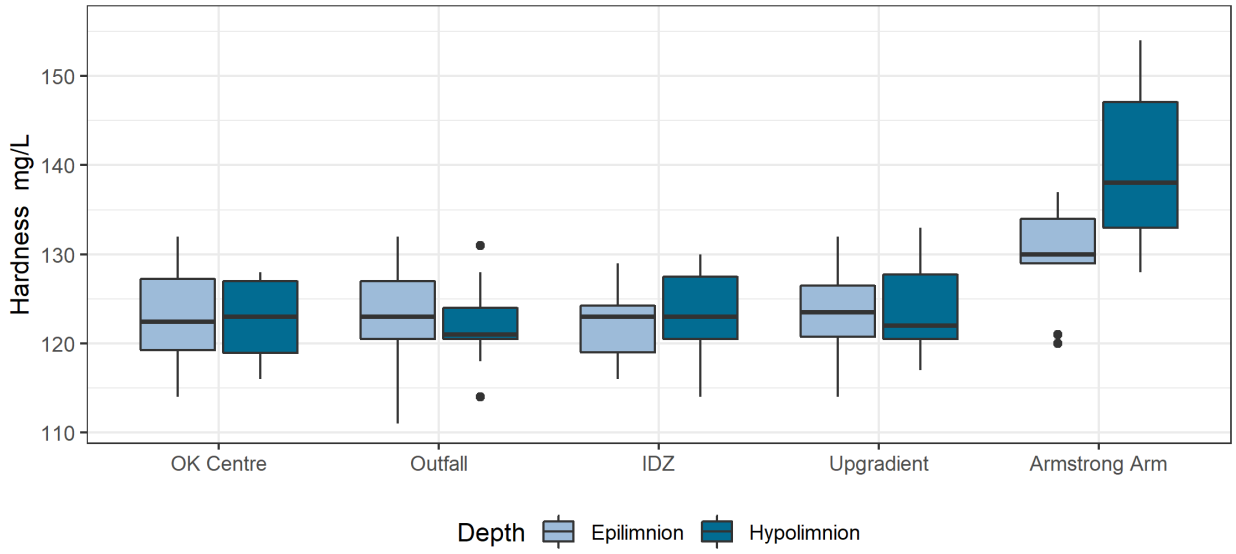


Figure 9: Hardness at Okanagan Lake sample sites, 2020-2024
Note: Concentration in VWRC outflow samples is above the scale of this graph and not displayed

Nutrients

The primary nutrients that control phytoplankton (algae) productivity within Okanagan Lake are the macronutrients, nitrogen and phosphorus.

Nitrogen

Nitrogen is found in both inorganic forms (NH_3, NO_3) and in organic molecules (proteins, amino acids, etc.). Dissolved inorganic nitrogen (DIN) is highly bioavailable and can be taken up and immediately used by algae while organic forms require bacterial processing before they can be reused. For this reason, the concentration of DIN has a greater impact on production than total nitrogen which includes the organic forms.

Total nitrogen averaged 0.237 ± 0.013 mg/L as N in the epilimnion and 0.241 ± 0.011 mg/L as N in the hypolimnion at the outfall location during the 2021-2024 discharges. There was not a statistically significant difference between the outfall, edge of IDZ, or upgradient sites for total nitrogen (KW-Test, p=0.15 for hypolimnion, 2021-2024[3]).

Total nitrogen concentrations exceeded the ENV objective at all sites[4]. The north basin and Armstrong Arm background sites also exceeded the objective indicating that it is a lake-wide condition and not related to the reclaimed water discharge.

[3] TN concentrations at both the background (EMS 0500730) and edge of IDZ sites were elevated during 2020 compared to 2021-2024. Not all sites were monitored in 2020 and so this year was excluded from this analysis.
[4] The total nitrogen objective (<0.230 mg/L as N) is based on the spring maximum concentration that is typically collected during March.

TN in the effluent stream upstream of the outfall averaged 5.46 ± 1.40 mg/L as N during the 2020-2024 discharges.

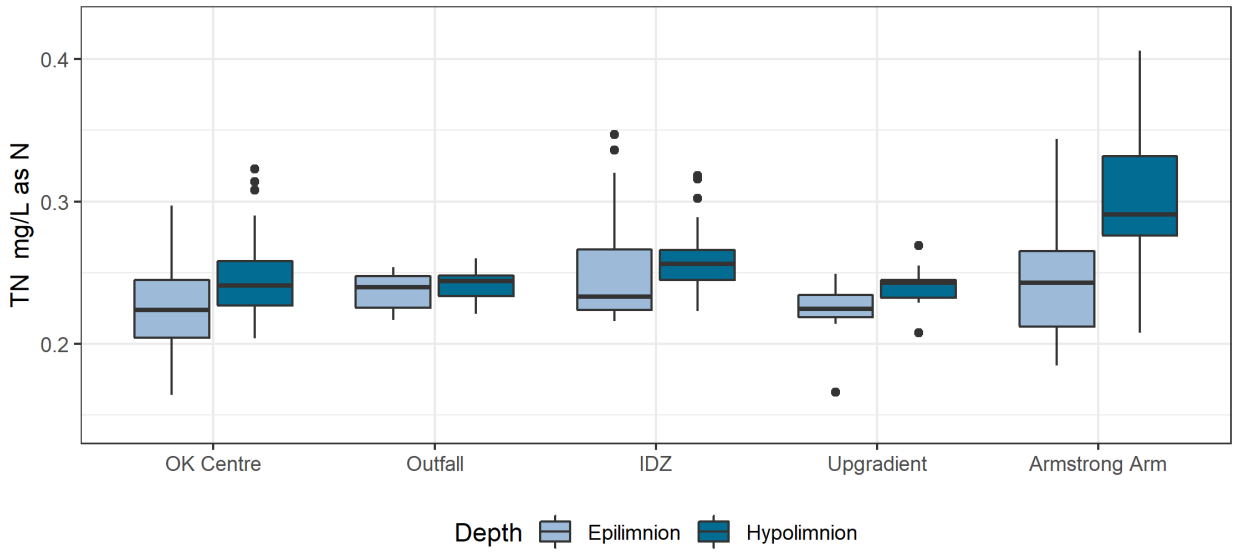


Figure 10: Total nitrogen concentration in Okanagan Lake, 2020-2024
Note: Concentration in VWRC outflow samples is above the scale of this graph and not displayed

DIN in Okanagan Lake is dominated by nitrate (NO_3) averaging 0.068 ± 0.029 mg/L as N in the hypolimnion at the outfall location during 2021-2024. Hypolimnion nitrate concentrations were statistically similar between the outfall, edge of IDZ, and upgradient sites (Figure 11; KW-Test, p=0.30, 2021-2024). At the same time, there was a decreasing concentration in nitrate from 2020-2024 at the Vernon monitoring sites (Mann-Kendall, p=0.006).

While nitrate is the dominant natural form of DIN in Okanagan Lake, ammonia can also be detected in the hypolimnion where phytoplankton consumption is minimal and ammonia can be generated by anoxic decomposition. Epilimnion ammonia was below detection nearly in all samples and also at the long-term ENV sites (69% of samples from Okanagan Lake sites; Figure 11). However, ammonia was detected in the hypolimnion at multiple sites but there was not a statistically significant difference between the sites, indicating rapid dilution of the reclaimed water plume within Okanagan Lake (KW-Test, p=0.79).

Nitrate and ammonia were much higher in the reclaimed water than at any of the lake sites averaging 3.29 ± 1.20 mg/L as N and 0.34 ± 0.39 mg/L as N respectively during the 2020-2024 discharges.

Nitrogen species in the north basin of Okanagan Lake (measured at ENV 0500730) declined over the course of this study as the lake recovers from the nutrient influx of the back-to-back 2017 and 2018 flood years followed by the major inflow year of 2020 (see Appendix 6; Mann-Kendall tests).

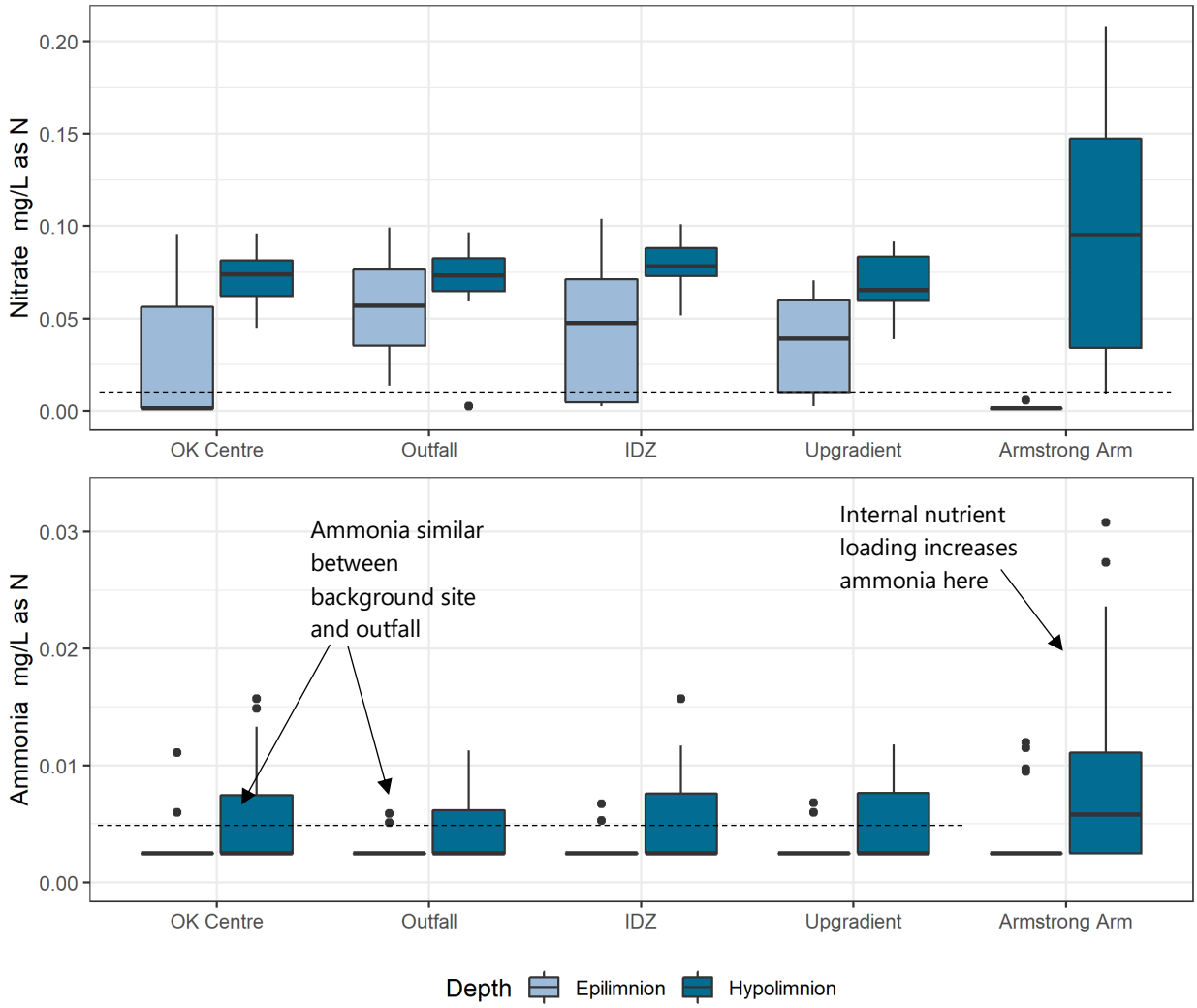


Figure 11: Nitrate + nitrite and ammonia in Okanagan Lake, 2020-2024
Note: Ok Centre = ENV Site 0500730, Armstrong Arm = ENV Site 0500239; black dashed line indicates lab detection limit; Concentration in VWRC outflow samples is above the scale of this graph and not displayed

Phosphorus

Phosphorus is the most important nutrient controlling productivity in Okanagan Lake. Total phosphorus (TP) averaged 0.0060 ± 0.0019 mg/L as P in the epilimnion and 0.0056 ± 0.0011 mg/L as P in the hypolimnion at the outfall location during the 2021-2024 discharges. There was no statistically significant difference detected in TP between the ENV background site (0500730) and the outfall location (Figure 12; KW-Test, p=0.6). TP concentrations did not exceed the ENV objective at the outfall sample site during the 2020-2024 discharges[5]. However, across all samples collected, there were

[5] The total nitrogen/phosphorus objectives is based on the spring maximum concentration that is typically collected during March. This comparison was made by looking at only the samples collected during March.

occasional results above the objective[6]. The upgradient site was most affected because of nutrient enrichment from the Armstrong Arm and not from the reclaimed water discharge. The north basin background site also met the objective while the Armstrong Arm background site exceeded the objective (Figure 12). TP in the reclaimed water averaged 0.390 ± 0.879 mg/L as P during 2020-2024.

Total dissolved phosphorus (TDP) was also similar between the outfall, edge of IDZ, and upgradient sample locations (KW-Test, p=0.67). The outfall site averaged 0.0029 ± 0.0011 mg/L as P in the epilimnion and 0.0030 ± 0.0011 mg/L as P in the hypolimnion during the 2021-2024 discharges.

Orthophosphate was below detection in 78% of lake samples collected during this study, preventing statistical comparisons between the sites.

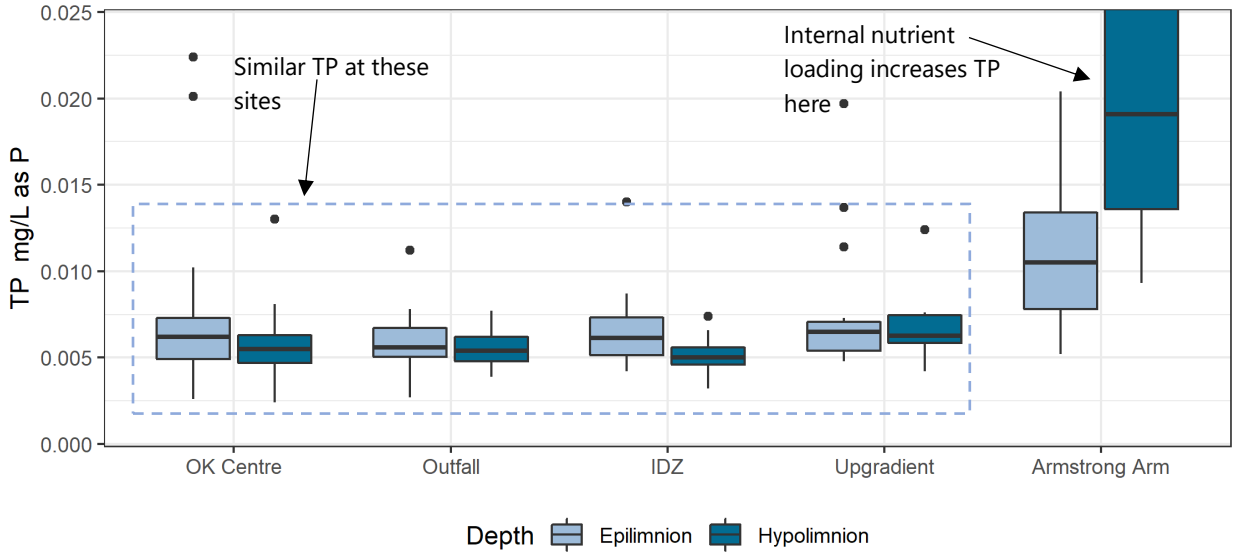


Figure 12: Total phosphorus in Okanagan Lake, 2020-2024
Note: Concentration in VWRC outflow samples is above the scale of this graph and not displayed

There was not a significant trend in TP or TDP concentrations in the north basin during this study (Mann-Kendall tests, Appendix 6).

Nutrient ratios

Nutrient ratios describe the relative abundance of nitrogen to phosphorus and are useful because they explain nutrient limitation. Ratios greater than 15:1 indicate that phosphorus is the limiting nutrient while ratios lower than 5:1 indicate that nitrogen is limiting productivity. In addition to describing nutrient limitation, the ratio of nitrogen to phosphorus can be used to predict the types of phytoplankton that will grow. Cyanobacteria prefer nitrogen limited environments because some taxa can fix atmospheric nitrogen, greatly reducing their dependence on dissolved nitrogen. At higher ratios where phosphorus is limiting, green algae and diatoms tend to be more abundant.

[6] There was an observed spike in TP on May 2, 2023. These samples were collected at the time of a major watershed failure and flooding event on Whiteman Creek, <3 km from the outfall and 1.2 km from the upgradient site.

There was a pattern of increasing ratios moving from north to south across the sites that was driven by nutrient recycling in the Armstrong Arm (KW-Test comparing outfall, IDZ, and upgradient sites, p=0.002; Figure 13). An impact from the release of reclaimed water into Okanagan Lake was not detected in the nutrient ratio data with no significant different observed between the outfall and background site during 2020-2024 (KW-Tests).

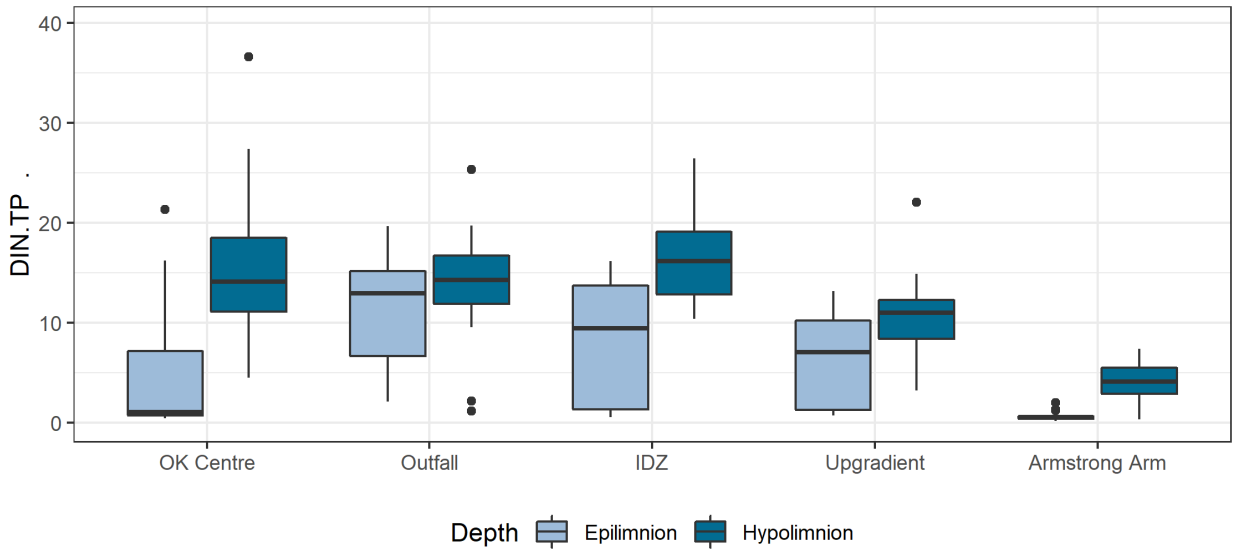


Figure 13: Dissolved inorganic nitrogen to total phosphorus ratio in Okanagan Lake during 2020-2024

Biological Samples

Bacteria

Fecal bacteria (as *E.coli*) were sampled for at each site. *E.coli* concentrations were below the detectable limit <1 MPN/100mL in 95% of lake samples with a maximum detection at only 2 MPN/100mL. Samples from the direct reclaimed water averaged 2 ± 3 MPN/100mL with 26% below detection during the 2020-2024 discharges. While higher than the lake samples, this would still be considered a very low value compared to natural inflows.

Phytoplankton

Chlorophyll-a (chl-a) is a pigment common to many types of algae and is used as a measure of algae production. As with other water chemistry parameters, chl-a was statistically similar between the three sites and averaged 1.87 ± 1.03 µg/L at the outfall site (Figure 14; KW-Test, p=0.76).

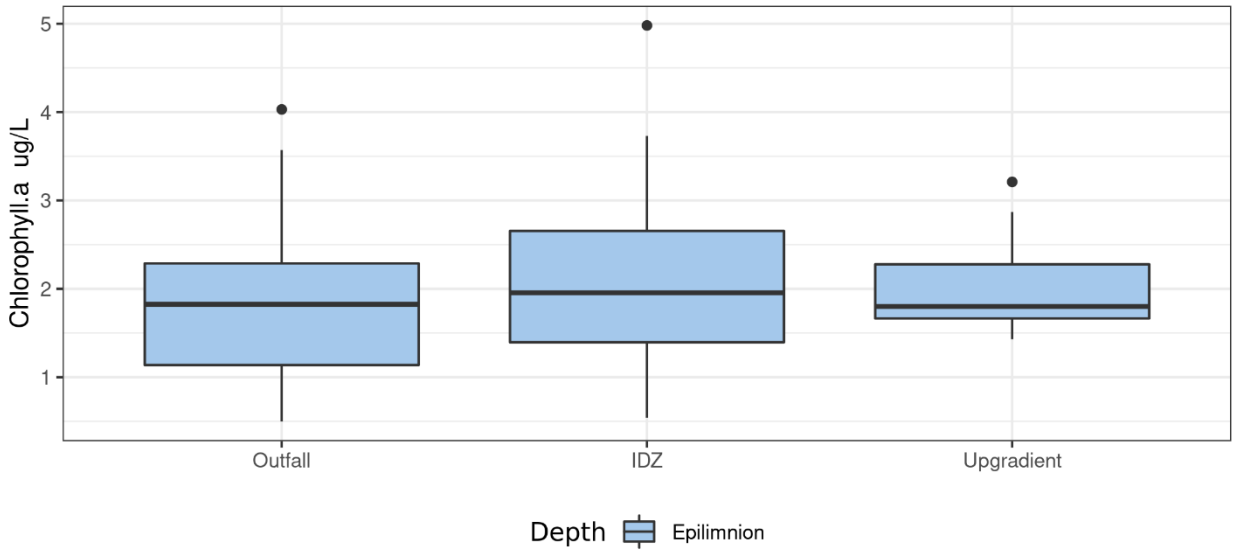


Figure 14: Chlorophyll-a at Okanagan Lake sample locations during 2020-2024

In addition to the chl-a measurements, algae samples were evaluated taxonomically to determine which species were present and their abundances. Total cell densities were similar between the outfall, edge of IDZ, and upgradient sites across the fours discharge events (Figure 15, Figure 16, Appendix 4). Algae community composition was compared at both the high level (Table 4, Figure 16) and at the species level (Appendix 4 and Appendix 5).

Total species diversity was similar between the sites with no significant differences observed (ANOVA, $p=0.9$). When comparing diversity on a per sample basis, there was a possible pattern of lower diversity at the outfall that increased moving away but this was not statistically significant (ANOVA, $p=0.7$). There was also an increasing temporal trend in total algae abundance from 2020-2024 (Mann-Kendall, $p \leq 0.006$), a suspected consequence of nutrient enrichment from the White Rock Lake wildfire.

The Okanagan Lake Objective for phytoplankton taxonomy is no more than 5% of cells counted should be heterocystous cyanobacteria (a group that are known to produce potentially harmful toxins). All three sites exceeded this objective with the outfall averaging 6.0 ± 11.4% during 2020-2024, a common result for Okanagan Lake. There was not a significant difference between the three sites (ANOVA, $p=0.94$).

Non-metric multidimensional scaling (NMDS) analysis was used to see if the community composition of phytoplankton differed between the sites (Appendix 5). These results showed that there were broad similarities between the sites but that green algae, in particular, showed a pattern of greater diversity at the outfall site, although the difference was not quite statistically significant (ANOVA, $p=0.1$[7]).

[7] Comparison of diversity rank (i.e., 1 = most diversity, 2 = middle, 3 = poorest diversity) provided a stronger statistical test than direct abundance values.

Table 4: Summary of algae taxonomy observations

Year	Comments
2020	• Abundance was very high during the discharge and declined over time with lowest samples after discharge ended. • Outfall and IDZ sites had higher peak abundance than the up-gradient site • No pre-discharge sample collected • High abundance corresponds to normal spring algae growth period and may not indicate effect of discharge
2021	• High abundance before discharge dominated by cyanobacteria • Abundance was low at the start of the discharge and increased during the discharge at all three sites • High abundance corresponds to normal spring algae growth period and may not indicate effect of discharge • Higher green diversity near outfall (see also Appendix 5)
2023	• Abundance increased at start of discharge with outfall site having the highest abundance and upgradient having the lowest • Spike in flagellates at the start of the discharge at all sites • First year of data that was collected after the White Rock Lake wildfire
2024	• Very brief discharge • Similar to pre-discharge sample • Post discharge sample was much higher but corresponded to natural spring growth period, not a discharge effect

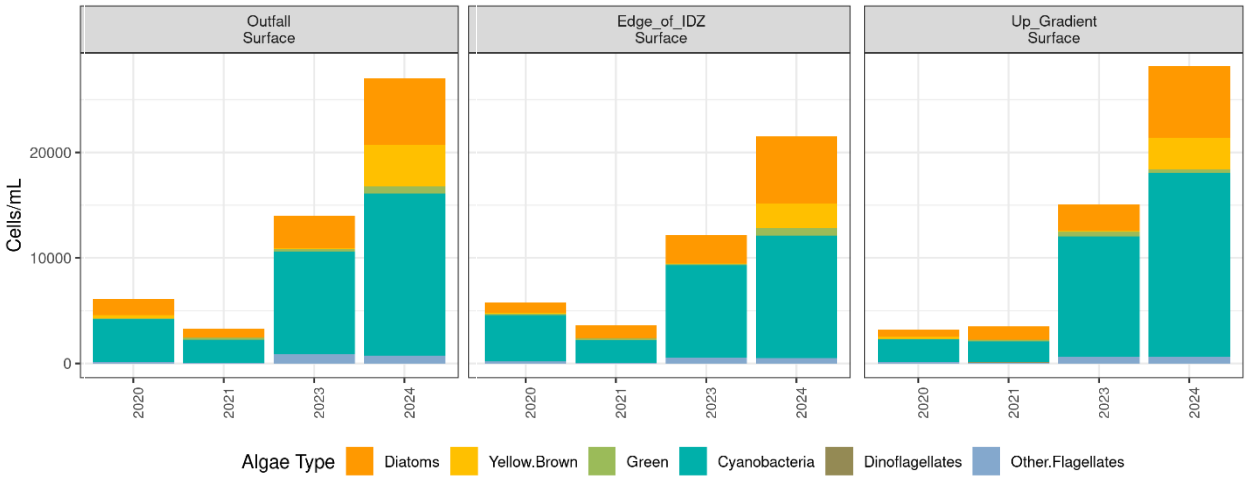


Figure 15: Annual average algae densities, 2020-2024
Note: Distinct increase in algae densities after White Rock Lake Wildfire



Figure 16: Algae cell densities at Okanagan Lake sampling sites during 2020-2024 discharge events

Zooplankton

Zooplankton are microscopic aquatic animals that feed upon algae and serve as food for fish, including immature kokanee salmon. Total zooplankton were statistically similar between the outfall, edge of IDZ, and upgradient site (ANOVA, p=0.92; Figure 17). There was also not a significant difference between the sites when considering paired sample ranks (ANOVA, p=0.7). Total zooplankton averaged 10.6 ± 6.9 zoops/L at the outfall while the edge of the IDZ and upgradient sites averaged 10.0 ± 7.4 zoops/L and 9.6 ± 5.5 zoops/L respectively (Figure 17). Approximately one third of samples met the Okanagan Lake objective of >5% of samples being cladocerans at each site. This objective is rarely met in Okanagan Lake based on the Okanagan Collaborative Monitoring Study (Self, 2023).

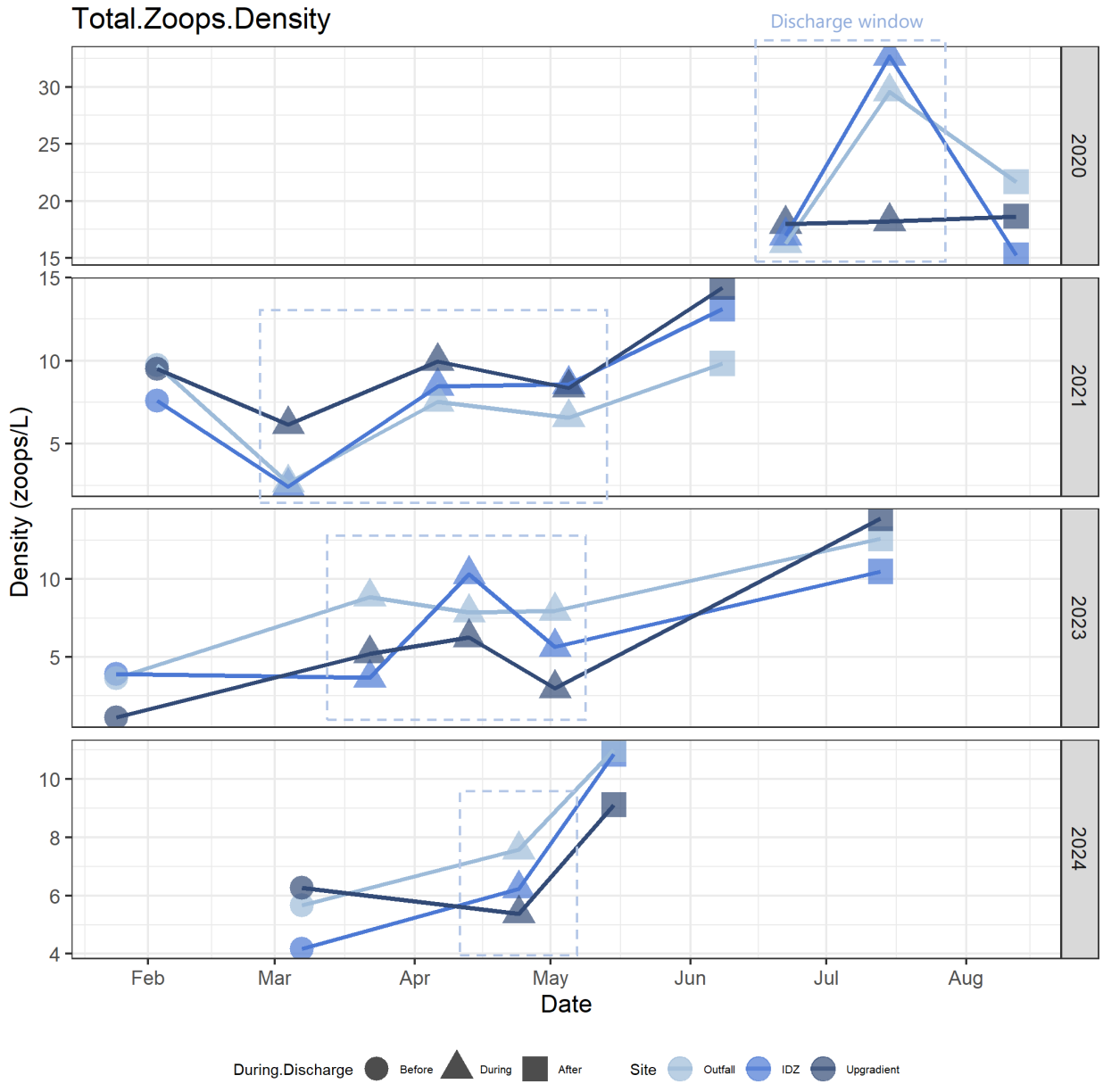


Figure 17: Total zooplankton densities at study locations in Okanagan Lake, 2020-2024

Discussion

1. Are there detectable impacts of treated effluent discharges on Okanagan Lake?

Through the course of four discharge events to Okanagan Lake, sampling failed to detect a change in lake limnology or water chemistry at any of the sample sites that could be attributed to the effluent plume.

2. Are there detectable changes in the phytoplankton community – a sensitive indicator of nutrients?

Phytoplankton taxonomy can be used as a sensitive indicator of changes in nutrients. During the four discharge events, total phytoplankton abundance and chlorophyll-a concentration were statistically similar between all three sites. However, there was a subtle but consistent pattern of higher green algae diversity at the outfall site compared to the other sites, the difference was almost statistically significant after 2024.

3. What are the risks of water quality guideline exceedances within and outside the initial dilution zone (IDZ)?

During the four discharge events (2020-2024), there was not a significant change in Okanagan Lake water chemistry that could be attributed to the reclaimed water plume. There were no exceedances of Okanagan Lake water quality objectives at the outfall or edge of IDZ sites that were not shared by the background sites distant to the outfall.

Total nitrogen exceeded the Okanagan Lake objective during most years in the north basin and Armstrong Arm (Figure 10). Total phosphorus did not exceed its objective at the outfall while the IDZ and upgradient sites did occasionally rise above their respective TP objectives.

The two primary biological objectives of interest were phytoplankton and zooplankton taxonomy. Both failed to meet their respective objectives in some samples at each site, a common result for Okanagan Lake.

No other parameter exceeded an objective during any of the four discharge events. The parameters that do not meet their respective objectives exhibit lake wide patterns that could not be attributed to the Vernon discharge events. Future discharges would serve as a relatively minor source of nutrients to Okanagan Lake.

4. How is the variable assimilative capacity of Okanagan Lake and its water quality affected by the predictable range of scenarios: flood years, wildfire impacts, watershed disturbance, and potential discharge scenarios?

Okanagan Lake is a dynamic system with numerous natural and human affected nutrient sources and sinks. The four Vernon discharge events were assessed for nutrient loads compared to other major sources of nutrients to Okanagan Lake (Kelowna effluent discharge and Mission Creek). Future discharge scenarios were also considered and the potential nutrient loads calculated and ranked against other sources. The results of these analyses are listed in Table 5.

The sporadic discharge from the Vernon outfall to the north basin of Okanagan Lake averaged 4,700 kg of TN and 330 kg of TP per event (2020-2024). This represented an increase in the estimated available nutrients in the north basin by 0.1% for TN and 0.4% for TP[8]. In a scenario where City of Vernon operated the outfall continuously as its only effluent discharge, the discharge would represent an estimated increase in total nutrients north basin by 0.5% for TN and 1.6% for TP. For comparison, the City of Kelowna discharge averaged 3.5% and 7.1% of the central basin TN and TP respectively each year. Despite this, the central basin had similar nutrient concentrations to the north basin from 2020-2024 (KW-Tests) illustrating Okanagan Lakes large natural assimilative capacity.

Mission Creek, the largest natural tributary to Okanagan Lake, averaged 88,500 kg of TN and 2,300 kg of TP[10] during the discharge years. The Vernon outfall represented 5.5% of the average annual TN and 8.4% of the average annual TP from Mission Creek. During the flood years of 2017-2018, Mission Creek averaged 101,000 kg of TN and an estimated 62,000 kg of TP[11]. The natural variability between average and flood years is therefore estimated at 14% for TN and as high as 2600% for TP. The average discharge from Vernon accounted for only 5% of a flood year TN and only 0.5% of a flood year TP from just Mission Creek. Put another way, the average Vernon discharge (2020-2024) would take over 100 years to release as much TP into Okanagan Lake as Mission Creek in one large flood year. Nutrient concentrations in Okanagan Lake have gradually declined in the years since 2018 indicating that Okanagan Lake has a large nutrient assimilative capacity for nitrogen, returning to pre-2017 concentrations within 3-6 years. TP and TDP remain elevated as of 2025, highlighting the natural potency of phosphorus in Okanagan Lake, a phosphorus limited system.

During the span of this study, the north basin of Okanagan Lake experienced a major wildfire (2021 White Rock Lake wildfire) and an associated watershed failure (Whiteman Creek washout in May 2023). Both events are associated with large phosphorus contributions to Okanagan Lake (United States Geological Survey, 2018). The reclaimed water discharge was compared to Okanagan Lake nutrients for those years in Table 5.

[8] The volume of the basin was calculated using the available 1966 bathymetry. This was multiplied by the average concentration of major nutrients in March. Okanagan Lake nutrient objectives use March samples to represent the lake in a fully mixed state.

Table 5: Comparison of different discharge scenarios and prospective effects on Okanagan Lake

Discharge Scenario	Observed?	Nutrient Load (kg) Unless otherwise specified, these represent Vernon outflow annual loads	% of estimated nutrient mass in Okanagan Lake basin[9]	Effect on Okanagan Lake
Reference Events:				
City of Kelowna Discharge (avg of 13 Mm^3)	Avg of 2021 and 2023	66,542 kg of TN 2,577 kg of TP	TN = 3.5% TP = 7.1%	-Nutrient load comparable to major creek inflow -Gradual nutrient enrichment of Okanagan Lake
Mission Creek	Avg of 2020, 2021, 2023, 2024	88,512 kg of TN 2,319 kg of TP	TN = 4.5% TP[10] = 6.0 %	-Largest tributary of Okanagan Lake -Major natural nutrient source
Mission Creek Flood	Avg of 2017 and 2018	101,273 kg of TN 62,554 kg of TP[11]	TN = 3.2 % TP = 92.1%	-Dramatic flooding and marked increase in nutrients -Nutrient increase lasted for several years before gradually declining; 2025 Okanagan Lake concentrations remain at or above pre-2017 concentrations
Environmental Events:				
Flood Year	2020 was a high inflow year	7,337 kg of TN 194 kg of TP	TN = 0.2% TP = 0.3%	-True shoreline flooding leads to a massive influx of nutrients to Okanagan Lake (observed in 2017-2018) -High inflows without shoreline flooding increase lake flushing causes smaller shifts in nutrients (as in 2020)
Wildfire	2021 White Rock Lake wildfire	5,697 kg of TN 208 kg of TP	TN = 0.2% TP= 0.3%	-Increase in nutrients and turbidity reporting to Okanagan Lake -Increased nutrients may fuel algae growth over the next several years -Increase algae was observed since 2023 -Increased risk of watershed failure (failure did occur in May 2023)

[9] Total nutrient mass estimated based on volume of basin multiplied by the concentration at spring overturn (March); concentration measured at ENV site 0500730 for north basin and 0500236 for central basin

[10] Available TP data for Mission Creek was limited to 2020

[11] This value represents an expected overestimation because the May 2018 sample contained unusually high TP during the freshet flooding and was not expected to be representative of the entire month.

Discharge Scenario	Observed?	Nutrient Load (kg) Unless otherwise specified, these represent Vernon outflow annual loads	% of estimated nutrient mass in Okanagan Lake basin[9]	Effect on Okanagan Lake
Slope Failure	2023 failure on Whiteman Creek	5,673 kg of TN 908 kg of TP	TN = 0.2% TP = 1.0%	-Increase in nutrients and turbidity reporting to Okanagan Lake -Increased nutrients may fuel algae growth over the next several years -Increase algae was observed since 2023
Vernon Discharge Scenarios:				
Sporadic discharge events (current situation)	2020, 2021, 2023, 2024	4,724 kg of TN 328 kg of TP	TN = 0.1% TP = 0.4%	-No detected change in water chemistry -Small apparent increase in green algae diversity[12]
Annual discharge (current size but repeated each year)	-	*See above*	*See above*	-No detectable change in water chemistry -Small increase in basin nutrient load by <1%, a much smaller amount than the normal variation in freshet loading
Double current discharge (Est. 2 Mm^3)	-	Est. TN = 10,000 to 20,000 kg TP = 500 to 1,000 kg	Est. TN = 0.4% TP = 0.5 to 1%	-Change in water chemistry still unlikely to be detected -Increase in nutrient load to north basin by 0.5 to 1%
Continuous discharge (avg of 4.5 Mm^3)	-	Est. TN = 18,000 kg TP = 1,200 kg	Est. TN = 0.5% TP = 1.5%	-Would represent effectively a new creek to the north basin -Discharge nutrient load would be approximately 10% of the Kelowna outfall load -Nutrient load still remains within the normal annual variation -Unlikely to have acute effect on north basin

[12] While this pattern was consistent across the study, the difference was too small to be statistically significant from 2020-2024.

5. What are the primary drivers of changes in nutrient status for the North Basin of Okanagan Lake?

There are many drivers affecting the nutrient balance of the north basin of Okanagan Lake. The main drivers are listed in Table 6 and ranked by the strength of the role each is expected to play on Okanagan Lake. These are estimates, a true nutrient balance for the entire Okanagan Valley would be required to accurately quantify each driver.

Table 6: Drivers of changes to nutrient status for north basin of Okanagan Lake

Driver	Rank	Description
Watershed Degradation	High	• Cumulative degradation to the watershed by many activities: deforestation, resource extraction, road building, recreation, development, etc. • Slowly reduces resilience of the watershed to other changes including climate change • Increase in flashiness of streams leading to greater risk of failures and less predictable flows
Wildfire	High	• Wildfire mobilizes enormous quantities of phosphorus as ash that can fall directly on downstream water bodies, or be washed in during subsequent runoff events • Reduces ability of watershed to retain water through hydrophobic soils and loss of vegetation • Greatly decreases soil stability on burned slopes leading to increased risk of slope failures. Sediment washed into Okanagan Lake from slope failures carries abundant phosphorus • Intensely burned areas (there were many in the White Rock Lake wildfire) take many years to recover

Population Growth	High	• Population growth throughout the Okanagan is high; RDNO population increased by 13% from 2011-2021 (Statistics Canada, 2021)
		• Population expected to increase a further 22% in the next 20 years (BC Stats, 2025)
		• Population growth exacerbates many other issues listed including:
		  ○ Increased stormwater
		  ○ Greater watershed recreation pressures
		  ○ Increased sewer and septic wastewater production
		  ○ More people = more boats = greater risk of invasive species

Climate Change	High	• Enhances the effects of other items in the list • Increases risk of both flooding and fires • Changes hydrology and seasonal water patterns of watersheds • Less winter snow = lower snow storage within the watershed
Nutrient Recycling in Armstrong Arm	High	• Armstrong Arm nutrient enrichment ongoing for many decades

Driver	Rank	Description
		• Low oxygen conditions in the deep water during the summer allow historic nutrients to return to the water column, fueling algae growth that consumes oxygen leading to a feedback cycle
Stormwater	Mod	• Major outfalls = dirty streams • Stormwater is high in nutrients
Septic Fields	Mod	• Distributed throughout the north basin • Non-point sources of nutrients to Okanagan Lake and its tributaries • Many systems are old and functioning poorly
Slope Failures	Mod	• Slope failures represent large but usually brief sources of nutrients to Okanagan Lake • Damaged slopes may take years to heal leading to low-level ongoing nutrient/sediment loading downstream
Treated Effluent Discharge	Low[13]	• Currently there are no treated effluent discharges to the north basin unless Vernon outfall is active • Vernon outfall provides <1% of the total available nutrients for the north basin • A continuous discharge would still be a relatively small source of nutrients to the north basin (estimated at <1% TN, 2% TP)
Aquatic Invasive Species	Low	• Invasive Eurasian watermilfoil is abundant in Okanagan Lake • Milfoil moves nutrients up from the lake sediment back into the water column where it fuels algae growth • Dense milfoil beds are often also thickly covered in filamentous algae • Introduction of invasive zebra/quagga/golden mussels would dramatically alter ecology of Okanagan Lake. The environmental and economic impacts would be disastrous
Boating Activities	Low	• Sediment disturbance by large power boats is an increasing concern in Okanagan Lake • Disturbed sediments release historic nutrients and contaminants • Fortunately, the north basin is very deep, only expansive shallows are in the Vernon Arm

[13] This rank would increase to Mod in a continuous discharge scenario.

Conclusions

The City of Vernon's 60 m deep outfall discharged reclaimed water to Okanagan Lake during 2020, 2021, 2023, and 2024. Each discharge event was assessed by a stand-alone monitoring program. Brief reports were drafted after each event summarizing the results of the monitoring programs.

The results from 2020-2024 did not indicate that the release of reclaimed water during the discharge window had a detectable impact on the water temperature, clarity, dissolved ions, nutrient concentrations, or zooplankton communities of Okanagan Lake. Nitrogen concentrations decreased in the north basin during 2020-2024 while phosphorus was stable. There was a small but not statistically significant increase in green algae diversity (chlorophytes) at the outfall site compared to the other sites that may be attributable to uptake of nutrients released by the outfall. Further study during future discharges may strengthen or eliminate this potential pattern.

The release of reclaimed water to Okanagan Lake is better framed as a source of nutrient loading to the north basin of Okanagan Lake because of the rapid mixing of the reclaimed water plume. In this way it represented a very small contribution for lake as large as Okanagan Lake, less than 1% of the estimated nutrient load in the north basin. However, damage to the north Okanagan watershed from the White Rock Lake wildfire has led to a dramatic increase in phytoplankton production unrelated to the discharges.

Okanagan Lake does experience exceedances of some water quality objectives, most notably for total nitrogen, but the reclaimed water discharge is not expected to change the exceedance behaviour for the north basin because of the small total nutrient loads.

Okanagan Lake continues to face pressure from many sources including but not limited to: climate change, watershed degradation, wildfires, and rapid population growth. These combine to reduce the overall assimilative capacity of Okanagan Lake.

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Appendices

Appendix 1: Overview Map



Appendix 2: Guidelines & Objectives

Okanagan Lake has objectives set by the Ministry of Environment. Each objective has a set value and also a time frame upon which to apply that value. For most parameters the growing season (Apr-Sep) average is applied against the guideline and this would not be applicable to this study. However, for total nitrogen (TN) and total phosphorus (TP), the value measured during March (called spring maximum) is considered. This value was used to compare against the results from this study.

Table A 1: Okanagan Lake water quality objectives

Parameter (Nordin, 2005)	**Summerland**	**Kelowna**	**OK Centre**	**Armstrong Arm**
Secchi Depth (growing season average: Apr-Sep)	>7m	>6m	**>6m**	>5m
Dissolved Oxygen (minimum in bottom waters)	-	-	**-**	>5 mg/L
TP (mg/L as P) (maximum at spring overturn)	<0.007	<0.008	**<0.008**	<0.01
Chlorophyll-a (µg/L) (maximum seasonal average)	<4.5	<4.5	**<4**	<5
TN (mg/L as N) (maximum at spring overturn)	<0.230	<0.230	**<0.230**	<0.250
N:P Ratio (spring weighted ratio)	>25:1	>25:1	**>25:1**	>25:1
Algae Taxonomy (% heterocystous cyanobacteria)	<5%	<5%	**<5%**	<5%
Algae Biomass (µL/L) (growing season average)	<0.75	<0.75	**<0.75**	<0.75
Zooplankton Biomass (µg/L) (growing season average)	>50	>50	**>50**	>50
Zooplankton Taxonomy (% cladocerans)	>5%	>5%	**>5%**	>5%

Note: Okanagan Centre objectives for the north basin applied to this study

Appendix 3: Statistical information

Statistical analyses were performed on data to support interpretations made throughout this report. The use of the word 'significantly' within this report is understood to signify that the claim being made has stood up under statistical analysis. Unless otherwise stated, all statistical analyses were performed to a confidence of greater than or equal to 95% ($p \leq 0.05$). The ± symbol indicates plus or minus the standard deviation throughout this report.

Water quality data often contains non-detect values for many parameters. Non-detect values were converted to ½ detection limit for all calculations.

Throughout this report the monthly sampling data was grouped seasonally for additional analyses. March, April, and May data were combined as "Spring"; June, July, and August as "Summer"; and September as "Fall".

Correlations were performed using the Pearson's Correlation method and all R values reported at Pearson's Correlation Coefficients.

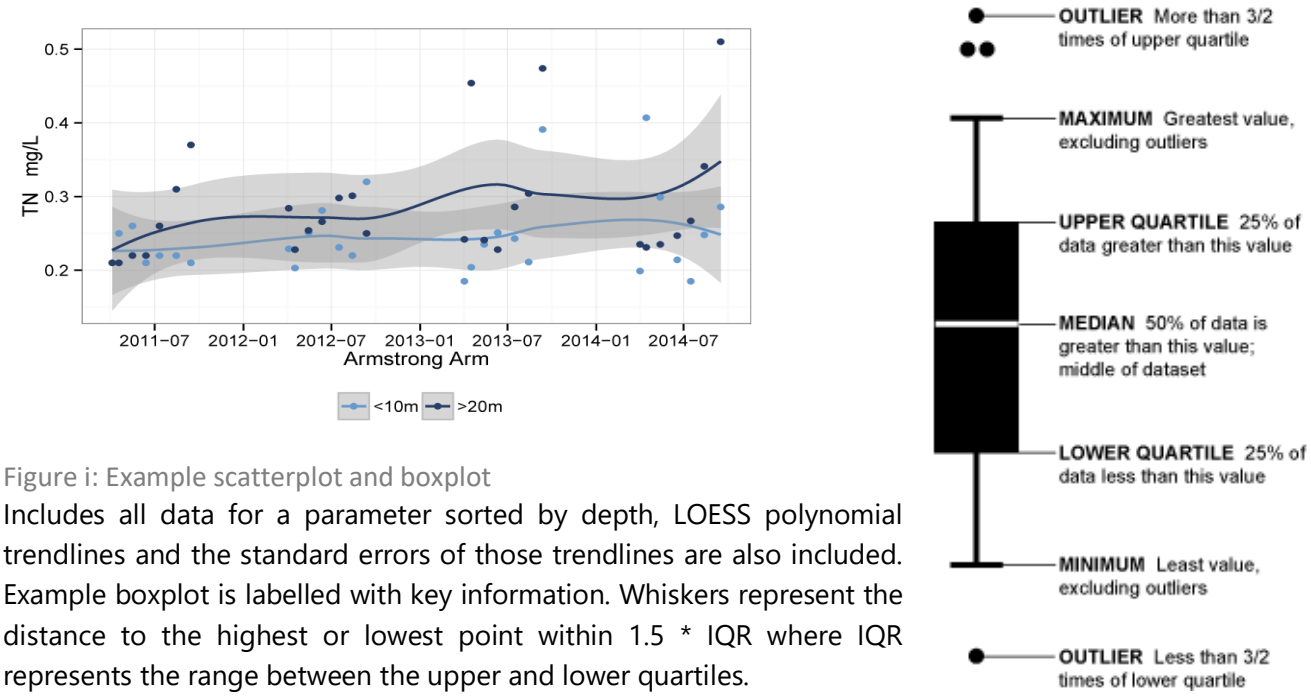


Figure i: Example scatterplot and boxplot

Includes all data for a parameter sorted by depth, LOESS polynomial trendlines and the standard errors of those trendlines are also included. Example boxplot is labelled with key information. Whiskers represent the distance to the highest or lowest point within 1.5 * IQR where IQR represents the range between the upper and lower quartiles.

The Kruskal–Wallis One-Way Analysis of Variance by Ranks is a non-parametric method for testing if samples originate from the same distribution, that is, if the means of two variables are significantly different. It is used to compare more than two independent or non-related samples. It is the non-parametric equivalent of the more traditional ANOVA statistical test that was also used in this report. These calculations produces a p-value from which statistical significance is determined (Spurrier, 2003).

Appendix 4: Phytoplankton Taxonomy Plots

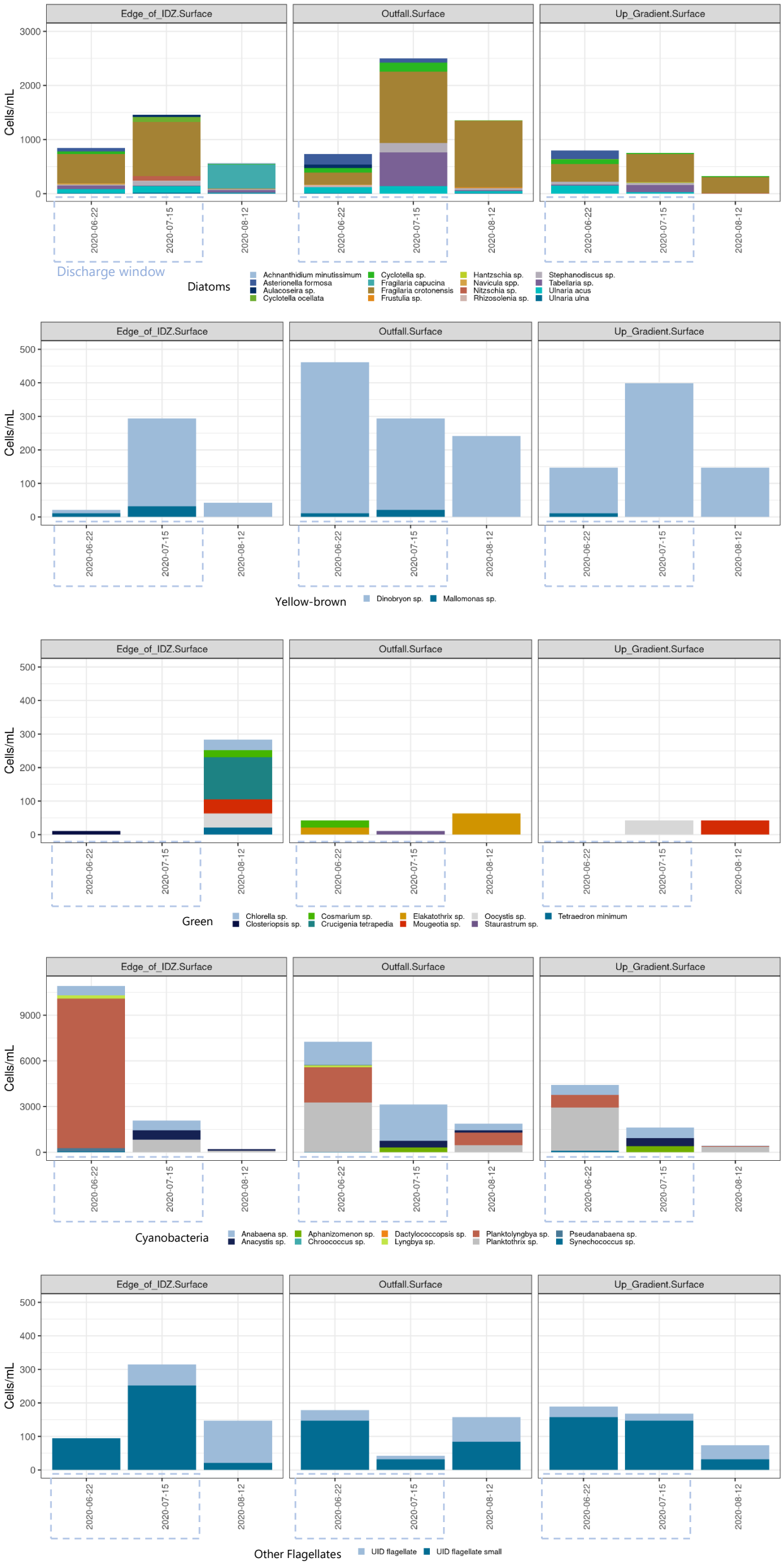


Figure 18: Phytoplankton taxonomy results during the 2020 discharge



Figure 19: Phytoplankton taxonomy results during the 2021 discharge

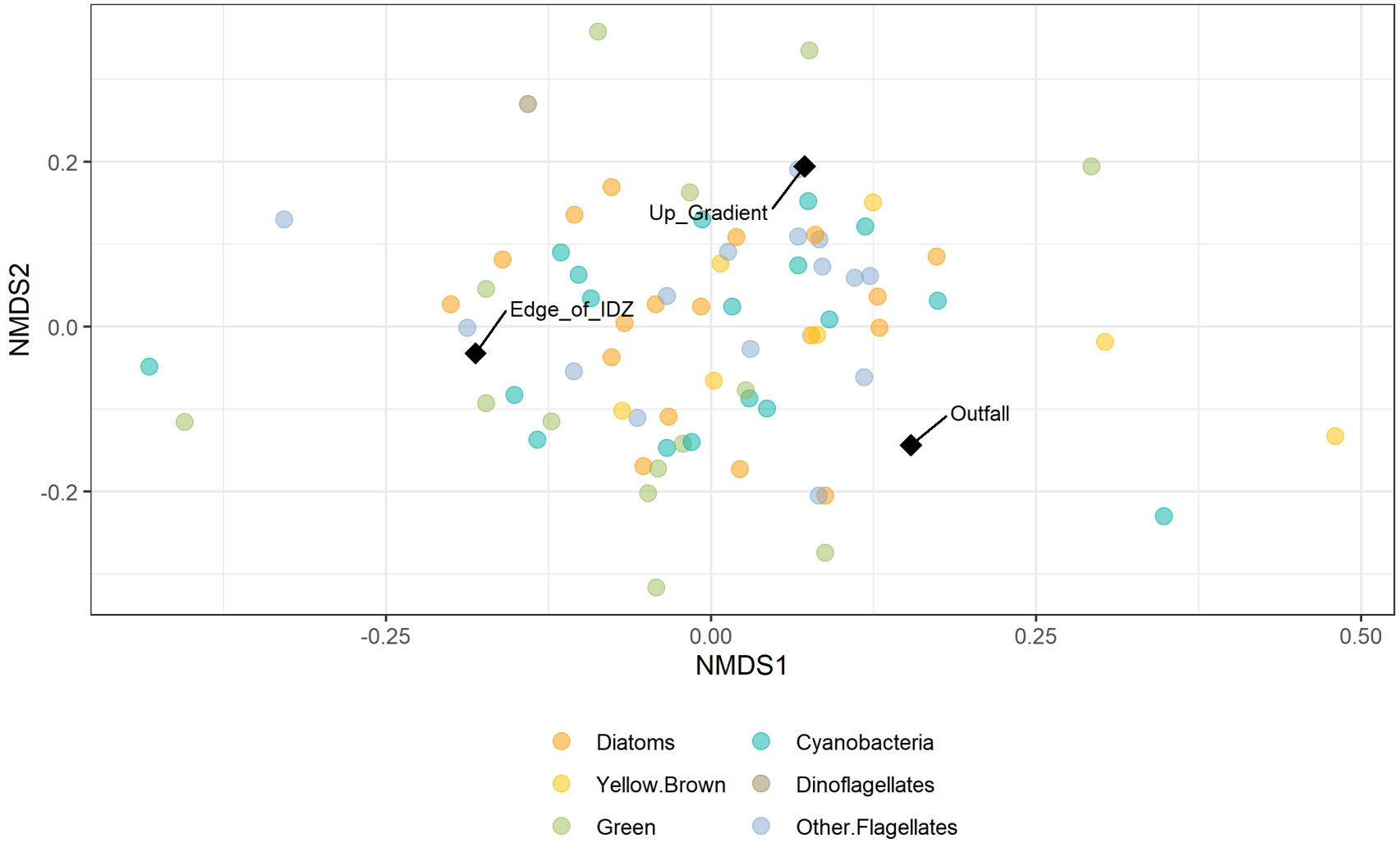


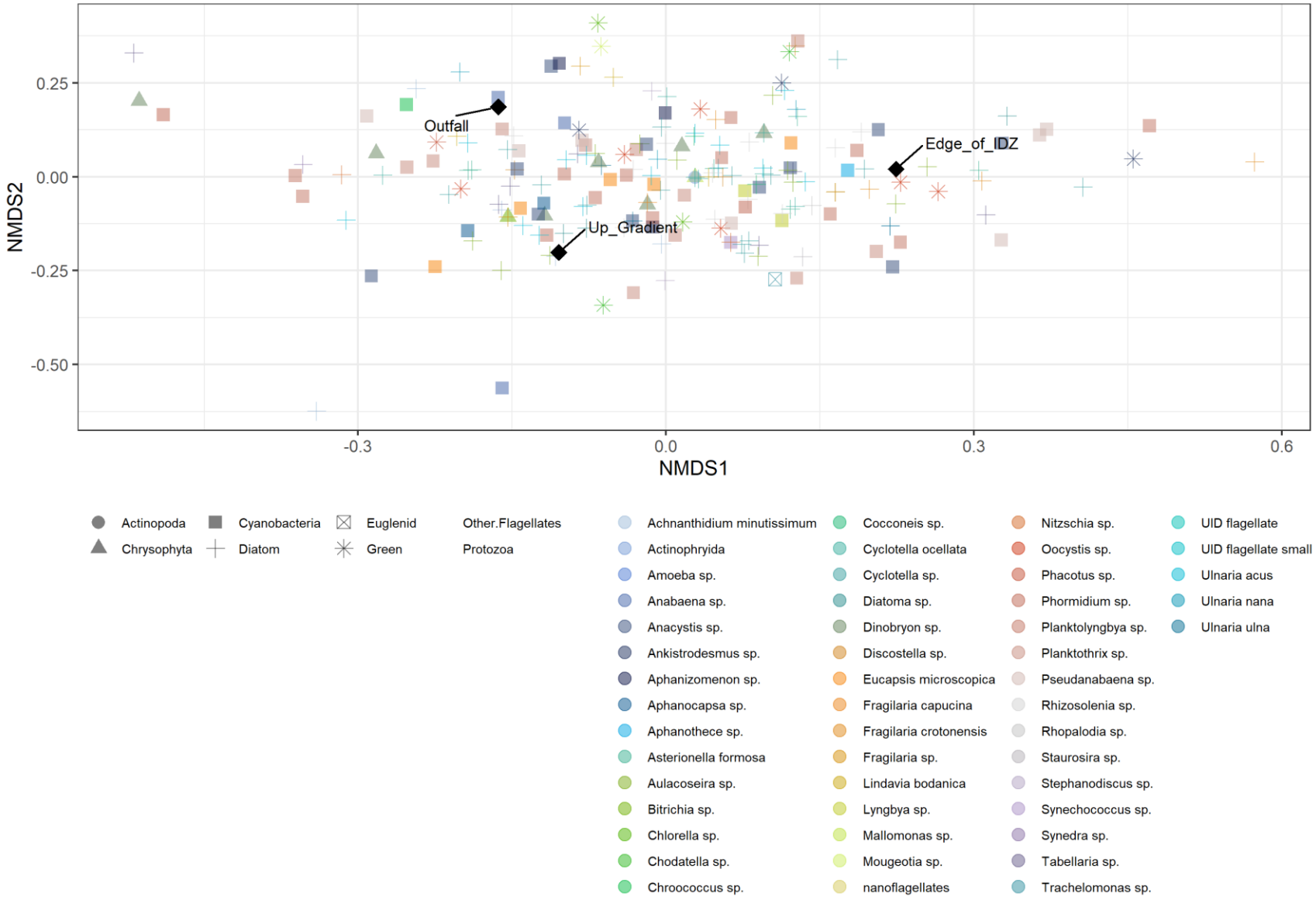
Figure 20: Phytoplankton taxonomy results during the 2023 discharge

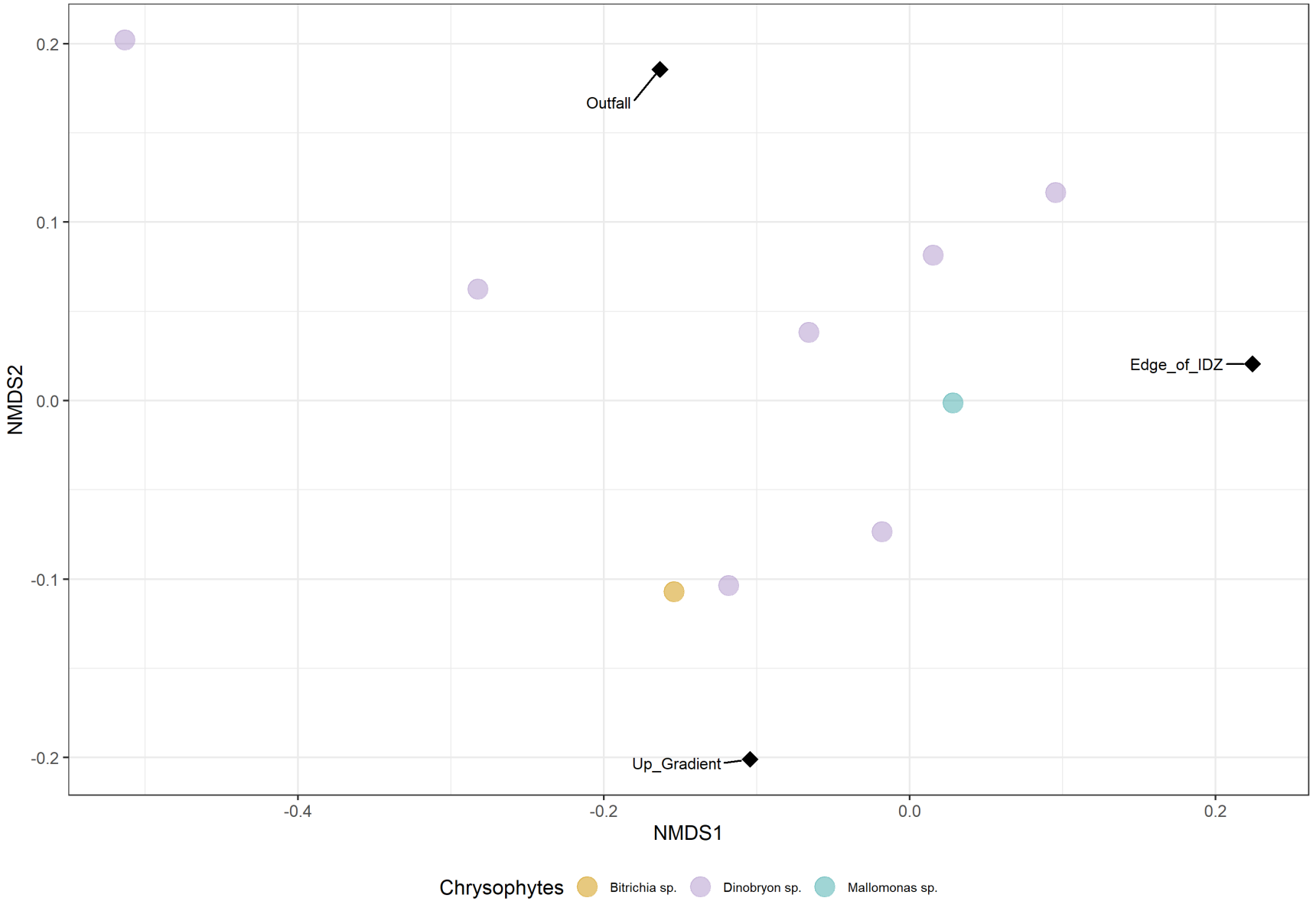


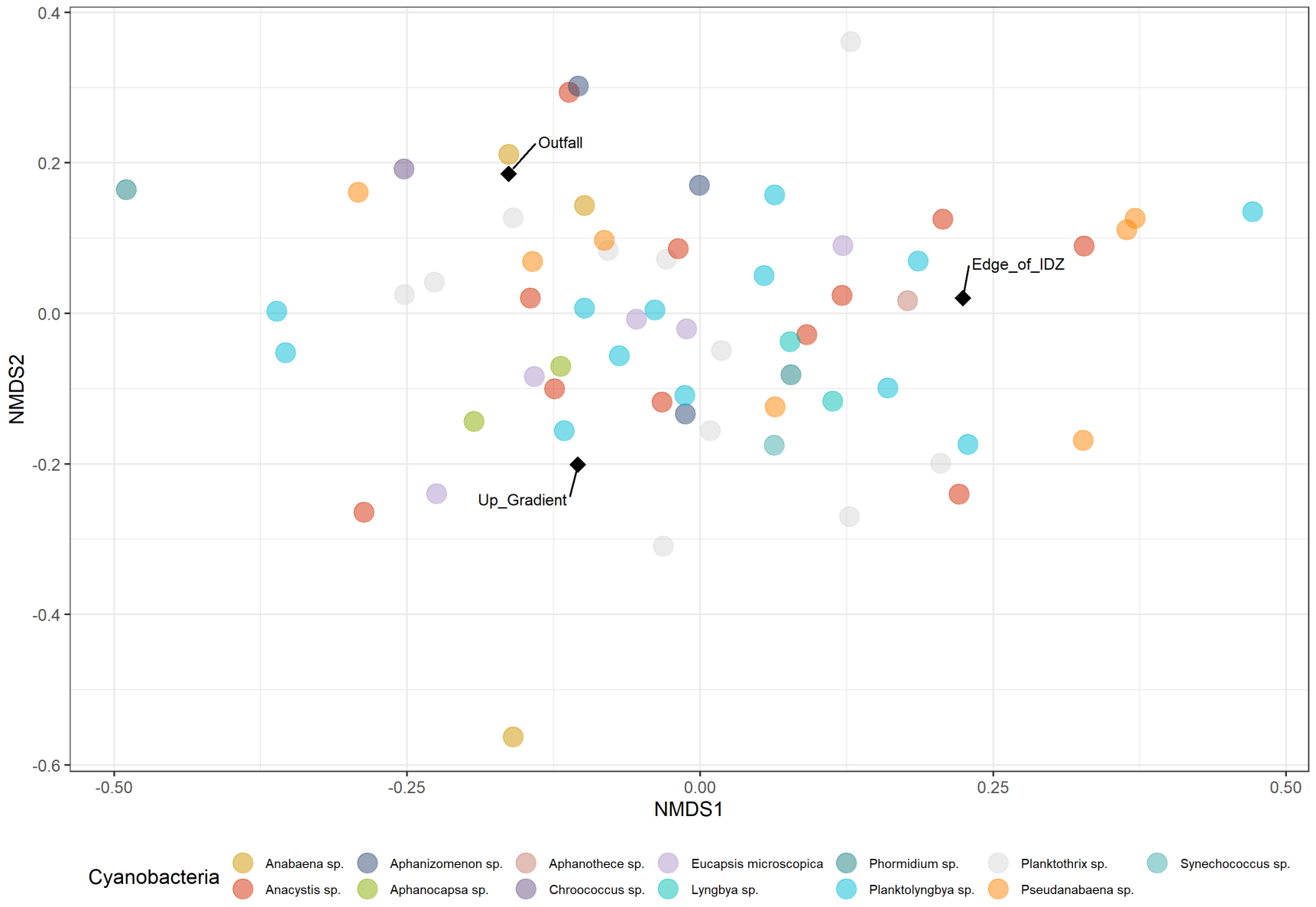
Figure 21: Phytoplankton taxonomy results during the 2024 discharge

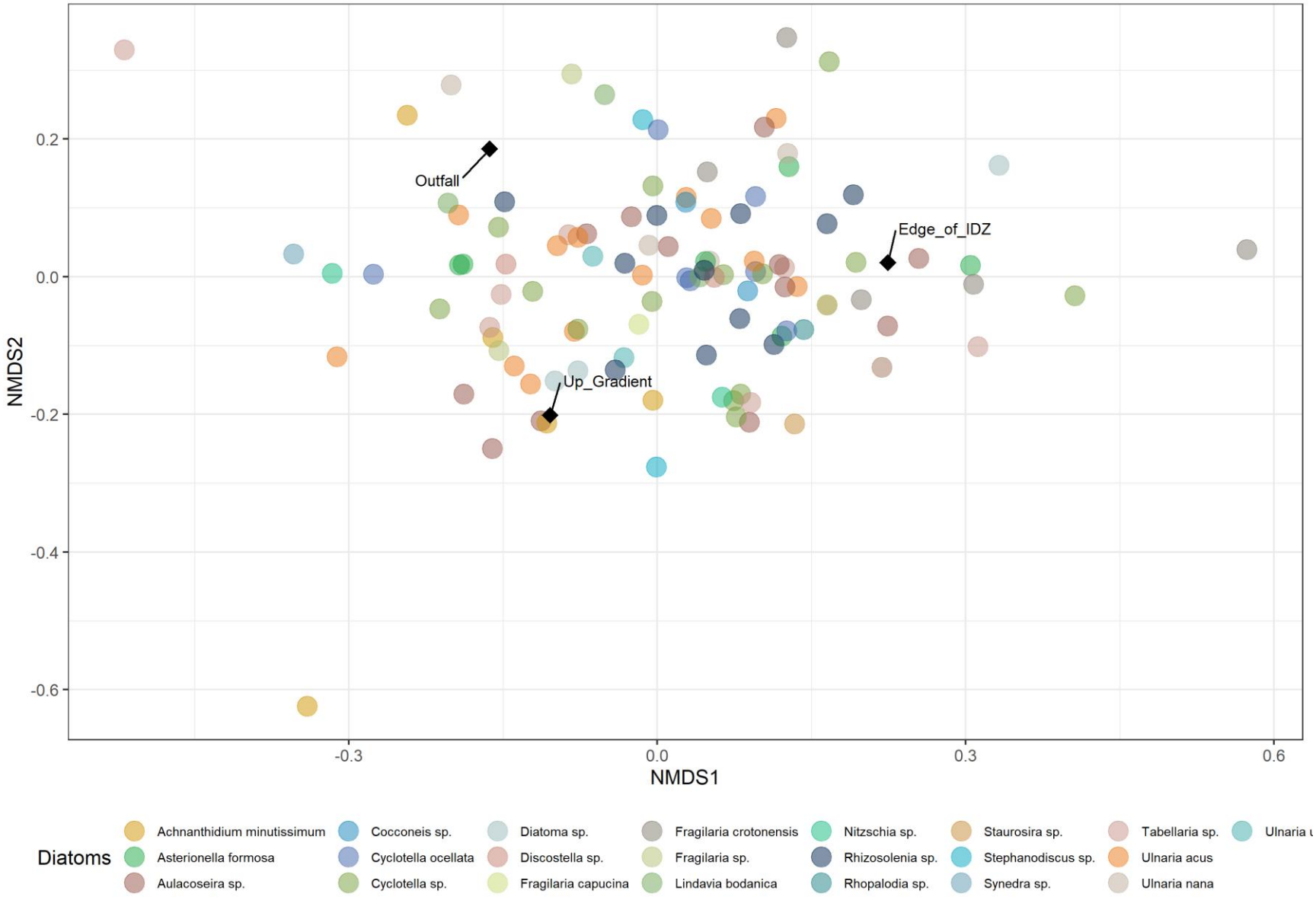
Appendix 5: Phytoplankton Taxonomy NMDS Plots

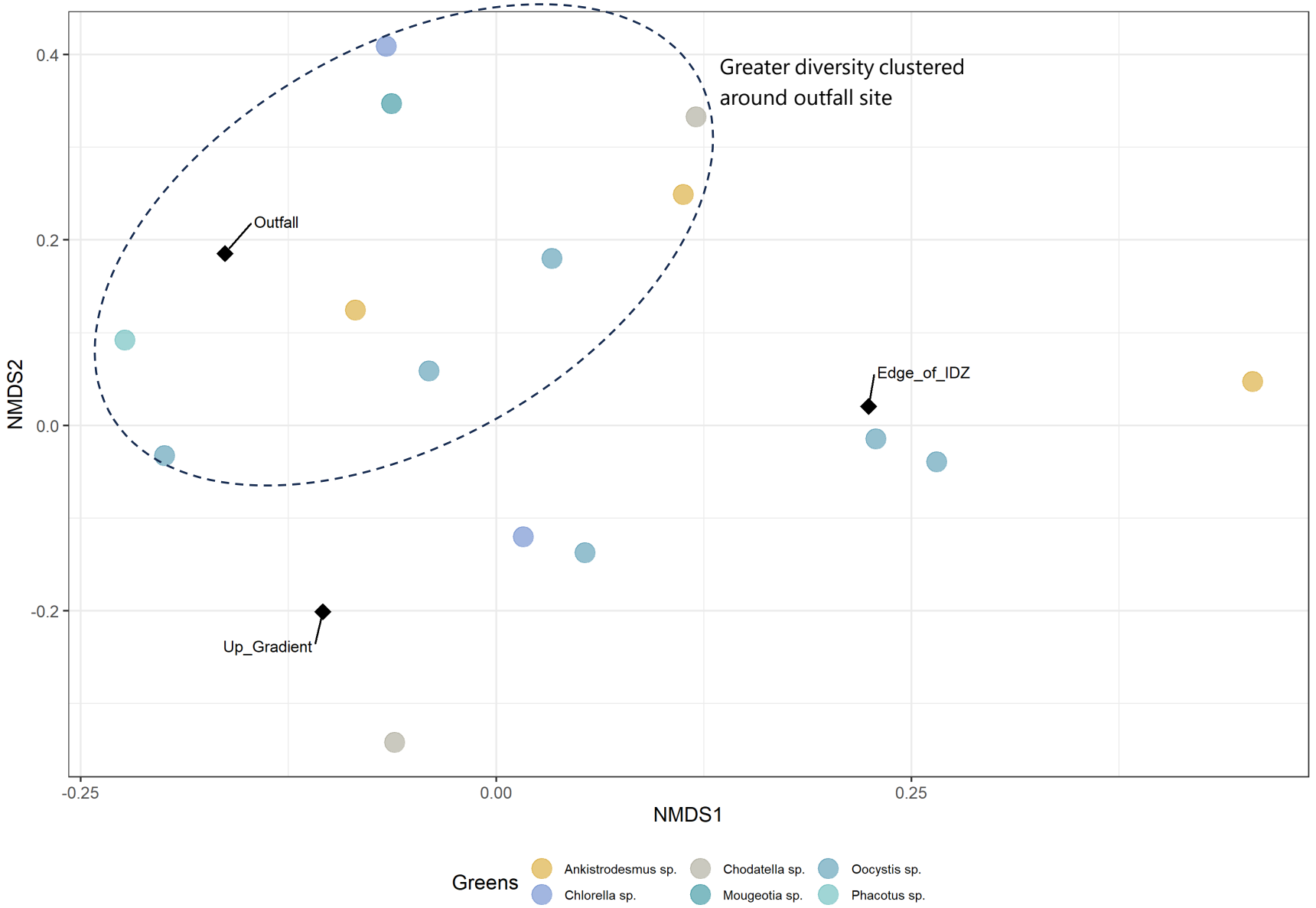


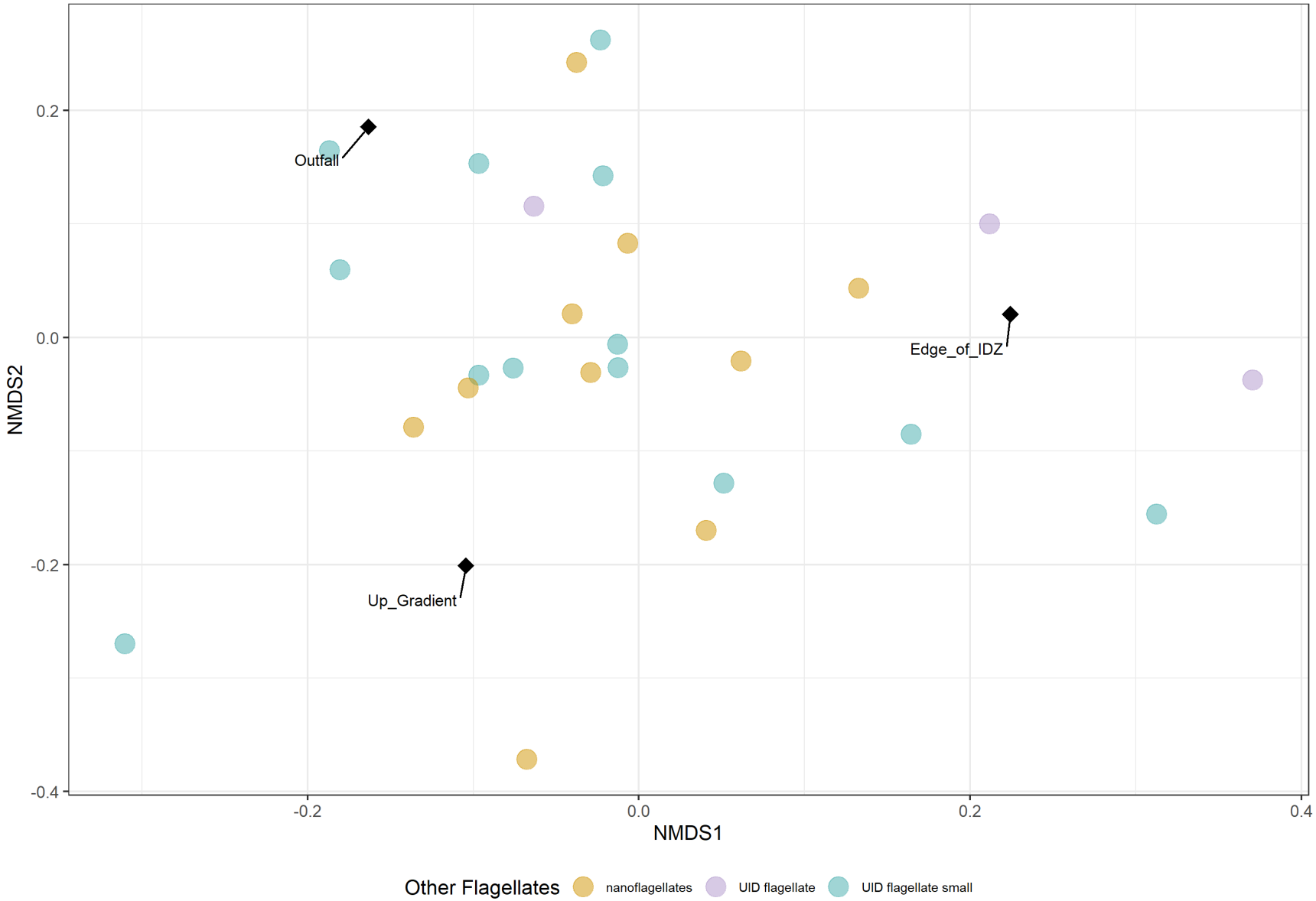

0.25
0.00
-0.25
-0.50
NMDS2
-0.3
0.0
0.3
0.6
NMDS1
Outfall
Edge_of_IDZ
Up_Gradient
Actinopoda
Chrysophyta
Cyanobacteria
Diatom
Euglenid
Green
Other.Flagellates
Protozoa
Achnanthidium minutissimum
Actinophryida
Amoeba sp.
Anabaena sp.
Anacystis sp.
Ankistrodesmus sp.
Aphanizomenon sp.
Aphanocapsa sp.
Aphanothece sp.
Asterionella formosa
Aulacoseira sp.
Bitrichia sp.
Chlorella sp.
Chodatella sp.
Chroococcus sp.
Cocconeis sp.
Cyclotella ocellata
Cyclotella sp.
Diatoma sp.
Dinobryon sp.
Discostella sp.
Eucapsis microscopica
Fragilaria capucina
Fragilaria crotonensis
Fragilaria sp.
Lindavia bodanica
Lyngbya sp.
Mallomonas sp.
Mougeotia sp.
nanoflagellates
Nitzschia sp.
Oocystis sp.
Phacotus sp.
Phormidium sp.
Planktolyngbya sp.
Planktothrix sp.
Pseudanabaena sp.
Rhizosolenia sp.
Rhopalodia sp.
Staurosira sp.
Stephanodiscus sp.
Synechococcus sp.
Synedra sp.
Tabellaria sp.
Trachelomonas sp.
UID flagellate
UID flagellate small
Ulnaria acus
Ulnaria nana
Ulnaria ulna


0.2
0.1
0.0
-0.1
-0.2
NMDS2
-0.4
-0.2
0.0
0.2
NMDS1
Outfall
Edge_of_IDZ
Up_Gradient
Chrysophytes
Bitrichia sp.
Dinobryon sp.
Mallomonas sp.

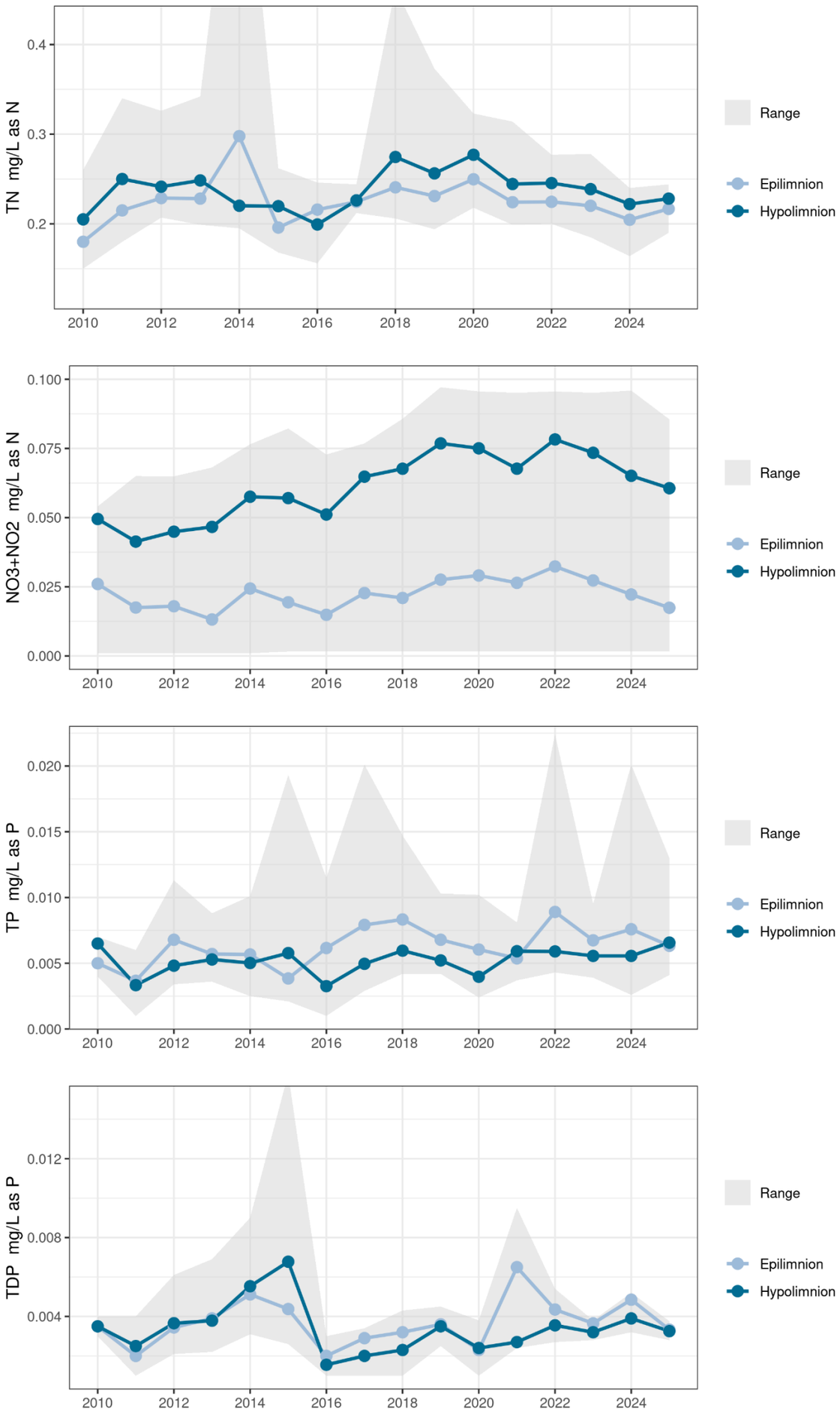

0.4
0.2
0.0
-0.2
-0.4
-0.6
NMDS2
-0.50
-0.25
0.00
0.25
0.50
NMDS1
Outfall
Edge_of_IDZ
Up_Gradient
Cyanobacteria
Anabaena sp.
Anacystis sp.
Aphanizomenon sp.
Aphanocapsa sp.
Aphanothece sp.
Chroococcus sp.
Eucapsis microscopica
Lyngbya sp.
Phormidium sp.
Planktolyngbya sp.
Planktothrix sp.
Pseudanabaena sp.
Synechococcus sp.


Outfall
Edge_of_IDZ
Up_Gradient
NMDS1
NMDS2
0.2
0.0
-0.2
-0.4
-0.6
-0.3
0.0
0.3
0.6
Diatoms
Achnanthidium minutissimum
Asterionella formosa
Aulacoseira sp.
Cocconeis sp.
Cyclotella ocellata
Cyclotella sp.
Diatoma sp.
Discostella sp.
Fragilaria capucina
Fragilaria crotonensis
Fragilaria sp.
Lindavia bodanica
Nitzschia sp.
Rhizosolenia sp.
Rhopalodia sp.
Staurosira sp.
Stephanodiscus sp.
Synedra sp.
Tabellaria sp.
Ulnaria acus
Ulnaria nana


Greater diversity clustered
around outfall site
Outfall
Edge_of_IDZ
Up_Gradient
NMDS1
NMDS2
0.4
0.2
0.0
-0.2
-0.25
0.00
0.25
Greens
Ankistrodesmus sp.
Chlorella sp.
Chodatella sp.
Mougeotia sp.
Oocystis sp.
Phacotus sp.


0.2
0.0
-0.2
-0.4
NMDS2
-0.2
0.0
0.2
0.4
NMDS1
Outfall
Edge_of_IDZ
Up_Gradient
Other Flagellates
nanoflagellates
UID flagellate
UID flagellate small

Appendix 6: Nutrient Concentrations in North Basin of Okanagan Lake from 2010-2025



Appendix 7: OC Sampling Program Requirements

Program	New Sampling Program	Old Sampling Program
Site Coordinates	Upgradient of discharge – 50.24710, -119.43786 (depth 63 m)	Background – 50.0899, -119.4783
	Edge of IDZ – 50.2131, -119.4241	
	Outfall – 50.21076, -119.42471 (depth	
Temperature and DO	Take temperature and DO measurements at 0.5 m, 1 m intervals down to approximately 30 m, 5 m intervals down to 60 m	Need temperature and DO at 1 m, 5 m, 10 m, and then 10 m intervals down to 60 m (can use measurements from new sampling program at IDZ)
Zooplankton	Use plankton net, lower down to 45 m (where knot is tied), and slowly pull back up. Preserve 10:1 (ethanol to sample).	
Secchi Disk	Record Secchi depth.	
Phytoplankton and Chlorophyll a	Collect grab samples from 0.5 m, Secchi depth, and twice the Secchi depth and compile into one bucket. Mix and fill sample containers. Keep phytoplankton cold or add 4 drops of Lugol's solution to the 400 mL jar.	Analyze grab samples from 1 m, 5 m, and 10 m for chlorophyll a.
Chemically Analyze	COMPOSITE SAMPLES with 2-4 samples collated to collect a sample from the epilimnion, and 2-4 samples collated to collect a sample from the hypolimnion. Analyze for: Total-P, diss-P, ortho-P TN, ammonia, nitrate, nitrite, TKN Faecal coliforms E. coli Chloride Sulphate Hardness Alkalinity pH	DISCRETE GRAB SAMPLES at each depth. Analyze samples collected at 1 m, 5 m, and 10 m for: Total-P, diss-P, ortho-P TN, ammonia, nitrate, nitrite, org-N, TKN Faecal coliforms Sodium Chloride pH Analyze samples collected at 20 m, 30 m, 40 m, 50 m, and 60 m for: Total-P, ortho-P TN, ammonia, nitrate, nitrite, TKN Faecal coliforms Sodium Chloride pH

---------- END OF REPORT ----------