Hosmer Septage Ponds
2020 Groundwater Monitoring Annual Report

PREPARED FOR:REGIONAL DISTRICT OF EAST KOOTENAY

PREPARED BY: SPERLING HANSEN ASSOCIATES

February, 2021

PRJ20050

SPERLING HANSEN ASSOCIATES

Regional District of East Kootenay

- Landfill Engineering
- Solid Waste Planning
- Environmental Monitoring
- Landfill Fire Control

1. INTRODUCTION

Sperling Hansen Associates (SHA) was retained by the Regional District of East Kootenay (RDEK) in 2020 to develop an updated Groundwater Monitoring Program (GMP) for seven (7) Solid Waste Management facilities located withing the RDEK. As part of this GMP update SHA, along with Subconsultant Bear Environmental Limited (BEAR), will conduct four (4) groundwater sampling events per year, and provide one interim report per event for each site. The goal of this program is to provide the RDEK with valuable information regarding the groundwater quality at disposal sites and to assist in developing appropriate monitoring and management measures for the next five years.

SHA was awarded this contract with the RDEK in April, 2020. The first two quarterly sampling events were completed by the previous consultant EcoLogic in January and April 2020. As SHA was brought on halfway through the year, the results of the first two sampling events were shared with SHA so that a complete data set for 2020 could be compiled, and that the complete data from all four events could be reviewed and included in this Annual report.

The final quarterly water sampling event for the year was completed in October, 2020 over a week period. Samples taken from each site are recorded below, and water quality analysis discussed in Section 4. This report details the sampling notes, lab analysis results, and trends observed at the wells throughout 2020. Section 5 presents recommendations for the next year of monitoring.

1.1 Location and Setting

The Hosmer site is located in the sub-region of Elk Valley within the RDEK. The site is approximately 5 km north of the community of Hosmer. The latitude and longitude are 49.63563 N and 114.92165 W respectively.

Photo 1-1. Hosmer Site Layout.

1.2 Site Operations

The site is around 1 hectare in size, and consists of two unlined septic waste disposal basins. The basins are located central on the site and occupy approximately 0.44 hectares.

Due to the nature of the septic waste when it comes into contact with water, it is required to monitor the groundwater on and surrounding the site to observe impacts from the exfiltration ponds. In compliance with Landfill Criteria for Municipal Solid Waste, Sperling Hansen Associates (SHA) was retained to conduct the groundwater monitoring for five (5) of the groundwater monitoring wells identified by the RDEK. The well locations are shown on Figure 1 and sampled quarterly in January, April, July, and October.

The property operates under certificate permit PE-6901, which is attached to this report as Appendix A.

2. MONITORING PROGRAM

Per the Site's Permit PE-6901, the RDEK is authorized to discharge septic tank pumpage and sewage holding tank effluent at 22.7 m^3/day from domestic and other sources through infiltration basins to the ground approximately 6.5 km north of Hosmer, BC. A groundwater monitoring program is not included in the Permit.

Per Section 85 of the BC Municipal Wastewater regulation, a discharger must install monitoring wells in sufficient number and orientation, as determined by a qualified professional, to measure background and receiving environment water quality. This includes at least 4 wells per aquifer, one of which must be a background monitoring well.

A total of five (5) monitoring wells exist and all were sampling in accordance to the BC Field Sampling Manual in 2020. Site monitoring wells are shown on Figure 1 and were sampled quarterly in January, April, July, and October.

2.1 Methodology

Subconsultant BEAR has been hired to implement the monitoring program and conduct field sampling for SHA. Each well sampled is tested for a set of parameters. These differ from site to site and some are only tested quarterly while others are only tested annually. Table 2-1 shows which parameters are tested Quarterly and Yearly.

Table 2-1. Groundwater Monitoring Parameters.

Site	Quarterly Params	Yearly Params
Hosmer Septage Treatment Pond	Temperature	Temperature
	Conductivity	Conductivity
	pH	pH
	Nitrite (N)	Nitrite (N)
	Nitrate (N)	Nitrate (N)
	Ammonia Nitrogen (NH3)	Ammonia Nitrogen (NH3)
	Fluoride (F)	Fluoride (F)
	Sulphate (SO4)	Sulphate (SO4)
	Chloride (Cl)	Chloride (Cl)
	Hardness	Hardness
	Total Alkalinity	Total Alkalinity
	Total Suspended Solids	Total Suspended Solids
	Fecal and Total Coliform	Fecal and Total Coliform
	Dissolved Metals	Dissolved Metals
		BTEX
		EPH/VPH

Analysis of the water samples was conducted by ALS Environmental, a CALA accredited laboratory. Samples were sent to ALS in Calgary via courier by BEAR. Certificates of Analysis (COA) are included in Appendix C. Based on internal laboratory QA/QC, the results are considered reliable. Note that COAs for Q1 and Q2 2020 were not available to SHA.

2.2 Groundwater Flow

The Hosmer site is located approximately 150 m directly east of the Elk River. The River is the closest surface water body to the Site. According to the BC Water Resources Atlas, there are no mapped aquifers underlying the site. Based on regional topography, groundwater is inferred to flow south west in the same direction as the Elk River. Locally, groundwater flow can be affected by building foundations, recharge areas, drainage and subsurface utilities. Depending on their depth, underground structures may significantly influence shallow groundwater flow in the vicinity of the Site. Locally, based on water levels collected in 2020, groundwater appears to flow west toward the Elk River. Well details are shown in the Table 2-2 below.

Table 2-2. Well Details and Water Level

Well ID	Well Construction	Water Level (from EcoLogic Reports)	Water Level (from EcoLogic Reports)	Q3 Depth to Water BGS (m)	Q4 Depth to Water BGS (m)
E265105	2" PVC	5.15	4.94	3.555	4.35
E265106	2" PVC	-	4.18	2.87	3.59
E265107	2" PVC	5.23	4.9	3.605	4.285
E265108	2" PVC	5.6	5.26	4.175	4.875
E265104	2" PVC	6	5.83	4.1	5.06

BGS – Below Ground Surface

2.3 Nomenclature

The reporting of monitoring wells at the East Kootenay sites has previously been a combination of Environmental Monitoring System Numbers (EMSN) and site number names that are the more common naming convention (MW-1). The majority of sites have both, but some wells only have the E number. To avoid confusion and the potential of double counting the wells, SHA has decided to use the E numbers when referring to them. This way reports and analyses can be consistent, and can be traced to the OC or Permit for the site. The site maps attached to these Annual Reports as Figure 1 have been updated to reflect this change and now have the EMSN numbers labelled.

2.4 Regulatory Criteria

The permit of operation for the site, published in 1983, does not specify water quality guidelines or standards to be used for comparison to assess groundwater. SHA has used the standards that are appropriate for the site to be consistent with the other solid waste sites in the RDEK.

The CSR Protocol 21 indicates that Drinking Water (DW) Standards generally apply where drinking water sources are within 500m of a site, or if a property is situated on an aquifer that could be used in the future for Drinking Water. A search for water wells revealed that there are no water wells within 500m of the Site. Information from the BC Water Atlas indicates that there are no mapped aquifers underlying the Site. Although current DW use appears to not apply to the site, without further investigation, future DW standards are assumed to apply. Note that future drinking water use applies where information is unavailable or inadequate to demonstrate an absence of drinking water aquifers below a site.

The BC Contaminated Sites Regulation (CSR) Protocol 21 indicates that Aquatic Life Standards (AW) generally apply to all groundwater located within 500 m of a surface water body containing aquatic life. The Site is located approximately 150m east of Elk River, therefore the Aquatic Life for Freshwater (AW) standards will apply.

Based on surrounding water use the following standards are considered to apply:

- The Schedule 3.2 of the BC CSR with consideration to Aquatic Life (AW) and Drinking Water (DW);

These standards and guidelines are the most recent published by BC ENV used to assess groundwater at contaminated sites and the quality of drinking water.

3. RESULTS

Permit PE-6901 does not outline parameters for monitoring. SHA has continued the monitoring program employed by EcoLogic for the past several years which are consistent with landfill leachate parameters analysed throughout the RDEK.

The parameters tested during this event include:

- temperature, conductivity, pH, nitrite, nitrate, ammonia nitrogen, fluoride, sulphate, chloride, hardness, alkalinity, total suspended solids, fecal and total coliform.

Appendix B attached shows the water quality analysis conducted by ALS Environmental, and Table B-1 provides the water quality analysis alongside the applicable water standards. Laboratory certificates are attached in Appendix C.

3.1 Exceedances

All parameters tested were below applicable BC CSR Schedule 3.2 AW standards.

The following parameters were above BC CSR Schedule 3.2 DW standards in one or more wells:

- Nitrate (as N)
- Arsenic
- Cobalt
- Iron
- Lithium.

Note that E.Coli and Fecal Coliform were present in some wells in numbers that exceed Canadian Drinking Water Standards.

Table 4-1 shows maximum concentrations.

Table 4-1. Maximum Parameter Concentrations Above BC CSR DW Standards

Parameter	BC CSR DW Standard	Maximum Concentration (mg/L)	Well Name
E.Coli	*No detectable bacteria per 100 mL	**45**	MW-7
Fecal Coliforms	*No detectable bacteria per 100 mL	**100**	MW-6
Nitrate (as N)	1 mg/L	**81.1**	MW-7
Lithium (Li)	0.008 mg/L	**0.0538**	E265105
Cobalt (Co)	0.001 mg/L	**0.0196**	E265107
Arsenic (As)	0.01 mg/L	**0.0215**	E265107
Iron (Fe)	6.5 mg/L	**18.1**	E265108

"*" Denotes applicable Canadian Drinking Water Standard as the is no BC CSR standards for coliforms. Green shading indicates a concentration above applicable standards.
Note: concentrations listed in the table are all above applicable DW standards. Maximum concentrations are shown in **bold.**

3.2 Notes on Regional Background Concentrations

As per the British Columbia Contaminated Sites Regulation (CSR) Schedule 3.2, 2019, the drinking water limit for Lithium (Li) is 8 µg/L or 0.008 mg/L. Many regions in B.C. have background concentrations of lithium that exceed this limit, which poses a complication for monitored sites that are required under Operation Certificates or Permits to avoid exceedances of harmful parameters. In response, the B.C. Ministry of Environment and Climate Change (BC ENV) published a document in 2018 qualifying the limit and providing background concentrations for three regions in the province for five metals, including arsenic, cobalt, and lithium. The limits published in the *Technical Bulletin 3: Regional Background Concentrations for Select Inorganic Substances in Groundwater* account for naturally occurring levels of the five metals, and are therefore higher than the limit within the CSR currently.

However, these three regions only comprise the Lower Mainland, South Vancouver Island, and Thompson-Okanagan. SHA believes the exceedances in lithium observed at the RDEK sites are attributable to natural background concentrations that are not accounted for in the CSR Schedule 3.2 or *Technical Bulletin 3*. It should be noted that Eco/Logic did not have a comparison limit for lithium, which explains why lithium was not a reported exceedance in previous years despite there being little difference between 2019 and 2020 results.

Thompson-Okanagan, the nearest region to the RDEK with a back ground concentration qualifier for lithium, has a qualified concentration in the Bulletin of 96 µg/L, or 0.096 mg/L. Arsenic has a background concentration of 0.013 mg/L, and Cobalt 0.02 mg/L. SHA recommends keeping a note of this and a close eye on these parameters in ongoing monitoring. SHA does not believe the RD needs to look into remediation measures at this point, but recommends the RD flag this exceedance history in the case that the Ministry publishes background concentrations for the Kootenay region.

4. DISCUSSION

All parameters tested were below applicable BC CSR Schedule 3.2 AW standards.

Parameters above applicable BC CSR Schedule 3.2 DW standards included the following.

- Nitrate
- Lithium
- Cobalt
- Iron
- Arsenic
- E.Coli (above the Canadian Drinking Water Standard)
- Fecal Coliform (above the Canadian Drinking Water Standard)

The maximum concentration of lithium was found at E265105 at 0.0538 mg/L versus the BC CSR DW standard of 0.008 mg/L. The maximum concentration of cobalt was found at E265107 at 0.0196 mg/L versus the BC CSR DW standard of 0.001 mg/L. The maximum arsenic concentration was found at E265107 at 0.0215 mg/L versus the BC CSR DW standard of 0.01 mg/L. The maximum iron concentration was found at E265108 at 18.1 mg/L versus the BC CSR DW standard of 6.5 mg/L.

These maximums are calculated as the following times their respective standards:

- Lithium – 6.7
- Cobalt – 19.6
- Arsenic – 2.1
- Iron – 2.8

Note that bacterial coliforms and elevated nitrate were also found in site groundwater indicating expected local impacts from the sewage infiltration basins.

SHA reviewed Site and surrounding water use per CSR Protocol 21. Although current DW use appears to not apply to the site, without further investigation of the underlying unmapped aquifer, future DW standards are assumed to apply.

Based on this information regarding current water use, and results that show concentrations below applicable AW standards, SHA considers the impacts of the sewage infiltration basin to the surrounding environment to be low.

4.1 Trend Analysis

To illustrate the trends observed in key parameters at the wells sampled, SHA has prepared figures that combine the 2020 analytical results with the applicable criteria limits.

- Figure 2 – Lithium concentrations
- Figure 3 – Sulfate concentrations
- Figure 4 – Sodium concentrations
- Figure 5 – Chloride concentrations
- Figure 6 – Nitrate Concentrations
- Figure 7 – Specific Conductance (Conductivity)
- Figure 8 – Cobalt
- Figure 9 – Iron
- Figure 10 – Arsenic

The red line on each figure represents the limit for that parameter according to the criteria, to show if wells are under or exceeding the maximum allowable concentration at the time of each quarterly sampling event.

Sulfate, sodium, chloride, nitrate, and nitrite are graphed because they are typical landfill indicators. As shown in the graphs, these parameters are below allowable limits and show the landfill is not impacting groundwater chemistry beyond regulatory standards.

Please note that the graphs provided are for observing trends, and data less than or equal to the detection limit for a parameter appears on graphs as trace concentrations. If a well shows to have no data on the graph, please refer to the master data table for the exact parameter concentration.

5. CONCLUSIONS AND RECOMMENDATIONS

Some parameters generally associated with sewage effluent including nitrate, arsenic, E. Coli, and fecal coliforms were noted above applicable BC CSR DW Standards, but below BC CSR AW standards in Site groundwater. Although there appears to be local impacts to groundwater from the Site's sewage infiltration basins, SHA considers the overall impacts to human health and the surrounding environment to be low based on Site and surrounding water use.

Other metals parameters that appear slightly elevated included lithium, cobalt, and iron that may be related to Site impacts but may also be naturally occurring. In conducting analyses for seven different sites within the RDEK with similar exceedances of lithium under the CSR DW limit, SHA believes these elevated concentrations are a region-wide occurrence caused by existing background concentrations rather than impacts caused by activities at the solid waste sites.

SHA recommends the following:

Slight parameter concentrations of dissolved metals above applicable standards were detected in the Site groundwater monitoring wells. SHA recommends that a future groundwater sampling event be conducted using a low flow method to minimize the re-suspension of colloidal materials that can be caused during sampling with bailers and/or Waterra inertia pumps. If this sampling method is effective in providing a more accurate interpretation of groundwater data and able to show the groundwater exceedances are a result of suspended materials from bailer sampling, then SHA could make a recommendation to the Regional District to implement this sampling method for the monitoring going forward.

The next sampling event, scheduled in Q2 in April 2021, will also be the annual sampling and analysis event. This follows the same schedule of 2020 that EcoLogic followed. SHA believes this makes the most sense as spring is the most likely time of year that all wells are accessible and have adequate water flow for sampling.

6. STATEMENT OF LIMITATIONS

This report has been prepared by Sperling Hansen Associates. (SHA) on behalf of the Regional District of East Kootenay (RDEK) in accordance with generally accepted engineering practices to a level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions in British Columbia.

The report is based on site visits, project experience, and analysis by SHA staff of data compiled during the preparation of this report from a number of sources. Except where specifically stated to the contrary, the information on which this study is based has been obtained from external sources. This external information has not been independently verified or otherwise examined by SHA to determine its accuracy and completeness. SHA has relied in good faith on this information and does not accept responsibility of any deficiency, misstatements or inaccuracies contained in the reports as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

The report is intended solely for the use of the RDEK. Any use which other parties makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such other parties. SHA does not accept any responsibility for other uses of the material contained herein nor for damages, if any, suffered by any third party because of decisions made or actions based on this report. Copying of this intellectual property for other purposes is not permitted.

The findings and conclusions of this report are valid only as of the date of this report. The interpretations presented in this report and the conclusions and recommendations that are drawn are based on information that was made available to SHA during the course of this project. Should additional new data become available in the future, SHA should be requested to re-evaluate the findings of this report and modify the conclusions and recommendations drawn, as required.

Should you have any questions on this report or require further assistance or information, please feel free to contact the undersigned at 778-471-7088 or 604-986-7723.

Report prepared by:

Chloe Hetherington
Environmental Analyst Assistant

Rahim Gaidhar
GIT, Project Geoscientist

Report reviewed by:

Scott Garthwaite
Sr. Civil Technologist

7. REFERENCES

Eco/Logic Environmental, Hosmer Septage Treatment Ponds Groundwater Monitoring Report 2019, prepared for the Regional District of East Kootenay.

Environmental Management Act, BC Contaminated Sites Regulation Schedule 3.2, 2019.

Ministry of Environment, BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report, August 2019.

RDEK Public Web Map 2020, retrieved from https://www.rdek.bc.ca/departments/mapping

7. REFERENCES

Eco/Logic Environmental, Hosmer Septage Treatment Ponds Groundwater Monitoring Report 2019, prepared for the Regional District of East Kootenay.

Environmental Management Act, BC Contaminated Sites Regulation Schedule 3.2, 2019.

Ministry of Environment, BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report, August 2019.

RDEK Public Web Map 2020, retrieved from https://www.rdek.bc.ca/departments/mapping

SPERLING HANSEN ASSOCIATES

Regional District of East Kootenay

PROJECT:

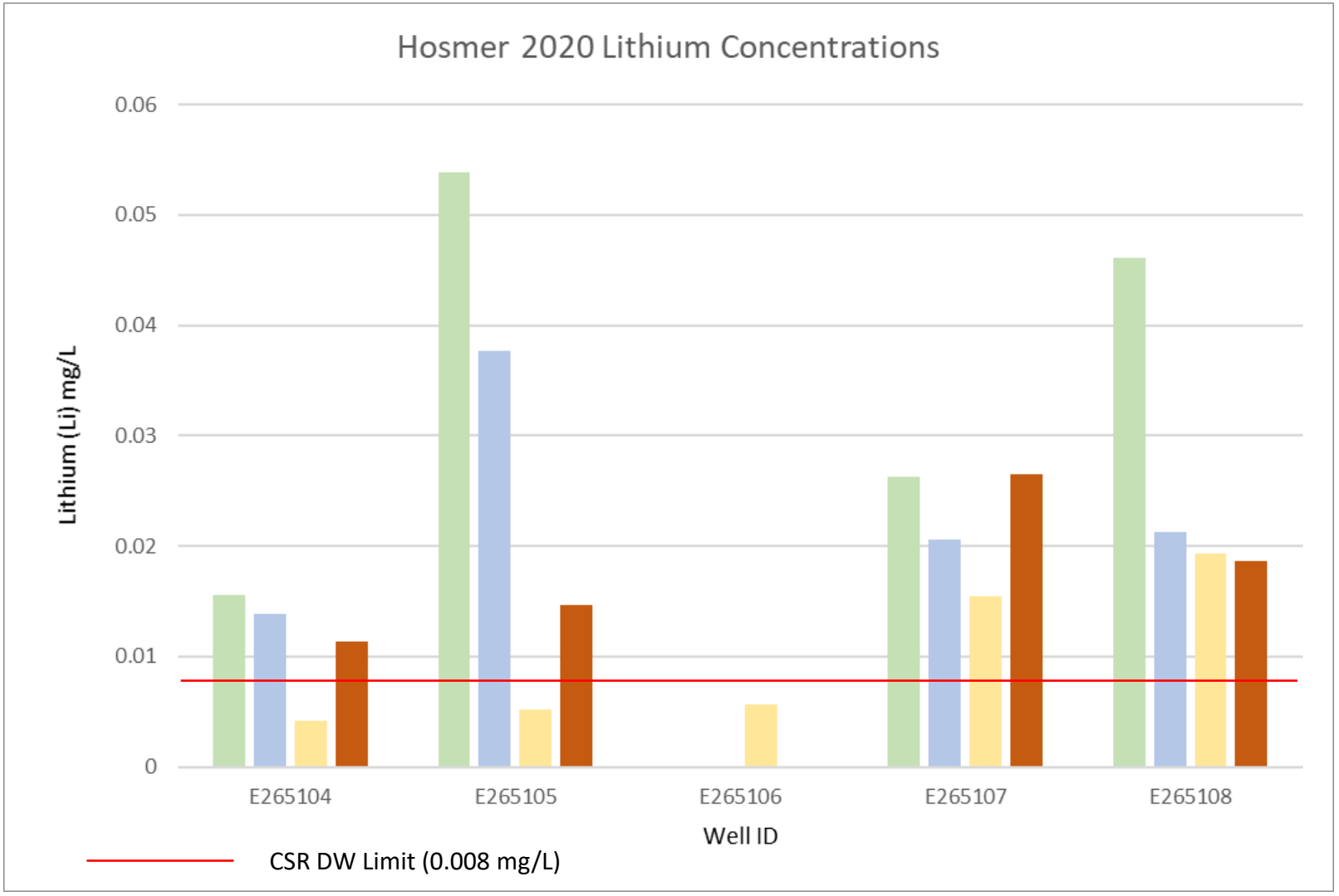
SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025

TITLE:

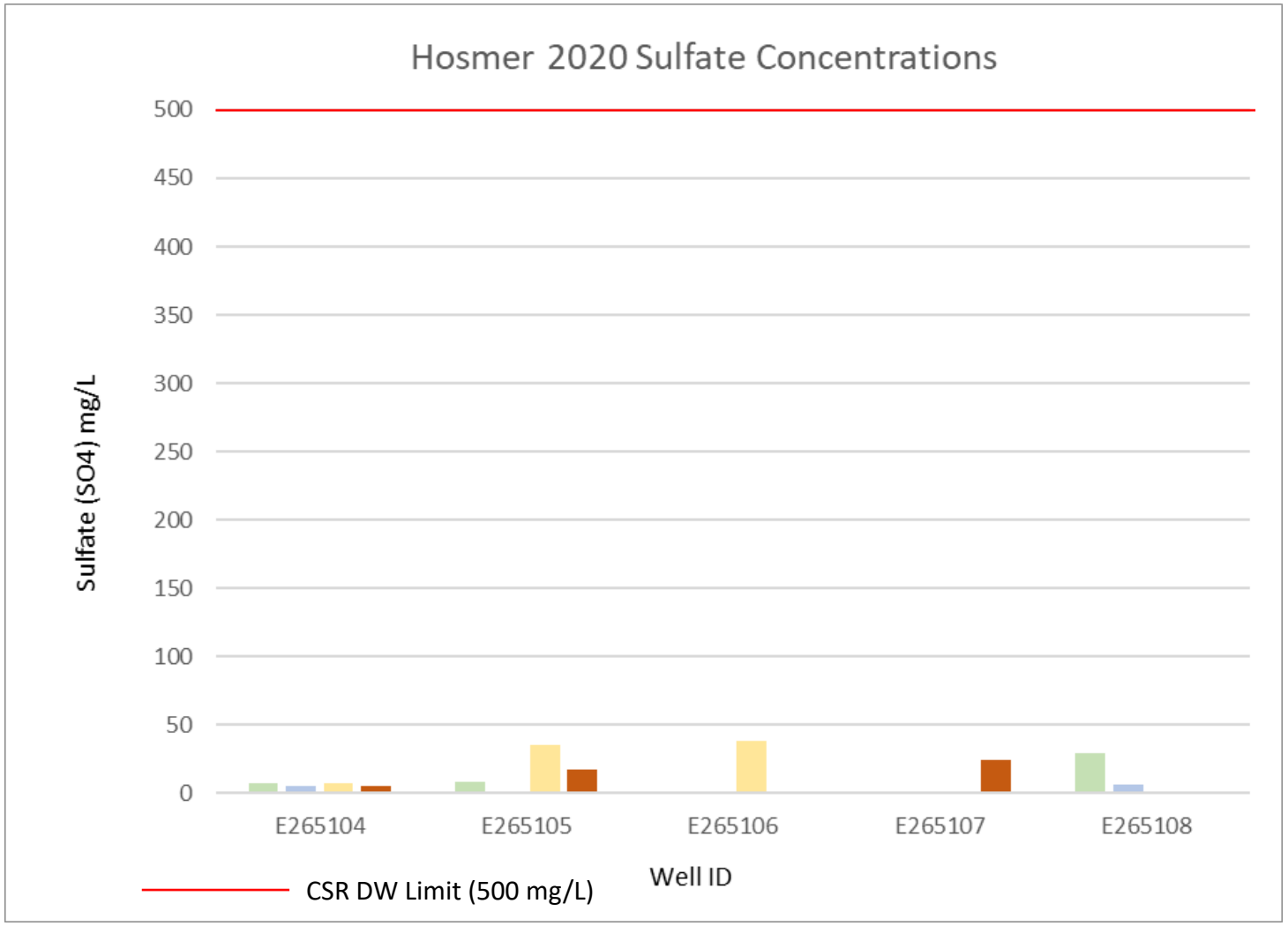
HOSMER SEPTAGE TREATMENT POND

MONITORING LOCATIONS

SCALE:	DATE:	PROJECT NO:
N/A	2020/10/01 yyyy/mm/dd	**20050**
DESIGNED	-	DRAWING NO:
DRAWN	MG	**Figure 1**
CHECKED		

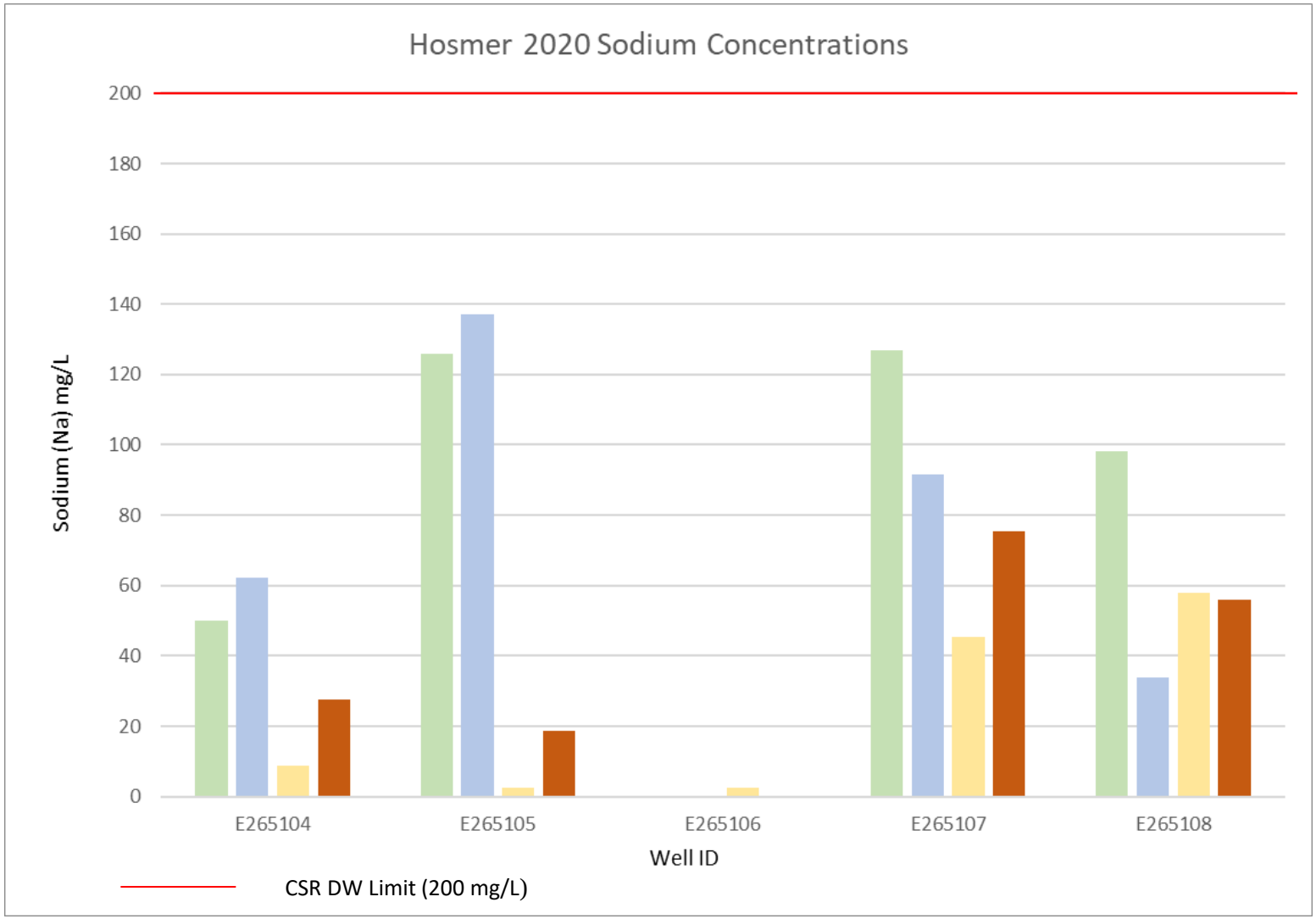


Sperling Hansen Associates	Regional District of East Kootenay	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Lithium Concentrations	SCALE: N/A; DATE: 28/01/2021 yyyy/mm/dd; PROJECT NO: 20050; DESIGNED; DRAWN CH; CHECKED SG; DRAWING NO: Figure 2



Sperling Hansen Associates	Regional District of East Kootenay	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Sulfate Concentrations

SCALE:	DATE:	PROJECT NO:
N/A	28/01/2021 (yyyy/mm/dd)	20050
DESIGNED		DRAWING NO:
DRAWN	CH	Figure 3
CHECKED	SG	



SPERLING HANSEN ASSOCIATES

Regional District of East Kootenay

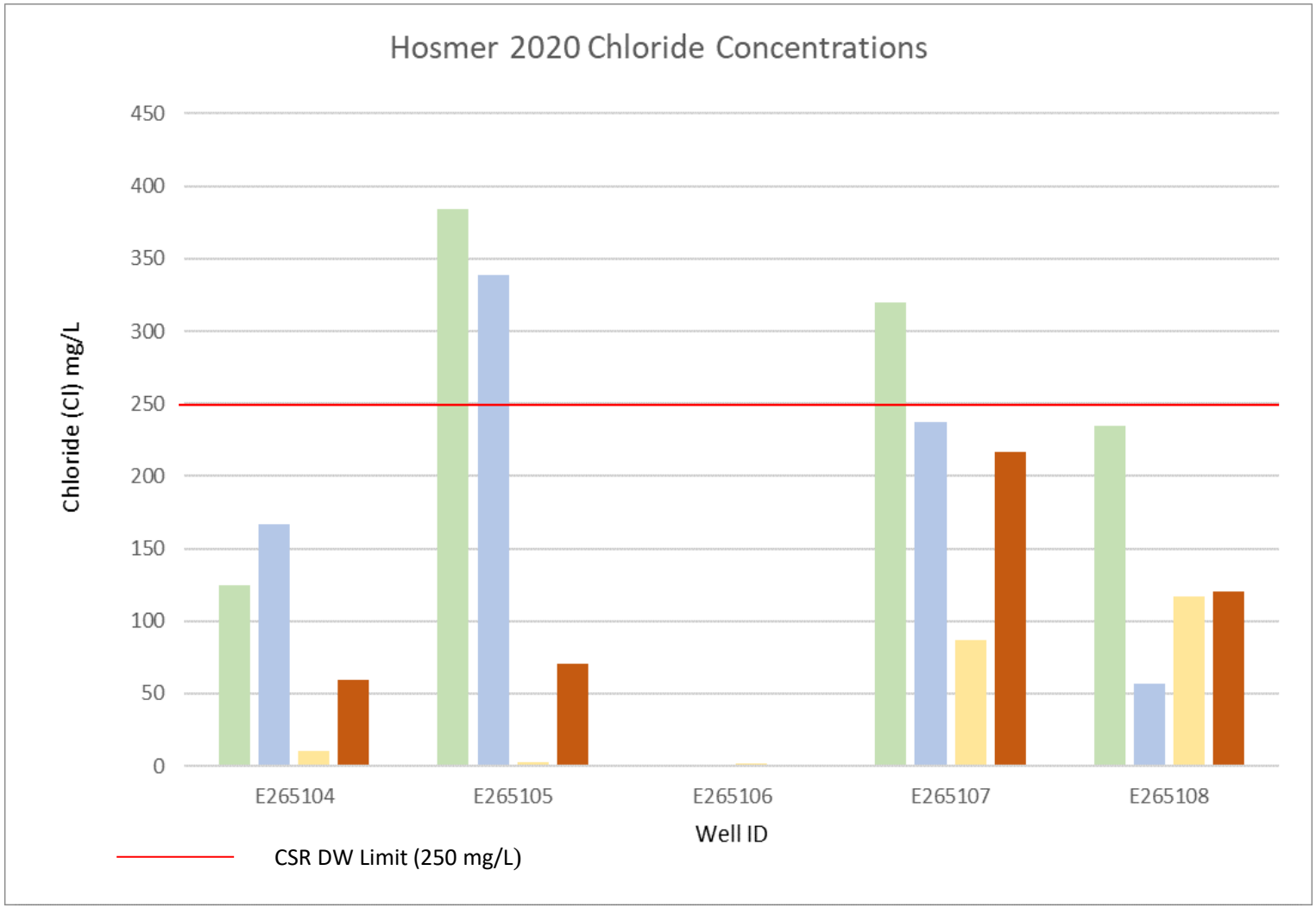
PROJECT:

SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025

TITLE:

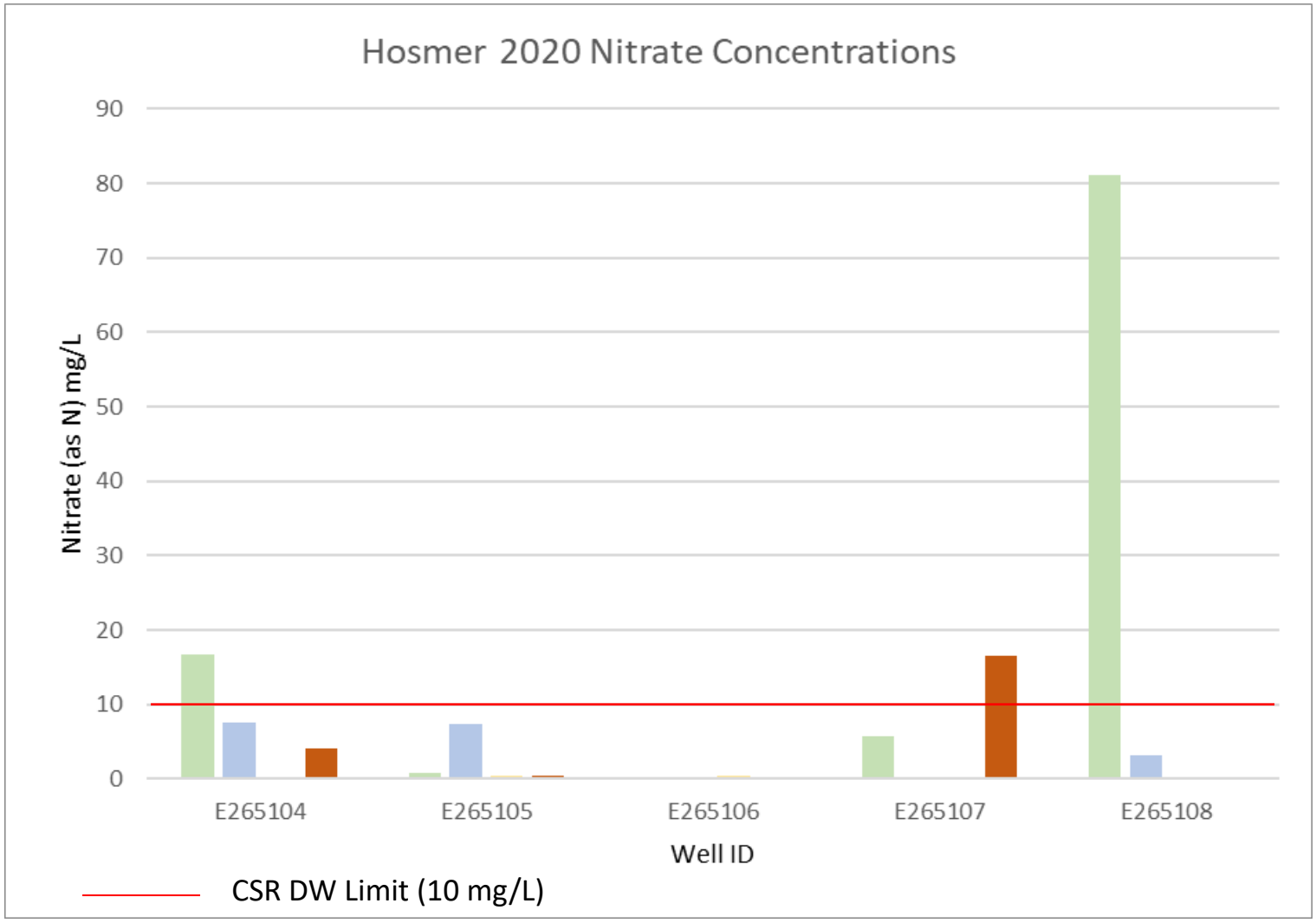
2020 Sodium Concentrations

SCALE:	DATE:	PROJECT NO:
N/A	28/01/2021 (yyyy/mm/dd)	20050
DESIGNED	-	DRAWING NO:
DRAWN	CH	**Figure 4**
CHECKED	SG	



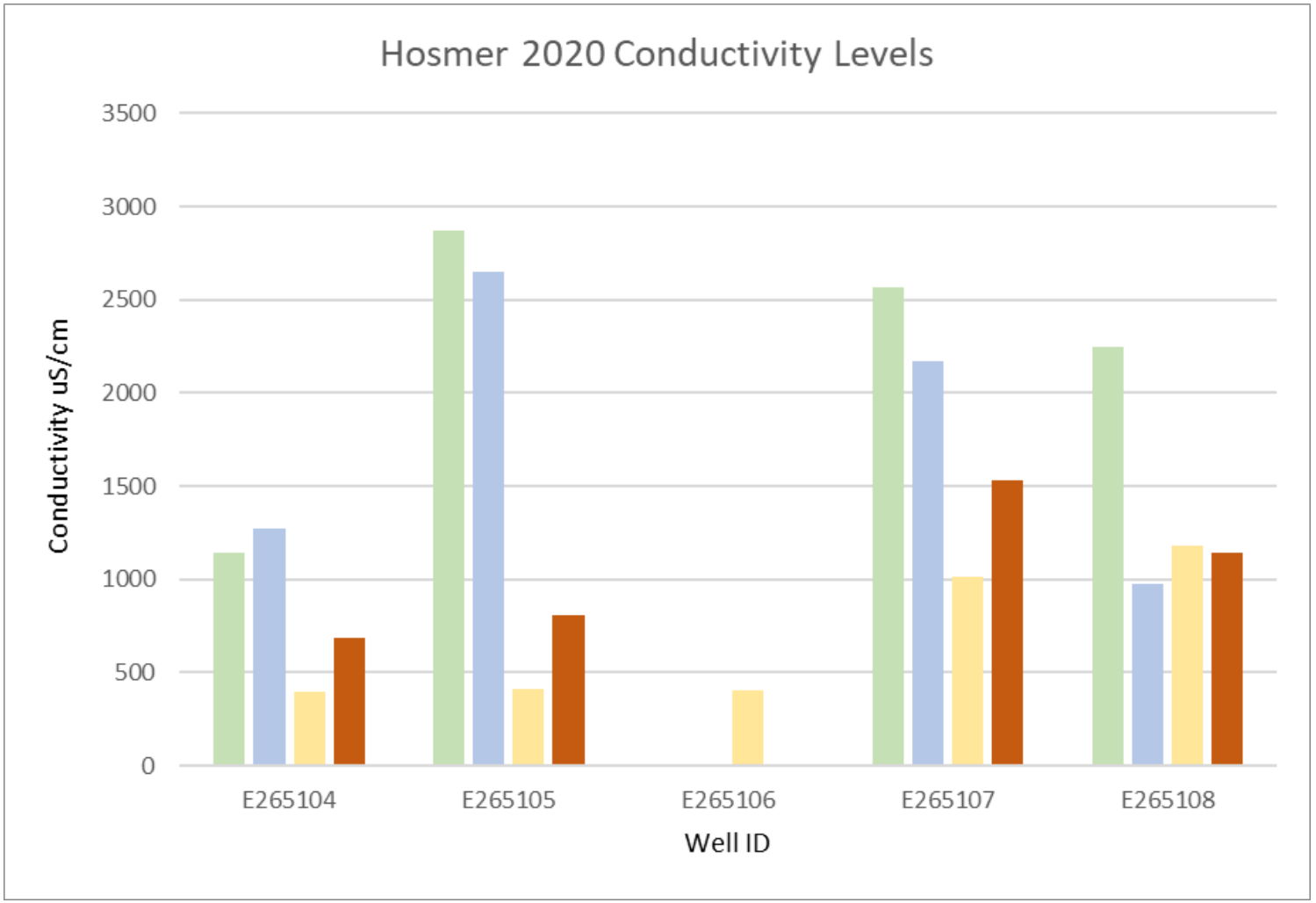
Sperling Hansen Associates	Regional District of East Kootenay	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Chloride Concentrations

SCALE: N/A	DATE: 28/01/2021 yyyy/mm/dd	PROJECT NO: 20050	
DESIGNED		DRAWING NO: Figure 5	
DRAWN	CH		
CHECKED	SG		

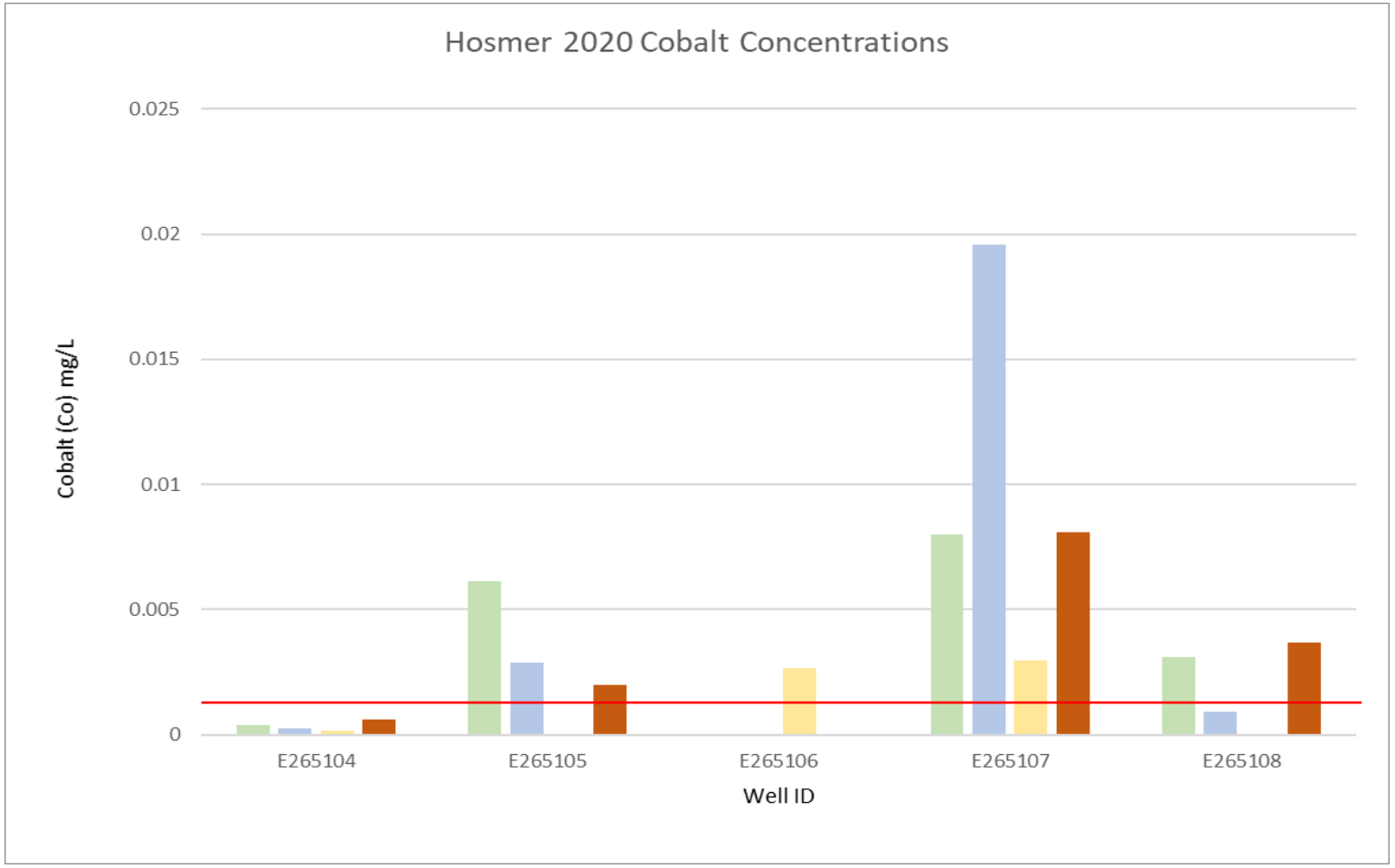


Sperling Hansen Associates	Regional District of East Kootenay	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Nitrate Concentrations

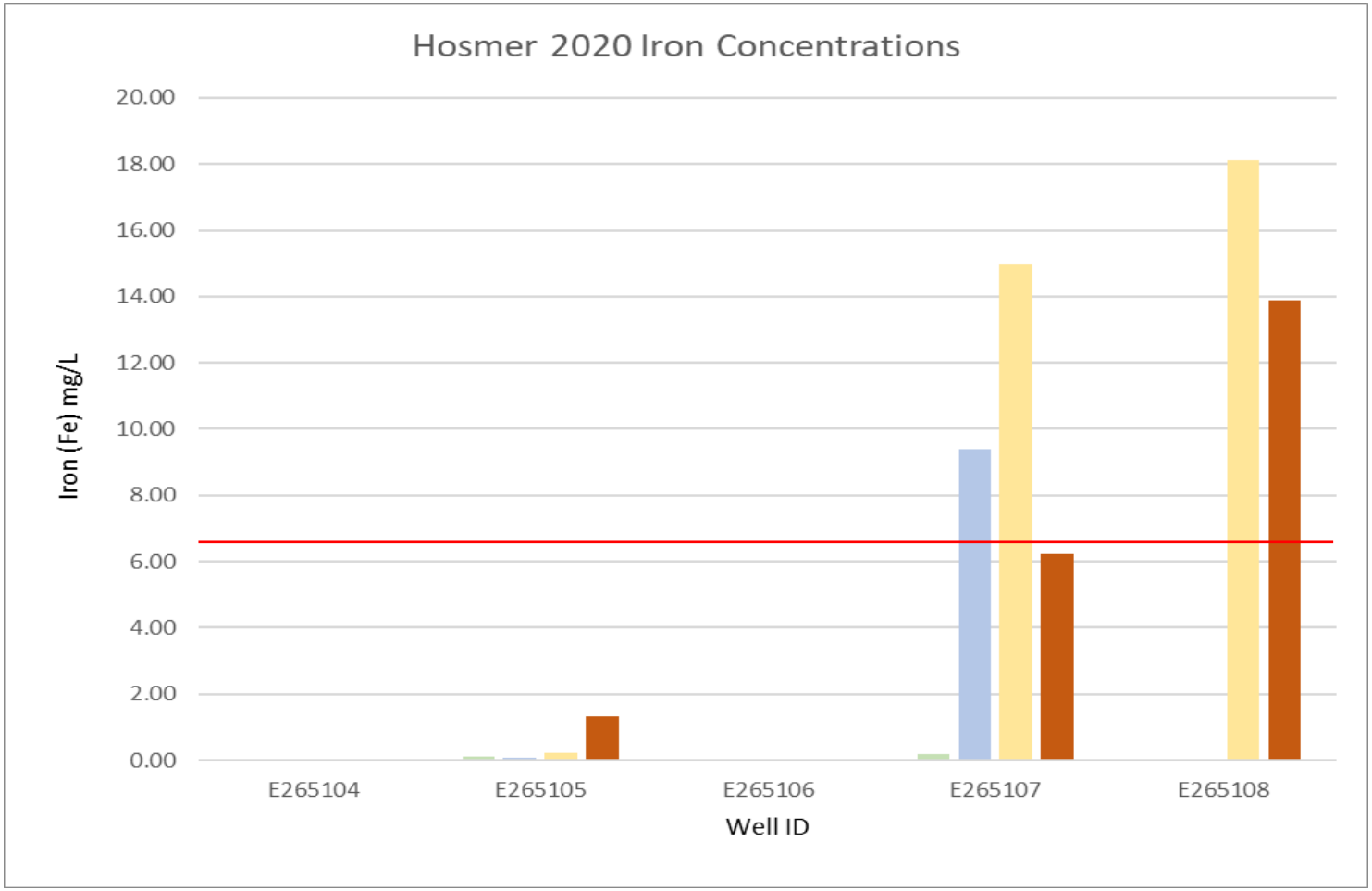
SCALE: N/A	DATE: 28/01/2021 yyyy/mm/dd	PROJECT NO: 20050	
DESIGNED		DRAWING NO: Figure 6	
DRAWN	CH		
CHECKED	SG		



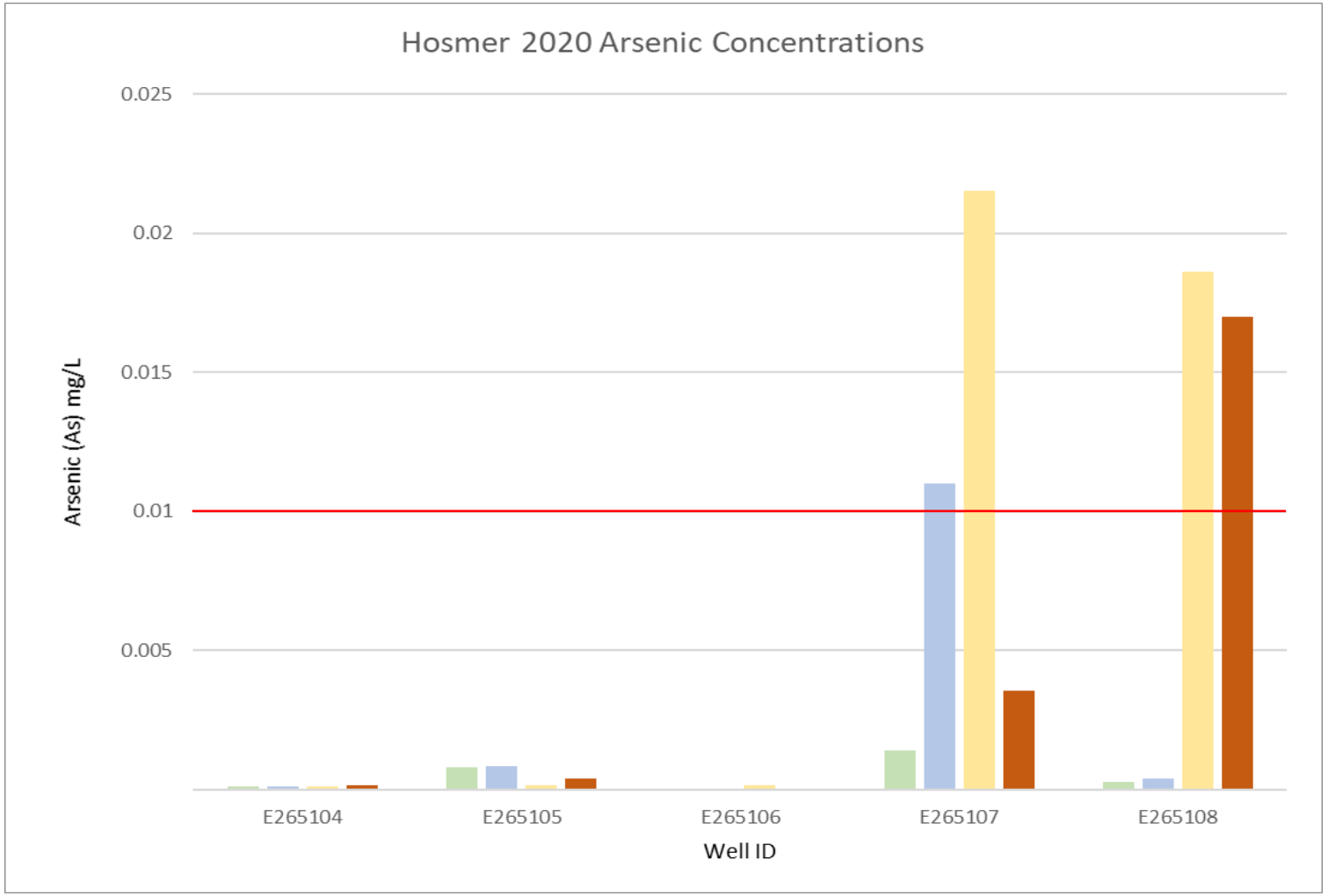
Sperling Hansen Associates	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Conductivity Trend	SCALE: N/A; DATE: 28/01/2021 yyyy/mm/dd; PROJECT NO: 20050
Regional District of East Kootenay			DESIGNED; DRAWN: CH; CHECKED: SG; DRAWING NO: Figure 7



Sperling Hansen Associates	Regional District of East Kootenay	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Cobalt Concentrations	SCALE: N/A; DATE: 28/01/2021 yyyy/mm/dd; PROJECT NO: 20050; DESIGNED; DRAWN CH; CHECKED SG; DRAWING NO: Figure 7



Sperling Hansen Associates	Regional District of East Kootenay	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Iron Concentrations	SCALE: N/A; DATE: 28/01/2021 yyyy/mm/dd; PROJECT NO: 20050; DESIGNED; DRAWN CH; CHECKED SG; DRAWING NO: Figure 8



Sperling Hansen Associates	Regional District of East Kootenay	PROJECT: SOLID WASTE FACILITY MONITORING PROGRAM 2020-2025	TITLE: 2020 Iron Concentrations	SCALE: N/A; DATE: 28/01/2021 yyyy/mm/dd; PROJECT NO: 20050; DESIGNED; DRAWN CH; CHECKED SG; DRAWING NO: Figure 8

Table B-1

					Q1 (EcoLogic)					Q2 (EcoLogic)					Q3					Q4				
					Jan-20					Apr-20					Jul-20					Oct-20				
					CSR	CSR		CSR	CSR	CSR	CSR		CSR	CSR	CSR	CSR	CSR	CSR	CSR	CSR	CSR	CSR	CSR	CSR
ALS		CSR-AW 2019 (2)	CSR-DW 2019 (2)	Sample ID	E265104	E265105	E265106	E265107	E265108	E265104	E265105	E265106	E265107	E265108	E265104	E265105	E265106	MW-6	MW-7	E265104	E265105	E265106	E265107	E265108
				Well Name	-	-		-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
8/7/2020				ALS ID	VA20A0149-001	VA20A0149-002		VA20A0149-003	VA20A0149-004	-	-		-	-	L2478666-1	L2478666-2	L2478666-3	L2478666-4	L2478666-5	L2520199-1	L2520199-2	L2478666-3	L2520199-3	L2520199-4
Multiple Work Orders				Date Sampled	5-Jan-20	5-Jan-20		5-Jan-20	5-Jan-20	1-Apr-20	1-Apr-20		1-Apr-20	1-Apr-20	7/22/2020	7/22/2020	7/22/2020	7/22/2020	7/22/2020	21/10/2020	21/10/2020	7/22/2020	21/10/2020	21/10/2020
Analyte	Units			LOR																				
Site					Hosmer	Hosmer		Hosmer	Hosmer	Hosmer	Hosmer		Hosmer	Hosmer	Hosmer	Hosmer	Hosmer	Hosmer	Hosmer	Hosmer	Hosmer	Hosmer	Hosmer	Hosmer
Hardness (as CaCO3)	mg/L	-	-	0.5	435	849	-	778	787	481	741	-	468	425	244	251	275	280	308	361	456	Insufficient recharg	481	292
Total Suspended Solids	mg/L	-	-	1	<3.0	8.5	-	105	388	6.1	11.1	-	83.8	27.5	4.9	14.7	2840 *	136 *	353 *	9.2	146	-	87.0	2650
Alkalinity, Total (as CaCO3)	mg/L	-	-	2	353	987	-	905	500	360	842	-	726	420	203	198	202	406	451	304	385	-	457	495
Ammonia as N (a)	mg/L	1.31-18.4	-	0.005	4.54	55.7	-	55.3	24.9	2.84	80.6	-	114	3.25	0.198	0.346	0.0864	50.0 *	97.4 *	3.88	8.01	-	53	56.0
Bicarbonate (HCO3)	mg/L	-	-	5	-	-	-	-	-	-	-	-	-	-	247	241	246	495	550	371	469	-	558	603
Carbonate (CO3)	mg/L	-	-	5	-	-	-	-	-	-	-	-	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0
Chloride (Cl)	mg/L	1,500	250		125	384	-	320	235	167	339	-	237	56.8	10.1	2.69	2.06	86.8	117	59.2	70.7	-	217	120
Conductivity (EC)	uS/cm	-	-	2	1140	2870	-	2570	2250	1270	2650	-	2170	975	395	411	405	1010	1180	683	809	-	1530	1140
Fluoride (F)	mg/L	2.0-3.0	1.5	0.02	0.127	<0.400	-	<0.400	<0.400	<0.100	<0.400	-	<0.400	0.12	0.132	0.153	0.161	0.30 *	0.26 *	0.171	0.23	-	0.33	0.44
Hydroxide (OH)	mg/L	-	-	5	-	-	-	-	-	-	-	-	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	<5.0	<5.0
Nitrate and Nitrite (as N)	mg/L	-	-	0.0051	-	-	-	-	-	-	-	-	-	-	0.327	0.475	0.432	0.045	<0.025	4.19	0.536	-	16.7	0.348
Nitrate (as N)	mg/L	400	10	0.005	16.8	0.759	-	5.82	81.1	7.53	7.31	-	<0.100	3.11	0.313	0.474	0.429	0.037	<0.025	4.18	0.529	-	16.6	0.328
Nitrite (as N)	mg/L	0.2-2	1	0.001	-	-	-	-	-	-	-	-	-	-	0.014	0.001	0.0022	0.0082 *	0.0066 *	0.0071	0.0068	-	0.138	0.0197
pH	pH	-	-	0.1	7.93	7.43	-	7.31	7.24	7.4	7.47	-	7.15	7.41	7.97	8.09	8.07	8.19	8.01	7.93	7.90	-	7.96	8.05
Orthophosphate-Dissolved (as P)	mg/L	-	-	0.001	-	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010	0.0019	0.014	0.0011	-	-	-	-	-
Phosphorus (P)-Total	mg/L	-	-	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulfate (SO4)	mg/L	1,280-4,290	500	0.05	7.69	7.84	-	<6.00	29.2	5.49	<6.00	-	<6.00	6.72	6.96	35.7	38.4	0.43 *	0.28 *	5.13	17.0	-	24.1	0.63
Total Organic Carbon	mg/L	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	-	-		0.8	25.9	-	110	282	1.76	3.5	-	35.4	10.6	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand	mg/L	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical Oxygen Demand	mg/L	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MPN - E. Coli	MPN/100mL	-	-	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<100 *	6	45	<1	<1	-	<1	<1
Coliform Bacteria - Fecal	CFU/100mL	-	-	1	-	-	-	-	-	-	-	-	-	-	<1	<1	<100 *	100 *	<100 *	<1	<2	-	<2	<100
MPN - Total Coliforms	MPN/100mL	-	-	1	-	-	-	-	-	-	-	-	-	-	6	<1	<100 *	260	580	<1	3	-	<1	<100
Dissolved Metals																								
Aluminum (Al)-Dissolved	mg/L	-	9.5	0.001	<0.0010	<0.0010	-	<0.0010	0.001	<0.0010	<0.0010	-	0.0056	0.0013	<0.0010	0.0456	0.0229	0.0044	0.0032	0.0010	0.0021	-	0.0022	0.0058
Antimony (Sb)-Dissolved	mg/L	0.09	0.006	0.0001	<0.00010	0.00015	-	0.00026	<0.00010	<0.00010	0.0003	-	0.00035	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	0.00011	<0.00010	<0.00010	-	0.00030	0.00024
Arsenic (As)-Dissolved	mg/L	0.05	0.01	0.0001	0.0001	0.0008	-	0.00141	0.00028	0.0001	0.00085	-	0.011	0.0004	0.0001	0.00015	0.00017	0.0215	0.0186	0.00014	0.00039	-	0.00356	0.0170
Barium (Ba)-Dissolved	mg/L	10	1	0.0001	0.401	1.04	-	0.518	0.859	0.413	0.755	-	0.424	0.383	0.185	0.128	0.129	0.289	0.485	0.353	0.352	-	0.365	0.458
Beryllium (Be)-Dissolved	mg/L	0.0015	0.008	0.00002	<0.000100	<0.000100	-	<0.000100	<0.000100	<0.000100	<0.000100	-	<0.000100	<0.000100	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	-	<0.000020	<0.000020
Bismuth (Bi)-Dissolved	mg/L	-	-	0.00005	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050
Boron (B)-Dissolved	mg/L	12	5	0.01	0.036	0.122	-	0.098	0.166	0.024	0.086	-	0.09	0.085	<0.010	<0.010	<0.010	0.085	0.092	0.035	0.038	-	0.132	0.105
Cadmium (Cd)-Dissolved	mg/L	0.0005-0.004	0.005	0.000005	0.000161	0.000414	-	0.000385	0.000303	0.000128	0.000608	-	0.000105	0.000351	0.0000752	0.0000778	0.0000345	0.0000094	0.0000083	0.000368	0.000119	-	0.0000675	0.0000183
Calcium (Ca)-Dissolved	mg/L	-	-	0.05	136	257	-	254	252	147	222	-	146	136	74.7	72.8	80.3	84.9	94.5	111	136	-	152	89.8
Chromium (Cr)-Dissolved	mg/L	0.01-0.09	0.05-6.0	0.0001	0.00024	0.00014	-	0.00015	<0.00010	0.00016	0.00013	-	0.0003	<0.00010	0.00015	0.00028	0.00013	0.00042	0.00031	<0.00010	<0.00010	-	0.00015	0.00022
Cobalt (Co)-Dissolved	mg/L	0.04	0.001	0.0001	0.0004	0.00611	-	0.00798	0.00308	0.00023	0.00288	-	0.0196	0.00093	<0.00010	0.00017	<0.00010	0.00266	0.00298	0.00060	0.00199	-	0.00810	0.00367
Copper (Cu)-Dissolved (b)	mg/L	0.02-0.09	1.5	0.0002	0.00112	0.00204	-	0.00372	0.00225	0.00111	0.00526	-	0.00276	0.00183	0.00073	0.00075	0.00048	0.00036	0.00037	0.00130	0.00048	-	0.00195	0.00046
Iron (Fe)-Dissolved	mg/L	-	6.5	0.01	0.01	0.095	-	0.169	0.018	0.01	0.065	-	9.39	<0.010	0.01	0.233	0.029	15	18.1	0.012	1.32	-	6.24	13.9
Lead (Pb)-Dissolved (b)	mg/L	0.04-0.16	0.01	0.00005	0.000069	<0.000050	-	<0.000050	0.000051	0.000083	<0.000050	-	0.000608	<0.000050	<0.000050	0.00121	0.000088	0.000082	<0.000050	0.000098	<0.000050	-	0.000068	0.000135
Lithium (Li)-Dissolved	mg/L	-	0.008	0.001	0.0156	0.0538	-	0.0263	0.0461	0.0139	0.0377	-	0.0206	0.0213	0.0042	0.0052	0.0056	0.0154	0.0193	0.0114	0.0146	-	0.0265	0.0186
Magnesium (Mg)-Dissolved	mg/L	-	-	0.005	23	50.2	-	34.9	38.5	27.5	44.9	-	24.9	20.6	13.9	16.7	18	16.5	17.5	20.3	28.3	-	24.9	16.3
Manganese (Mn)-Dissolved	mg/L	-	1.5	0.0001	0.0383	1.08	-	1.32	0.902	0.0192	1.32	-	4.88	0.185	0.0157	0.115	0.00661	0.554	0.335	0.441	0.930	-	1.18	0.437
Mercury (Hg)-Dissolved	mg/L	0.00025	0.001		<0.0000050	0.0000124	-	<0.0000050	<0.0000050	<0.0000050	0.0000276	-	0.0000056	<0.0000050	-	-	-	-	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved	mg/L	10	0.25	0.00005	0.000374	0.00164	-	0.0064	0.000965	0.000314	0.00416	-	0.0104	0.000813	0.000584	0.000648	0.00083	0.00487	0.00984	0.000819	0.00112	-	0.00999	0.0112
Nickel (Ni)-Dissolved (b)	mg/L	0.25-1.5	0.08	0.0005	0.00294	0.0323	-	0.0548	0.0101	0.00181	0.0352	-	0.0739	0.00384	0.00093	0.00175	0.00052	0.00765	0.00998	0.00512	0.00934	-	0.0463	0.00840
Phosphorus (P)-Dissolved	mg/L	-	-	0.05	<0.050	<0.050	-	<0.050	<0.050	<0.050	<0.050	-	0.441	<0.050	<0.050	<0.050	<0.050	1.96	0.312	<0.050	<0.050	-	<0.050	0.071
Potassium (K)-Dissolved	mg/L	-	-	0.1	7	42.5	-	61.4	25.4	6.26	47	-	49.4	14.8	1.93	0.91	0.66	28.8	34.6	6.70	6.24	-	30.4	28.2
Selenium (Se)-Dissolved	mg/L	0.02	0.01	0.00005	0.000482	0.00243	-	0.00124	0.00023	0.000286	0.00163	-	0.00211	0.000617	0.000365	0.00209	0.0021	0.000294	0.000214	0.000310	0.000995	-	0.000758	0.000353
Silicon (Si)-Dissolved	mg/L	-	-	0.05	4	6.78	-	7.81	5.41	3.66	5.77	-	7.34	3.96	2.94	2.76	2.78	6.16	6.53	3.99	4.68	-	7.11	6.37
Silver (Ag)-Dissolved (b)	mg/L	0.0005-0.015	0.02	0.00001	<0.000010	<0.000010	-	0.000012	<0.000010	<0.000010	0.000018	-	0.000029	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010
Sodium (Na)-Dissolved	mg/L	-	200	0.05	49.9	126	-	127	98.1	62.1	137	-	91.6	34	8.88	2.49	2.56	45.4	57.9	27.6	18.5	-	75.4	56.0
Strontium (Sr)-Dissolved	mg/L	-	-	0.0002	0.664	2.36	-	2.64	3.48	0.593	2.36	-	1.22	1.72	0.161	0.176	0.167	1.03	1.26	0.498	0.830	-	1.74	1.39
Sulfur (S)-Dissolved	mg/L	-	-	0.5	3.01	4.4	-	2.53	11.3	2.98	1.35	-	2.56	3.58	4.82	14.5	16.2	2.34	2.53	1.79	7.08	-	7.49	<0.50
Thallium (Tl)-Dissolved	mg/L	0.003	-	0.00001	0.000096	0.000411	-	0.000291	0.000116	0.000059	0.000585	-	0.000819	0.000044	0.000035	0.000031	<0.000010	<0.000010	<0.000010	0.000143	0.000113	-	0.000141	<0.000010
Tin (Sn)-Dissolved	mg/L	-	2.5	0.0001	<0.00010	<0.00010	-	0.00011	<0.00010	<0.00010	<0.00010	-	0.00033	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	0.0001	<0.00010	<0.00010	-	0.00016	<0.00010
Titanium (Ti)-Dissolved	mg/L	1	-	0.0003	<0.00030	<0.00030	-	<0.00030	<0.00030	<0.00030	<0.00030	-	<0.00030	<0.00030	<0.00030	0.00087	<0.00030	0.00049	<0.00030	<0.00030	<0.00030	-	<0.00030	<0.00030
Uranium (U)-Dissolved	mg/L	0.085	0.02	0.00001	0.000594	0.00189	-	0.0021	0.000432	0.000551	0.00105	-	0.000993	0.000317	0.000459	0.000596	0.000716	0.000023	0.000032	0.000527	0.000770	-	0.00162	0.000101
Vanadium (V)-Dissolved	mg/L	-	0.02	0.0005	<0.00050	<0.00050	-	<0.00050	<0.00050	<0.00050	<0.00050	-	0.0024	<0.00050	<0.00050	<0.00050	<0.00050	0.00245	0.0016	<0.00050	<0.00050	-	0.00058	0.00229
Zinc (Zn)-Dissolved (b)	mg/L	0.075-2.4	3.0	0.001	0.0017	0.0048	-	0.0063	0.0053	0.002	0.0033	-	0.0056	0.0031	0.0017	0.0031	0.0019	0.0034	0.0018	0.0051	0.0077	-	0.0134	0.0030
Zirconium (Zr)-Dissolved	mg/L	-	-	0.0003	<0.00020	0.00051	-	0.0008	<0.00020	<0.00020	0.00053	-	0.00068	<0.00020	<0.00030	<0.00030	<0.00030	0.00048	0.00057	<0.00030	<0.00030	-	0.00042	0.00074

NOTES

(1) BC Contaminated Sites Regulation (CSR) for Protection of Aquatic Life (AW) - January 2019 Update, Schedule 3.2
(2) BC Contaminated Sites Regulation (CSR) for protection of Drinking Water (DW) - January 2019 Update, Schedule 3.2
(3) BC Source Drinking Water Quality Guidelines, 2020
(4) All criteria limits for Drinking Quality Guidelines based on Total Metal Concentration
(5) BC Source Water Quality Guidelines apply to total metals but are inlcuded to be compared with disscolved metals parameters where total metals data is unavailable
(a) Range based on max pH 8.5 to min pH 6.5 at temperature of 10.0 ºC
(b) Limit dependent upon hardness.
MAC = Maximum Acceptable Concentration
AO = Aesthetic Objective
** = Domestic Well, BC SDWQG Apply*

APPLICABLE WATER QUALITY GUIDELINES

CSR-AW	*BC Contaminated Sites Regulation Water Quality Guidelines for Protection of Aquatic Life (2019)*
CSR-DW	*BC Contaminated Sites Regulation Water Quality Guidelines for Drinking Water (2019)*
BCSDWQG	*BC ENV Source Drinking Water Quality Guidelines for Drinking Water (2020)*
BCWQG-AW	*BC ENV Approved and Working Water Quality Guidelines for Protection of Aquatic Life (2019)*
	Exceeds More Than One Guideline

APPENDICES

APPENDIX A
Hosmer Permit

Province of British Columbia

Ministry of Environment

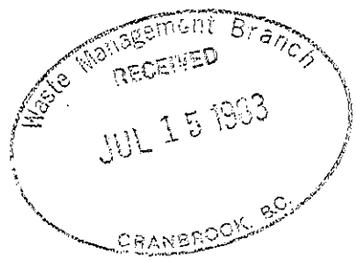
Waste Management Branch
Kootenay Region
310 Ward Street
Nelson, B.C.
V1L 5S4
Phone: 352-2211
Local 273, 305, or 339

YOUR FILE .....

OUR FILE .. PE-6901

G.C.
R.D.
file in front of folder.

JUL 13 1983



REGISTERED MAIL:

The Regional District of East Kootenay
19 - 24th Avenue South
CRANBROOK, British Columbia
V1C 3H8

Dear Sir:

Re: LETTER OF TRANSMITTAL

Enclosed is a copy of Permit No. PE-6901 issued under the provisions of the Waste Management Act in the name of Regional District of East Kootenay. Your attention is respectfully directed to the terms and conditions outlined in the Permit.

You will note that values have been expressed in the International Systems of Units (SI). These units are to be used in submitting monitoring results and any other information in connection with this Permit.

The administration of this Permit will be carried out by staff from our Regional Office located at 310 Ward Street, Nelson, British Columbia, V1L 5S4 (telephone 352-2211). Plans, data and reports pertinent to the Permit are to be submitted to the Regional Waste Manager at this address.

This Permit does not authorize entry upon, crossing over, or use for any purpose of private or Crown lands or works, unless and except as authorized by the owner of such lands or works. The responsibility for obtaining such authority shall rest with the Permittee.

Yours very truly,

M.K. Baillargeon, P. Eng.
Regional Waste Manager

MB:as

Enclosure

MINISTRY OF ENVIRONMENT

PERMIT

Under the Provisions of the Waste Management Act

The Regional District of East Kootenay

19 - 24th Avenue South, Cranbrook, British Columbia V1C 3H8

is hereby authorized to discharge septic tank pumpage and sewage holding tank effluent

from domestic and other sources

located in the Elk Valley

to the ground approximately 6.5 kilometers north of Hosmer, British Columbia

This permit has been issued under the terms and conditions prescribed in the attached appendices

01, A-1, B-1, C-1

M.R. Baillargeon

Regional Waste Manager

Date issued JUL 13 1983, 19 .....

Amendments dated ....., 19 .....

....., 19 .....

....., 19 .....

Permit No. PE-6901

ENV 1988

MINISTRY OF ENVIRONMENT

WASTE MANAGEMENT BRANCH

APPENDIX No. 01

to Permit No. PE-6901

E209899

(a) The discharge of effluent to which this appendix is applicable is to land known and described as 0.42 hectares on a portion of Parcel 35, District Lot 4588, Kootenay District
(Source of operation)

as shown on attached Appendix A-1.

(b) The quantity of effluent which may be discharged is an average of 22.7 cubic metres per day

(c) The characteristics of the effluent shall be equivalent to or better than typical septic tank pumpage and typical holding tank effluent from residential, commercial and industrial sources

(d) The works authorized are infiltration basins

approximately as shown on the attached Appendix A-1.

(e) The land from which the effluent originates and to which this appendix is appurtenant is in the Elk Valley

(f) Those works authorized and proposed must be completed ~~and in operation~~ before discharge commences

Date issued JUL 13 1983, 19

Date amended , 19

, 19

M.B. Burlingame

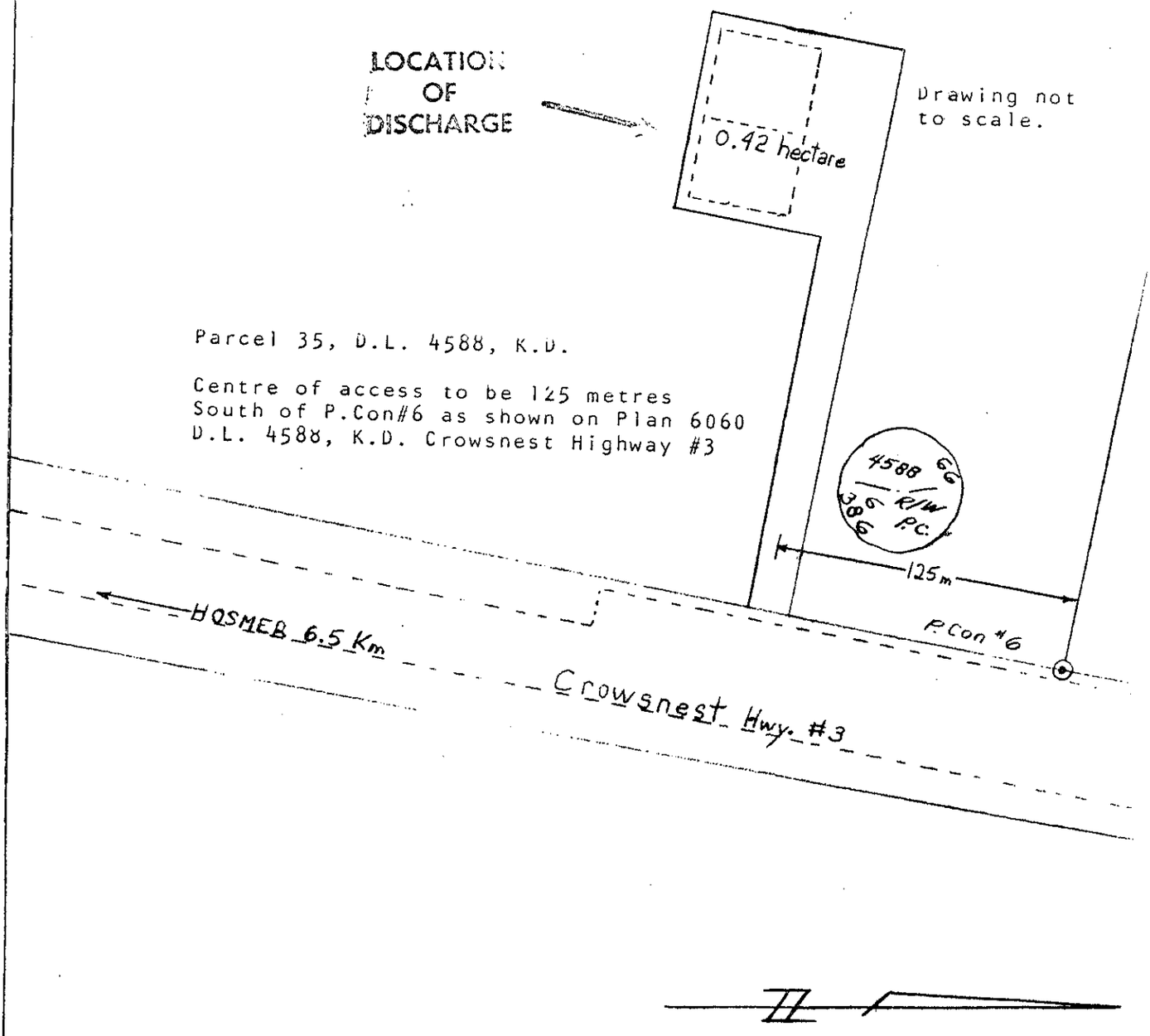
Regional Waste Manager

ENV 1994

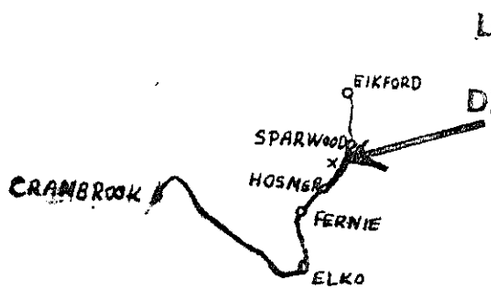
Province of British Columbia

Ministry of Environment

SITE PLAN



LOCATION MAP



REGIONAL DISTRICT OF EAST KOOTENAY
(Name of applicant(s))

Apr. 1 15/83
(Date)

(Signature of applicant(s) or agent)

(FOR OFFICE USE ONLY)

JUL 13 1983
(Date issued)

(Director of Pollution Control)

Appendix A-1 to Permit No. PE-6901

PCB 12—0

MINISTRY OF ENVIRONMENT

WASTE MANAGEMENT BRANCH

APPENDIX No. B-1

to Permit No. PE-6901

A. OPERATION

1. Septic tank pumpage and sewage holding tank effluent are to be discharged to infiltration basins and dried before removal to a landfill site. The dried sludge is to be covered with inert material immediately after placement in the landfill.

2. The minimum freeboard in the infiltration basins shall be 0.6 metre. The infiltration basin area is to be fenced and locked to prevent unauthorized access. Notice must be posted on the site to make the public aware of the type of facility being operated.

M Bacchuyon
Regional Waste Manager

JUL 13 1983

Date issued ....., 19 .....

Date amended ....., 19 .....

....., 19 .....

ENV 1993

MINISTRY OF ENVIRONMENT

WASTE MANAGEMENT BRANCH

APPENDIX No. C-1

to Permit No. PE-6901

MONITORING:

Monthly records of the quantity of septic tank pumpage and holding tank effluent discharged to the basins, in cubic metres per day, and the names of operators having access to the facility shall be maintained and retained for periodic inspection.

M Bullington

Regional Waste Manager

Date issued JUL 13 1983, 19

Date amended ....., 19

....., 19

ENV 1993

APPENDIX B
Water Quality Analysis

Results Summary VA20A0149

Project HOSMER

Report To Ron Mickel, Eco/Logic Environmental

Client Sample ID		BCE STANDARDS		E265104	E265105	MW-6	MW-7
Date Sampled		DRINKING	AQUATIC	5-Jan-20	5-Jan-20	5-Jan-20	5-Jan-20
ALS Sample ID	Units			VA20A0149-001	VA20A0149-002	VA20A0149-003	VA20A0149-004
Physical Tests (Matrix: Water)							
alkalinity, total (as CaCO3)	mg/L	*na*	*na*	353	987	905	500
conductivity	µS/cm	*700*	*na*	1140	2870	2570	2250
hardness (as CaCO3), dissolved	mg/L	500	*na*	435	849	778	787
pH	pH units	*6.5-8.5*	*6.5-9*	7.93	7.43	7.31	7.24
solids, total suspended [TSS]	mg/L	*na*	*na*	<3.0	8.5	105	388
turbidity	NTU	*na*	*na*	0.8	25.9	110	282
Anions and Nutrients (Matrix: Water)							
ammonia, total (as N)	mg/L	*0.68-27.72*	*na*	4.54	55.7	55.3	24.9
chloride	mg/L	*250*	*na*	125	384	320	235
fluoride	mg/L	*1.5*	*na*	0.127	<0.400	<0.400	<0.400
nitrate (as N)	mg/L	*10*	*200*	16.8	0.759	5.82	81.1
sulfate (as SO4)	mg/L	*500*	*100*	7.69	7.84	<6.00	29.2

Dissolved Metals (Matrix: Water)		DRINKING	AQUATIC	**E265104**	**E265105**	**MW-6**	**MW-7**
aluminum, dissolved	mg/L	*0.2*	*0.1*	<0.0010	<0.0010	<0.0010	0.001
antimony, dissolved	mg/L	*0.006*	*na*	<0.00010	0.00015	0.00026	<0.00010
arsenic, dissolved	mg/L	*0.025*	*0.005*	<0.00010	0.0008	0.00141	0.00028
barium, dissolved	mg/L	*1*	*na*	0.401	1.04	0.518	0.859
beryllium, dissolved	mg/L	*na*	*na*	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, dissolved	mg/L	*na*	*na*	<0.000050	<0.000050	<0.000050	<0.000050
boron, dissolved	mg/L	*5*	*0.12*	0.036	0.122	0.098	0.166
cadmium, dissolved	mg/L	*0.005*	*0.2*	0.000161	0.000414	0.000385	0.000303
calcium, dissolved	mg/L	*na*	*na*	136	257	254	252
cesium, dissolved	mg/L	*na*	*na*	0.000032	0.000104	0.000071	0.000044
chromium, dissolved	mg/L	*na*	*1*	0.00024	0.00014	0.00015	<0.00010
cobalt, dissolved	mg/L	*na*	*na*	0.0004	0.00611	0.00798	0.00308
copper, dissolved	mg/L	*5*	*0.09*	0.00112	0.00204	0.00372	0.00225
iron, dissolved	mg/L	*0.03*	*na*	<0.010	0.095	0.169	0.018
lead, dissolved	mg/L	*0.01*	*3*	0.000069	<0.000050	<0.000050	0.000051
lithium, dissolved	mg/L	*na*	*na*	0.0156	0.0538	0.0263	0.0461
magnesium, dissolved	mg/L	*na*	*na*	23	50.2	34.9	38.5
manganese, dissolved	mg/L	*0.05*	*na*	0.0383	1.08	1.32	0.902
mercury, dissolved	mg/L	0.001	0.0006	<0.0000050	0.0000124	<0.0000050	<0.0000050
molybdenum, dissolved	mg/L	*0.25*	*2*	0.000374	0.00164	0.0064	0.000965
nickel, dissolved	mg/L	*0.025*	*na*	0.00294	0.0323	0.0548	0.0101

phosphorus, dissolved	mg/L	*na*	*na*	<0.050	<0.050	<0.050	<0.050
potassium, dissolved	mg/L	*na*	*na*	7	42.5	61.4	25.4
rubidium, dissolved	mg/L	*na*	*na*	0.00321	0.0153	0.0329	0.0158
selenium, dissolved	mg/L	*0.01*	*na*	0.000482	0.00243	0.00124	0.00023
silicon, dissolved	mg/L	*na*	*na*	4	6.78	7.81	5.41
silver, dissolved	mg/L	*na*	*na*	<0.000010	<0.000010	0.000012	<0.000010
sodium, dissolved	mg/L	*200*	*na*	49.9	126	127	98.1
strontium, dissolved	mg/L	*na*	*na*	0.664	2.36	2.64	3.48
sulfur, dissolved	mg/L	*500*	*na*	3.01	4.4	2.53	11.3
tellurium, dissolved	mg/L	*na*	*na*	<0.00020	0.00027	0.00033	0.00033
thallium, dissolved	mg/L	*na*	*na*	0.000096	0.000411	0.000291	0.000116
thorium, dissolved	mg/L	*na*	*na*	<0.00010	<0.00010	<0.00010	<0.00010
tin, dissolved	mg/L	*na*	*na*	<0.00010	<0.00010	0.00011	<0.00010
titanium, dissolved	mg/L	*na*	*na*	<0.00030	<0.00030	<0.00030	<0.00030
tungsten, dissolved	mg/L	*na*	*na*	<0.00010	<0.00010	<0.00010	<0.00010
uranium, dissolved	mg/L	0.015	*na*	0.000594	0.00189	0.0021	0.000432
vanadium, dissolved	mg/L	*na*	*na*	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	mg/L	*na*	*0.03*	0.0017	0.0048	0.0063	0.0053
zirconium, dissolved	mg/L	*na*	*na*	<0.00020	0.00051	0.0008	<0.00020

Qualifier Legend

DLDS

Results Summary VA20A4290

Project HOSMER
Report To Ron Mickel, Eco/Logic Environmental
Date Received 02-Apr-2020 08:25

Client Sample ID			BCE STANDARDS		E265104	E265105	MW-6	MW-7
Date Sampled			DRINKING	AQUATIC	1-Apr-20	1-Apr-20	1-Apr-20	1-Apr-20
Time Sampled					14:30	15:00	15:30	16:00
Physical Tests	LDL	Units						
alkalinity, total (as CaCO3)	1.0	mg/L	*na*	*na*	360	842	726	420
conductivity	2.0	µS/cm	*700*	*na*	1270	2650	2170	975
hardness (as CaCO3), diss	0.60	mg/L	500	*na*	481	741	468	425
pH	0.10	pH units	*6.5-8.5*	*6.5-9*	7.40	7.47	7.15	7.41
solids total suspended [TSS]	3.0	mg/L	*na*	*na*	6.1	11.1	83.8	27.5
turbidity	0.10	NTU	*na*	*na*	1.76	3.50	35.4	10.6
Anions and Nutrients (Matrix: Water)								
ammonia, total (as N)	0.0050	mg/L	*0.68-27.72*	*na*	2.84	80.6	114	3.25
chloride	0.50	mg/L	*250*	*na*	167	339	237	56.8
fluoride	0.020	mg/L	*1.5*	*na*	<0.100	<0.400	<0.400	0.120
nitrate (as N)	0.0050	mg/L	*10*	*200*	7.53	7.31	<0.100	3.11
sulfate (as SO4)	0.30	mg/L	*500*	*100*	5.49	<6.00	<6.00	6.72

Bacteriological Tests (Matrix: V								
coliforms,[fecal]	1	CFU/100mL	<1	200	<1	15	>6000	1
coliforms, total	1	CFU/100mL	<1	200	<1	36	>6000	1

Dissolved Metals			DRINKING	AQUATIC	E265104	E265105	MW-6	MW-7
aluminum, dissolved	0.0010	mg/L	*0.2*	*0.1*	<0.0010	<0.0010	0.0056	0.0013
antimony, dissolved	0.00010	mg/L	*0.006*	*na*	<0.00010	0.00030	0.00035	<0.00010
arsenic, dissolved	0.00010	mg/L	*0.025*	*0.005*	0.00010	0.00085	0.0110	0.00040
barium, dissolved	0.00010	mg/L	*1*	*na*	0.413	0.755	0.424	0.383
beryllium, dissolved	0.000100	mg/L	*na*	*na*	<0.000100	<0.000100	<0.000100	<0.000100
bismuth, dissolved	0.000050	mg/L	*na*	*na*	<0.000050	<0.000050	<0.000050	<0.000050
boron, dissolved	0.010	mg/L	*5*	*0.12*	0.024	0.086	0.090	0.085
cadmium, dissolved	0.0000050	mg/L	*0.005*	*0.2*	0.000128	0.000608	0.000105	0.000351
calcium, dissolved	0.050	mg/L	*na*	*na*	147	222	146	136
cesium, dissolved	0.000010	mg/L	*na*	*na*	0.000025	0.000156	0.000070	0.000012
chromium, dissolved	0.00010	mg/L	*na*	*1*	0.00016	0.00013	0.00030	<0.00010
cobalt, dissolved	0.00010	mg/L	*na*	*na*	0.00023	0.00288	0.0196	0.00093
copper, dissolved	0.00020	mg/L	*5*	*0.09*	0.00111	0.00526	0.00276	0.00183
iron, dissolved	0.010	mg/L	*0.03*	*na*	<0.010	0.065	9.39	<0.010
lead, dissolved	0.000050	mg/L	*0.01*	*3*	0.000083	<0.000050	0.000608	<0.000050
lithium, dissolved	0.0010	mg/L	*na*	*na*	0.0139	0.0377	0.0206	0.0213
magnesium, dissolved	0.0050	mg/L	*na*	*na*	27.5	44.9	24.9	20.6
manganese, dissolved	0.00010	mg/L	*0.05*	*na*	0.0192	1.32	4.88	0.185
mercury, dissolved	0.0000050	mg/L	0.001	0.0006	<0.0000050	0.0000276	0.0000056	<0.0000050
molybdenum, dissolved	0.000050	mg/L	*0.25*	*2*	0.000314	0.00416	0.0104	0.000813

nickel, dissolved	0.00050	mg/L	*0.025*	*na*	0.00181	0.0352	0.0739	0.00384
phosphorus, dissolved	0.050	mg/L	*na*	*na*	<0.050	<0.050	0.441	<0.050
potassium, dissolved	0.050	mg/L	*na*	*na*	6.26	47.0	49.4	14.8
rubidium, dissolved	0.00020	mg/L	*na*	*na*	0.00351	0.0174	0.0374	0.00534
selenium, dissolved	0.000050	mg/L	*0.01*	*na*	0.000286	0.00163	0.00211	0.000617
silicon, dissolved	0.050	mg/L	*na*	*na*	3.66	5.77	7.34	3.96
silver, dissolved	0.000010	mg/L	*na*	*na*	<0.000010	0.000018	0.000029	<0.000010
sodium, dissolved	0.050	mg/L	*200*	*na*	62.1	137	91.6	34.0
strontium, dissolved	0.00020	mg/L	*na*	*na*	0.593	2.36	1.22	1.72
sulfur, dissolved	0.50	mg/L	*500*	*na*	2.98	1.35	2.56	3.58
tellurium, dissolved	0.00020	mg/L	*na*	*na*	<0.00020	0.00021	<0.00020	<0.00020
thallium, dissolved	0.000010	mg/L	*na*	*na*	0.000059	0.000585	0.000819	0.000044
thorium, dissolved	0.00010	mg/L	*na*	*na*	<0.00010	<0.00010	<0.00010	<0.00010
tin, dissolved	0.00010	mg/L	*na*	*na*	<0.00010	<0.00010	0.00033	<0.00010
titanium, dissolved	0.00030	mg/L	*na*	*na*	<0.00030	<0.00030	<0.00030	<0.00030
tungsten, dissolved	0.00010	mg/L	*na*	*na*	<0.00010	<0.00010	0.00024	<0.00010
uranium, dissolved	0.000010	mg/L	0.015	*na*	0.000551	0.00105	0.000993	0.000317
vanadium, dissolved	0.00050	mg/L	*na*	*na*	<0.00050	<0.00050	0.00240	<0.00050
zinc, dissolved	0.0010	mg/L	*na*	*0.03*	0.0020	0.0033	0.0056	0.0031
zirconium, dissolved	0.00020	mg/L	*na*	*na*	<0.00020	0.00053	0.00068	<0.00020

Qualifier Legend

DLA	Detection Limit adjusted for required dilution.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
TNTC	Too numerous to count (microbiology test). Overcrowded, confluent &/or non-identifiable microbial gro

wth prevented identification & measurement of target bacterial colonies.

Results Summary L2478666

Job Reference
Report To David Kvick, Sperling Hansen Associates Inc.
Date Received 23-Jul-2020 8:25
Report Date 29-Jul-2020 14:46
Report Version 1

Client Sample ID			E265104	E265105	E265106	MW-6
Date Sampled			22-Jul-2020	22-Jul-2020	22-Jul-2020	22-Jul-2020
Time Sampled			12:00	12:00	12:00	12:00
ALS Sample ID			L2478666-1	L2478666-2	L2478666-3	L2478666-4
Parameter	Lowest Detection Limit	Units	Water	Water	Water	Water
Physical Tests (Water)						
Hardness (as CaCO3)	0.50	mg/L	244	251	275	280
Total Suspended Solids	1.0	mg/L	4.9	14.7	2840	136
Anions and Nutrients (Water)						
Alkalinity, Total (as CaCO3)	2.0	mg/L	203	198	202	406
Ammonia as N	0.0050	mg/L	0.198	0.346	0.0864	50.0
Bicarbonate (HCO3)	5.0	mg/L	247	241	246	495
Carbonate (CO3)	5.0	mg/L	<5.0	<5.0	<5.0	<5.0
Chloride (Cl)	0.10	mg/L	10.1	2.69	2.06	86.8
Conductivity (EC)	2.0	uS/cm	395	411	405	1010
Fluoride (F)	0.020	mg/L	0.132	0.153	0.161	0.30
Hydroxide (OH)	5.0	mg/L	<5.0	<5.0	<5.0	<5.0
Nitrate and Nitrite (as N)	0.0051	mg/L	0.327	0.475	0.432	0.045
Nitrate (as N)	0.0050	mg/L	0.313	0.474	0.429	0.037
Nitrite (as N)	0.0010	mg/L	0.0140	0.0010	0.0022	0.0082
pH	0.10	pH	7.97	8.09	8.07	8.19
Orthophosphate-Dissolved (as P)	0.0010	mg/L	<0.0010	<0.0010	0.0019	0.0140
Sulfate (SO4)	0.050	mg/L	6.96	35.7	38.4	0.43
Bacteriological Tests (Water)						
MPN - E. Coli	1	MPN/100mL	<1	<1	<100	6
Coliform Bacteria - Fecal	1	CFU/100mL	<1	<1	<100	100
MPN - Total Coliforms	1	MPN/100mL	6	<1	<100	260
Dissolved Metals (Water)						
Dissolved Metals Filtration Location		-	FIELD	FIELD	FIELD	FIELD
Dissolved Metals Filtration Location		-	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	0.0010	mg/L	<0.0010	0.0456	0.0229	0.0044
Antimony (Sb)-Dissolved	0.00010	mg/L	<0.00010	<0.00010	<0.00010	0.00012
Arsenic (As)-Dissolved	0.00010	mg/L	<0.00010	0.00015	0.00017	0.0215
Barium (Ba)-Dissolved	0.00010	mg/L	0.185	0.128	0.129	0.289
Beryllium (Be)-Dissolved	0.000020	mg/L	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth (Bi)-Dissolved	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Dissolved	0.010	mg/L	<0.010	<0.010	<0.010	0.085
Cadmium (Cd)-Dissolved	0.0000050	mg/L	0.0000752	0.0000778	0.0000345	0.0000094
Calcium (Ca)-Dissolved	0.050	mg/L	74.7	72.8	80.3	84.9
Chromium (Cr)-Dissolved	0.00010	mg/L	0.00015	0.00028	0.00013	0.00042
Cobalt (Co)-Dissolved	0.00010	mg/L	<0.00010	0.00017	<0.00010	0.00266
Copper (Cu)-Dissolved	0.00020	mg/L	0.00073	0.00075	0.00048	0.00036
Iron (Fe)-Dissolved	0.010	mg/L	<0.010	0.233	0.029	15.0
Lead (Pb)-Dissolved	0.000050	mg/L	<0.000050	0.00121	0.000088	0.000082
Lithium (Li)-Dissolved	0.0010	mg/L	0.0042	0.0052	0.0056	0.0154
Magnesium (Mg)-Dissolved	0.0050	mg/L	13.9	16.7	18.0	16.5
Manganese (Mn)-Dissolved	0.00010	mg/L	0.0157	0.115	0.00661	0.554
Molybdenum (Mo)-Dissolved	0.000050	mg/L	0.000584	0.000648	0.000830	0.00487

Results Summary L2478666

Job Reference
Report To David Kvick, Sperling Hansen Associates Inc.
Date Received 23-Jul-2020 8:25
Report Date 29-Jul-2020 14:46
Report Version 1

Client Sample ID			MW-7
Date Sampled			22-Jul-2020
Time Sampled			12:00
ALS Sample ID			L2478666-5
Parameter	Lowest Detection Limit	Units	Water
Physical Tests (Water)			
Hardness (as CaCO3)	0.50	mg/L	308
Total Suspended Solids	1.0	mg/L	353
Anions and Nutrients (Water)			
Alkalinity, Total (as CaCO3)	2.0	mg/L	451
Ammonia as N	0.0050	mg/L	97.4
Bicarbonate (HCO3)	5.0	mg/L	550
Carbonate (CO3)	5.0	mg/L	<5.0
Chloride (Cl)	0.10	mg/L	117
Conductivity (EC)	2.0	uS/cm	1180
Fluoride (F)	0.020	mg/L	0.26
Hydroxide (OH)	5.0	mg/L	<5.0
Nitrate and Nitrite (as N)	0.0051	mg/L	<0.025
Nitrate (as N)	0.0050	mg/L	<0.025
Nitrite (as N)	0.0010	mg/L	0.0066
pH	0.10	pH	8.01
Orthophosphate-Dissolved (as P)	0.0010	mg/L	0.0011
Sulfate (SO4)	0.050	mg/L	0.28
Bacteriological Tests (Water)			
MPN - E. Coli	1	MPN/100mL	45
Coliform Bacteria - Fecal	1	CFU/100mL	<100
MPN - Total Coliforms	1	MPN/100mL	580
Dissolved Metals (Water)			
Dissolved Metals Filtration Location		-	FIELD
Dissolved Metals Filtration Location		-	FIELD
Aluminum (Al)-Dissolved	0.0010	mg/L	0.0032
Antimony (Sb)-Dissolved	0.00010	mg/L	0.00011
Arsenic (As)-Dissolved	0.00010	mg/L	0.0186
Barium (Ba)-Dissolved	0.00010	mg/L	0.485
Beryllium (Be)-Dissolved	0.000020	mg/L	<0.000020
Bismuth (Bi)-Dissolved	0.000050	mg/L	<0.000050
Boron (B)-Dissolved	0.010	mg/L	0.092
Cadmium (Cd)-Dissolved	0.0000050	mg/L	0.0000083
Calcium (Ca)-Dissolved	0.050	mg/L	94.5
Chromium (Cr)-Dissolved	0.00010	mg/L	0.00031
Cobalt (Co)-Dissolved	0.00010	mg/L	0.00298
Copper (Cu)-Dissolved	0.00020	mg/L	0.00037
Iron (Fe)-Dissolved	0.010	mg/L	18.1
Lead (Pb)-Dissolved	0.000050	mg/L	<0.000050
Lithium (Li)-Dissolved	0.0010	mg/L	0.0193
Magnesium (Mg)-Dissolved	0.0050	mg/L	17.5
Manganese (Mn)-Dissolved	0.00010	mg/L	0.335
Molybdenum (Mo)-Dissolved	0.000050	mg/L	0.00984

Results Summary L2478666

Job Reference
Report To David Kvick, Sperling Hansen Associates Inc.
Date Received 23-Jul-2020 8:25
Report Date 29-Jul-2020 14:46
Report Version 1

Client Sample ID			E265104	E265105	E265106	MW-6
Date Sampled			22-Jul-2020	22-Jul-2020	22-Jul-2020	22-Jul-2020
Time Sampled			12:00	12:00	12:00	12:00
ALS Sample ID			L2478666-1	L2478666-2	L2478666-3	L2478666-4
Parameter	Lowest Detection Limit	Units	Water	Water	Water	Water
Nickel (Ni)-Dissolved	0.00050	mg/L	0.00093	0.00175	0.00052	0.00765
Phosphorus (P)-Dissolved	0.050	mg/L	<0.050	<0.050	<0.050	1.96
Potassium (K)-Dissolved	0.10	mg/L	1.93	0.91	0.66	28.8
Selenium (Se)-Dissolved	0.000050	mg/L	0.000365	0.00209	0.00210	0.000294
Silicon (Si)-Dissolved	0.050	mg/L	2.94	2.76	2.78	6.16
Silver (Ag)-Dissolved	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved	0.050	mg/L	8.88	2.49	2.56	45.4
Strontium (Sr)-Dissolved	0.00020	mg/L	0.161	0.176	0.167	1.03
Sulfur (S)-Dissolved	0.50	mg/L	4.82	14.5	16.2	2.34
Thallium (Tl)-Dissolved	0.000010	mg/L	0.000035	0.000031	<0.000010	<0.000010
Tin (Sn)-Dissolved	0.00010	mg/L	<0.00010	<0.00010	<0.00010	0.00013
Titanium (Ti)-Dissolved	0.00030	mg/L	<0.00030	0.00087	<0.00030	0.00049
Uranium (U)-Dissolved	0.000010	mg/L	0.000459	0.000596	0.000716	0.000023
Vanadium (V)-Dissolved	0.00050	mg/L	<0.00050	<0.00050	<0.00050	0.00245
Zinc (Zn)-Dissolved	0.0010	mg/L	0.0017	0.0031	0.0019	0.0034
Zirconium (Zr)-Dissolved	0.00030	mg/L	<0.00030	<0.00030	<0.00030	0.00048

Qualifier Legend

DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

Results Summary L2478666

Job Reference
Report To David Kvick, Sperling Hansen Associates Inc.
Date Received 23-Jul-2020 8:25
Report Date 29-Jul-2020 14:46
Report Version 1

Client Sample ID			MW-7
Date Sampled			22-Jul-2020
Time Sampled			12:00
ALS Sample ID			L2478666-5
Parameter	Lowest Detection Limit	Units	Water
Nickel (Ni)-Dissolved	0.00050	mg/L	0.00998
Phosphorus (P)-Dissolved	0.050	mg/L	0.312
Potassium (K)-Dissolved	0.10	mg/L	34.6
Selenium (Se)-Dissolved	0.000050	mg/L	0.000214
Silicon (Si)-Dissolved	0.050	mg/L	6.53
Silver (Ag)-Dissolved	0.000010	mg/L	<0.000010
Sodium (Na)-Dissolved	0.050	mg/L	57.9
Strontium (Sr)-Dissolved	0.00020	mg/L	1.26
Sulfur (S)-Dissolved	0.50	mg/L	2.53
Thallium (Tl)-Dissolved	0.000010	mg/L	<0.000010
Tin (Sn)-Dissolved	0.00010	mg/L	0.00010
Titanium (Ti)-Dissolved	0.00030	mg/L	<0.00030
Uranium (U)-Dissolved	0.000010	mg/L	0.000032
Vanadium (V)-Dissolved	0.00050	mg/L	0.00160
Zinc (Zn)-Dissolved	0.0010	mg/L	0.0018
Zirconium (Zr)-Dissolved	0.00030	mg/L	0.00057

Qualifier Legend

DLHC	Detection Limit Raised: Dilution required due t
DLM	Detection Limit Adjusted due to sample matrix

Results Summary L2520199

Job Reference 20050 HOSMER
Report To Scott Garthwaite, Sperling Hansen Associates Inc.
Date Received 22-Oct-2020 8:50
Report Date 29-Oct-2020 14:33
Report Version 1

Client Sample ID			E265104	E265105	MW6	MW7
Date Sampled			21-Oct-2020	21-Oct-2020	21-Oct-2020	21-Oct-2020
Time Sampled			8:00	8:00	8:00	8:00
ALS Sample ID			L2520199-1	L2520199-2	L2520199-3	L2520199-4
Parameter	Lowest Detection Limit	Units	Water	Water	Water	Water
Physical Tests (Water)						
Hardness (as CaCO3)	0.50	mg/L	361	456	481	292
Total Suspended Solids	1.0	mg/L	9.2	146	87.0	2650
Anions and Nutrients (Water)						
Alkalinity, Total (as CaCO3)	2.0	mg/L	304	385	457	495
Ammonia as N	0.50	mg/L	3.88	8.01	53	56.0
Bicarbonate (HCO3)	5.0	mg/L	371	469	558	603
Carbonate (CO3)	5.0	mg/L	<5.0	<5.0	<5.0	<5.0
Chloride (Cl)	0.10	mg/L	59.2	70.7	217	120
Conductivity (EC)	2.0	uS/cm	683	809	1530	1140
Fluoride (F)	0.020	mg/L	0.171	0.23	0.33	0.44
Hydroxide (OH)	5.0	mg/L	<5.0	<5.0	<5.0	<5.0
Nitrate and Nitrite (as N)	0.0051	mg/L	4.19	0.536	16.7	0.348
Nitrate (as N)	0.0050	mg/L	4.18	0.529	16.6	0.328
Nitrite (as N)	0.0010	mg/L	0.0071	0.0068	0.138	0.0197
pH	0.10	pH	7.93	7.90	7.96	8.05
Sulfate (SO4)	0.050	mg/L	5.13	17.0	24.1	0.63
Bacteriological Tests (Water)						
MPN - E. Coli	1	MPN/100mL	<1	<1	<1	<1
Coliform Bacteria - Fecal	1	CFU/100mL	<1	<2	<2	<100
MPN - Total Coliforms	1	MPN/100mL	<1	3	<1	<100
Dissolved Metals (Water)						
Dissolved Mercury Filtration Location		-	FIELD	FIELD	FIELD	FIELD
Dissolved Metals Filtration Location		-	FIELD	FIELD	FIELD	FIELD
Dissolved Metals Filtration Location		-	FIELD	FIELD	FIELD	FIELD
Aluminum (Al)-Dissolved	0.0010	mg/L	0.0010	0.0021	0.0022	0.0058
Antimony (Sb)-Dissolved	0.00010	mg/L	<0.00010	<0.00010	0.00030	0.00024
Arsenic (As)-Dissolved	0.00010	mg/L	0.00014	0.00039	0.00356	0.0170
Barium (Ba)-Dissolved	0.00010	mg/L	0.353	0.352	0.365	0.458
Beryllium (Be)-Dissolved	0.000020	mg/L	<0.000020	<0.000020	<0.000020	<0.000020
Bismuth (Bi)-Dissolved	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050
Boron (B)-Dissolved	0.010	mg/L	0.035	0.038	0.132	0.105
Cadmium (Cd)-Dissolved	0.0000050	mg/L	0.000368	0.000119	0.0000675	0.0000183
Calcium (Ca)-Dissolved	0.050	mg/L	111	136	152	89.8
Chromium (Cr)-Dissolved	0.00010	mg/L	<0.00010	<0.00010	0.00015	0.00022
Cobalt (Co)-Dissolved	0.00010	mg/L	0.00060	0.00199	0.00810	0.00367
Copper (Cu)-Dissolved	0.00020	mg/L	0.00130	0.00048	0.00195	0.00046
Iron (Fe)-Dissolved	0.010	mg/L	0.012	1.32	6.24	13.9
Lead (Pb)-Dissolved	0.000050	mg/L	0.000098	<0.000050	0.000068	0.000135
Lithium (Li)-Dissolved	0.0010	mg/L	0.0114	0.0146	0.0265	0.0186
Magnesium (Mg)-Dissolved	0.0050	mg/L	20.3	28.3	24.9	16.3
Manganese (Mn)-Dissolved	0.00010	mg/L	0.441	0.930	1.18	0.437
Mercury (Hg)-Dissolved	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)-Dissolved	0.000050	mg/L	0.000819	0.00112	0.00999	0.0112
Nickel (Ni)-Dissolved	0.00050	mg/L	0.00512	0.00934	0.0463	0.00840
Phosphorus (P)-Dissolved	0.050	mg/L	<0.050	<0.050	<0.050	0.071
Potassium (K)-Dissolved	0.10	mg/L	6.70	6.24	30.4	28.2
Selenium (Se)-Dissolved	0.000050	mg/L	0.000310	0.000995	0.000758	0.000353
Silicon (Si)-Dissolved	0.050	mg/L	3.99	4.68	7.11	6.37
Silver (Ag)-Dissolved	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved	0.050	mg/L	27.6	18.5	75.4	56.0
Strontium (Sr)-Dissolved	0.00020	mg/L	0.498	0.830	1.74	1.39
Sulfur (S)-Dissolved	0.50	mg/L	1.79	7.08	7.49	<0.50
Thallium (Tl)-Dissolved	0.000010	mg/L	0.000143	0.000113	0.000141	<0.000010
Tin (Sn)-Dissolved	0.00010	mg/L	<0.00010	<0.00010	0.00016	<0.00010
Titanium (Ti)-Dissolved	0.00030	mg/L	<0.00030	<0.00030	<0.00030	<0.00030
Uranium (U)-Dissolved	0.000010	mg/L	0.000527	0.000770	0.00162	0.000101
Vanadium (V)-Dissolved	0.00050	mg/L	<0.00050	<0.00050	0.00058	0.00229
Zinc (Zn)-Dissolved	0.0010	mg/L	0.0051	0.0077	0.0134	0.0030
Zirconium (Zr)-Dissolved	0.00030	mg/L	<0.00030	<0.00030	0.00042	0.00074

Qualifier Legend

DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
DLA	Detection Limit adjusted for required dilution

APPENDIX C
Certificate of Analysis

Sperling Hansen Associates Inc.
ATTN: David Kvick
#8 - 1225 East Keith Road
North Vancouver BC V7J 1J3

Date Received: 23-JUL-20
Report Date: 29-JUL-20 14:46 (MT)
Version: FINAL

Client Phone: 604-986-7723

Certificate of Analysis

Lab Work Order #: L2478666

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Patryk Wojciak, B.Sc., P.Chem.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2478666-1 WATER 22-JUL-20 12:00 E265104	L2478666-2 WATER 22-JUL-20 12:00 E265105	L2478666-3 WATER 22-JUL-20 12:00 E265106	L2478666-4 WATER 22-JUL-20 12:00 MW-6	L2478666-5 WATER 22-JUL-20 12:00 MW-7
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	244	251	275	280	308
	Total Suspended Solids (mg/L)	4.9	14.7	2840 DLHC	136 DLHC	353 DLHC
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	203	198	202	406	451
	Ammonia as N (mg/L)	0.198	0.346	0.0864	50.0 DLHC	97.4 DLHC
	Bicarbonate (HCO3) (mg/L)	247	241	246	495	550
	Carbonate (CO3) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Chloride (Cl) (mg/L)	10.1	2.69	2.06	86.8 DLHC	117 DLHC
	Conductivity (EC) (uS/cm)	395	411	405	1010	1180
	Fluoride (F) (mg/L)	0.132	0.153	0.161	0.30 DLHC	0.26 DLHC
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0
	Nitrate and Nitrite (as N) (mg/L)	0.327	0.475	0.432	0.045	<0.025
	Nitrate (as N) (mg/L)	0.313	0.474	0.429	0.037 DLHC	<0.025 DLHC
	Nitrite (as N) (mg/L)	0.0140	0.0010	0.0022	0.0082 DLHC	0.0066 DLHC
	pH (pH)	7.97	8.09	8.07	8.19	8.01
	Orthophosphate-Dissolved (as P) (mg/L)	<0.0010	<0.0010	0.0019	0.0140	0.0011
	Sulfate (SO4) (mg/L)	6.96	35.7	38.4	0.43 DLHC	0.28 DLHC
Bacteriological Tests	MPN - E. Coli (MPN/100mL)	<1	<1	<100 DLM	6	45
	Coliform Bacteria - Fecal (CFU/100mL)	<1	<1	<100 DLM	100 DLM	<100 DLM
	MPN - Total Coliforms (MPN/100mL)	6	<1	<100 DLM	260	580
Dissolved Metals	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	FIELD
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	0.0456	0.0229	0.0044	0.0032
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	0.00012	0.00011
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00015	0.00017	0.0215	0.0186
	Barium (Ba)-Dissolved (mg/L)	0.185	0.128	0.129	0.289	0.485
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	0.085	0.092
	Cadmium (Cd)-Dissolved (mg/L)	0.0000752	0.0000778	0.0000345	0.0000094	0.0000083
	Calcium (Ca)-Dissolved (mg/L)	74.7	72.8	80.3	84.9	94.5
	Chromium (Cr)-Dissolved (mg/L)	0.00015	0.00028	0.00013	0.00042	0.00031
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	0.00017	<0.00010	0.00266	0.00298
	Copper (Cu)-Dissolved (mg/L)	0.00073	0.00075	0.00048	0.00036	0.00037
	Iron (Fe)-Dissolved (mg/L)	<0.010	0.233	0.029	15.0	18.1
	Lead (Pb)-Dissolved (mg/L)	<0.000050	0.00121	0.000088	0.000082	<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0042	0.0052	0.0056	0.0154	0.0193
	Magnesium (Mg)-Dissolved (mg/L)	13.9	16.7	18.0	16.5	17.5

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L2478666-1 WATER 22-JUL-20 12:00 E265104	L2478666-2 WATER 22-JUL-20 12:00 E265105	L2478666-3 WATER 22-JUL-20 12:00 E265106	L2478666-4 WATER 22-JUL-20 12:00 MW-6	L2478666-5 WATER 22-JUL-20 12:00 MW-7
WATER						
Dissolved Metals	Manganese (Mn)-Dissolved (mg/L)	0.0157	0.115	0.00661	0.554	0.335
	Molybdenum (Mo)-Dissolved (mg/L)	0.000584	0.000648	0.000830	0.00487	0.00984
	Nickel (Ni)-Dissolved (mg/L)	0.00093	0.00175	0.00052	0.00765	0.00998
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	1.96	0.312
	Potassium (K)-Dissolved (mg/L)	1.93	0.91	0.66	28.8	34.6
	Selenium (Se)-Dissolved (mg/L)	0.000365	0.00209	0.00210	0.000294	0.000214
	Silicon (Si)-Dissolved (mg/L)	2.94	2.76	2.78	6.16	6.53
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Dissolved (mg/L)	8.88	2.49	2.56	45.4	57.9
	Strontium (Sr)-Dissolved (mg/L)	0.161	0.176	0.167	1.03	1.26
	Sulfur (S)-Dissolved (mg/L)	4.82	14.5	16.2	2.34	2.53
	Thallium (Tl)-Dissolved (mg/L)	0.000035	0.000031	<0.000010	<0.000010	<0.000010
	Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	0.00013	0.00010
	Titanium (Ti)-Dissolved (mg/L)	<0.00030	0.00087	<0.00030	0.00049	<0.00030
	Uranium (U)-Dissolved (mg/L)	0.000459	0.000596	0.000716	0.000023	0.000032
	Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	<0.00050	0.00245	0.00160
	Zinc (Zn)-Dissolved (mg/L)	0.0017	0.0031	0.0019	0.0034	0.0018
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	0.00048	0.00057

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
UIC	Unreliable: Improper Container - ROUTINE BOTTLE RECEIVED FOR FECAL AND E. COLI

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-CL	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CL-L-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

F-L-IC-CL	Water	Fluoride	APHA 4110 B-Ion Chromatography
FCC-MF-CL	Water	Fecal Coliform Count-MF	APHA 9222D

This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.

HARDNESS-CALC-CL	Water	Hardness	APHA 2340 B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

MET-D-CCMS-CL	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NH3-L-F-CL	Water	Ammonia, Total (as N)	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity	APHA 4500H,2510,2320

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)
pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode.
Alkalinity measurement is based on the sample's capacity to neutralize acid
Conductivity measurement is based on the sample's capacity to convey an electric current

PO4-DO-L-COL-CL	Water	Orthophosphate-Dissolved (as P)	APHA 4500-P PHOSPHORUS

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter.

SO4-L-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TC-EC-MPN-CL	Water	Total Coliforms and E. Coli by MPN	APHA METHOD 9223

Reference Information

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The
sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

TSS-L-CL Water Total Suspended Solids APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: Sperling Hansen Associates Inc.
#8 - 1225 East Keith Road
North Vancouver BC V7J 1J3
Contact: David Kvick

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BE-D-L-CCMS-CL	**Water**							
Batch R5167403								
WG3370662-6 LCS		**TMRM**						
Beryllium (Be)-Dissolved			99.4		%		80-120	28-JUL-20
WG3370662-5 MB								
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	28-JUL-20
CL-L-IC-N-CL	**Water**							
Batch R5166746								
WG3370070-11 DUP		**L2478666-1**						
Chloride (Cl)		10.1	10.1		mg/L	0.3	20	23-JUL-20
WG3370070-10 LCS								
Chloride (Cl)			103.2		%		85-115	23-JUL-20
WG3370070-9 MB								
Chloride (Cl)			<0.10		mg/L		0.1	23-JUL-20
WG3370070-12 MS		**L2478666-1**						
Chloride (Cl)			102.7		%		75-125	23-JUL-20
F-L-IC-CL	**Water**							
Batch R5166746								
WG3370070-11 DUP		**L2478666-1**						
Fluoride (F)		0.132	0.131		mg/L	0.3	20	23-JUL-20
WG3370070-10 LCS								
Fluoride (F)			100.7		%		85-115	23-JUL-20
WG3370070-9 MB								
Fluoride (F)			<0.020		mg/L		0.02	23-JUL-20
WG3370070-12 MS		**L2478666-1**						
Fluoride (F)			100.5		%		75-125	23-JUL-20
FCC-MF-CL	**Water**							
Batch R5166750								
WG3370086-7 MB								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	23-JUL-20
WG3370086-9 MB								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	23-JUL-20
MET-D-CCMS-CL	**Water**							
Batch R5167403								
WG3370662-6 LCS		**TMRM**						
Aluminum (Al)-Dissolved			109.3		%		80-120	28-JUL-20
Antimony (Sb)-Dissolved			103.6		%		80-120	28-JUL-20
Arsenic (As)-Dissolved			106.1		%		80-120	28-JUL-20
Barium (Ba)-Dissolved			113.5		%		80-120	28-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R5167403								
WG3370662-6 LCS		**TMRM**						
Bismuth (Bi)-Dissolved			104.3		%		80-120	28-JUL-20
Boron (B)-Dissolved			95.5		%		80-120	28-JUL-20
Cadmium (Cd)-Dissolved			105.6		%		80-120	28-JUL-20
Calcium (Ca)-Dissolved			104.3		%		80-120	28-JUL-20
Chromium (Cr)-Dissolved			104.3		%		80-120	28-JUL-20
Cobalt (Co)-Dissolved			105.2		%		80-120	28-JUL-20
Copper (Cu)-Dissolved			106.3		%		80-120	28-JUL-20
Iron (Fe)-Dissolved			100.2		%		80-120	28-JUL-20
Lead (Pb)-Dissolved			107.7		%		80-120	28-JUL-20
Lithium (Li)-Dissolved			98.9		%		80-120	28-JUL-20
Magnesium (Mg)-Dissolved			111.9		%		80-120	28-JUL-20
Manganese (Mn)-Dissolved			107.4		%		80-120	28-JUL-20
Molybdenum (Mo)-Dissolved			101.0		%		80-120	28-JUL-20
Nickel (Ni)-Dissolved			103.3		%		80-120	28-JUL-20
Phosphorus (P)-Dissolved			113.6		%		70-130	28-JUL-20
Potassium (K)-Dissolved			110.1		%		80-120	28-JUL-20
Selenium (Se)-Dissolved			98.3		%		80-120	28-JUL-20
Silicon (Si)-Dissolved			101.6		%		60-140	28-JUL-20
Silver (Ag)-Dissolved			102.4		%		80-120	28-JUL-20
Sodium (Na)-Dissolved			104.0		%		80-120	28-JUL-20
Strontium (Sr)-Dissolved			102.3		%		80-120	28-JUL-20
Sulfur (S)-Dissolved			103.4		%		80-120	28-JUL-20
Thallium (Tl)-Dissolved			113.3		%		80-120	28-JUL-20
Tin (Sn)-Dissolved			100.7		%		80-120	28-JUL-20
Titanium (Ti)-Dissolved			104.9		%		80-120	28-JUL-20
Uranium (U)-Dissolved			105.4		%		80-120	28-JUL-20
Vanadium (V)-Dissolved			106.6		%		80-120	28-JUL-20
Zinc (Zn)-Dissolved			103.7		%		80-120	28-JUL-20
Zirconium (Zr)-Dissolved			93.4		%		80-120	28-JUL-20
WG3370662-5 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	28-JUL-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	28-JUL-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	28-JUL-20
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	28-JUL-20

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R5167403								
WG3370662-5 MB								
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	28-JUL-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	28-JUL-20
Cadmium (Cd)-Dissolved			<0.000005C		mg/L		0.000005	28-JUL-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	28-JUL-20
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	28-JUL-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	28-JUL-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	28-JUL-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	28-JUL-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	28-JUL-20
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	28-JUL-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	28-JUL-20
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	28-JUL-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	28-JUL-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	28-JUL-20
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	28-JUL-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	28-JUL-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	28-JUL-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	28-JUL-20
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	28-JUL-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	28-JUL-20
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	28-JUL-20
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	28-JUL-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	28-JUL-20
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	28-JUL-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	28-JUL-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	28-JUL-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	28-JUL-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	28-JUL-20
Zirconium (Zr)-Dissolved			<0.00020		mg/L		0.0002	28-JUL-20
NH3-L-F-CL	**Water**							
Batch R5171059								
WG3372159-26 LCS								
Ammonia as N			99.1		%		85-115	28-JUL-20
WG3372159-25 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-L-F-CL	**Water**							
Batch R5171059								
WG3372159-25 MB								
Ammonia as N			<0.0050		mg/L		0.005	28-JUL-20
NO2-L-IC-N-CL	**Water**							
Batch R5166746								
WG3370070-11 DUP		**L2478666-1**						
Nitrite (as N)		0.0140	0.0141		mg/L	0.7	20	23-JUL-20
WG3370070-10 LCS								
Nitrite (as N)			102.2		%		90-110	23-JUL-20
WG3370070-9 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	23-JUL-20
WG3370070-12 MS		**L2478666-1**						
Nitrite (as N)			101.0		%		75-125	23-JUL-20
NO3-L-IC-N-CL	**Water**							
Batch R5166746								
WG3370070-11 DUP		**L2478666-1**						
Nitrate (as N)		0.313	0.311		mg/L	0.5	20	23-JUL-20
WG3370070-10 LCS								
Nitrate (as N)			103.6		%		90-110	23-JUL-20
WG3370070-9 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	23-JUL-20
WG3370070-12 MS		**L2478666-1**						
Nitrate (as N)			102.9		%		75-125	23-JUL-20
PH/EC/ALK-CL	**Water**							
Batch R5167219								
WG3370559-8 LCS								
Conductivity (EC)			98.4		%		90-110	24-JUL-20
Alkalinity, Total (as CaCO3)			98.3		%		85-115	24-JUL-20
WG3370559-7 MB								
Conductivity (EC)			<2.0		uS/cm		2	24-JUL-20
Bicarbonate (HCO3)			<5.0		mg/L		5	24-JUL-20
Carbonate (CO3)			<5.0		mg/L		5	24-JUL-20
Hydroxide (OH)			<5.0		mg/L		5	24-JUL-20
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	24-JUL-20
PO4-DO-L-COL-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
PO4-DO-L-COL-CL	**Water**							
Batch R5166881								
WG3370100-2 LCS								
Orthophosphate-Dissolved (as P)			100.5		%		80-120	24-JUL-20
WG3370100-1 MB								
Orthophosphate-Dissolved (as P)			<0.0010		mg/L		0.001	24-JUL-20
SO4-L-IC-N-CL	**Water**							
Batch R5166746								
WG3370070-11 DUP		**L2478666-1**						
Sulfate (SO4)		6.96	6.99		mg/L	0.4	20	23-JUL-20
WG3370070-10 LCS								
Sulfate (SO4)			104.3		%		85-115	23-JUL-20
WG3370070-9 MB								
Sulfate (SO4)			<0.050		mg/L		0.05	23-JUL-20
WG3370070-12 MS		**L2478666-1**						
Sulfate (SO4)			103.2		%		75-125	23-JUL-20
TC-EC-MPN-CL	**Water**							
Batch R5166738								
WG3370064-7 MB								
MPN - E. Coli			<1		MPN/100mL		1	23-JUL-20
MPN - Total Coliforms			<1		MPN/100mL		1	23-JUL-20
TSS-L-CL	**Water**							
Batch R5169563								
WG3370699-8 LCS								
Total Suspended Solids			98.0		%		85-115	27-JUL-20
WG3370699-7 MB								
Total Suspended Solids			<1.0		mg/L		1	27-JUL-20

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L2478666-COFC

COC Number: 15 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	Sperling Hansen Associates Inc.
Contact:	David Kvick
Phone:	604-813-8476
	Company address below will appear on the final report
Street:	8-1225 East Keith Road
City/Province:	North Vancouver B.C.,
Postal Code:	V7J 1J3
Invoice To	Same as Report To ☑ ☐ NO
	Copy of Invoice with Report ☑ ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☑ ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

Email 3

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax

Email 2

Select Service Level Below - Please confirm all E&P TATs with your AM - surcharges will apply

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)			EMERGENCY	
	4 day [P4]	☐	1 Business day [E1]	☐
	3 day [P3]	☐	Same Day, Weekend or Statutory holiday [E0]	☐
	2 day [P2]	☐		

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

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:	Q80923	AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location: Hosmer	
ALS Lab Work Order # (lab use only)		ALS Contact: Dean	Sampler: J. Solmen

Analysis Request

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

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Conductivity	pH	Anions	Ammonia Nitrogen (NH_3)	Total Alkalinity	TSS	Metals (F/P)	Fecal & Total Coliform	Number of Containers
	E265104 (Fecal in standard bottle)	22-07-20			x	x	x	x	x	x	x	x	4
	E265105	"			x	x	x	x	x	x	x	x	4
	E265106	"			x	x	x	x	x	x	x	x	4
	MW-6	"			x	x	x	x	x	x	x	x	4
	MW-7	"			x	x	x	x	x	x	x	x	4

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

Are samples taken from a Regulated DW System? ☐ ☑ NO

Are samples for human drinking water use? ☐ ☑ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact ☑ Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: J. Solmen	Date: 22/7/20	Time:	Received by:	Date: 7/22	Time:	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

OCTOBER 2015 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Sperling Hansen Associates Inc.
ATTN: Scott Garthwaite
#8 - 1225 East Keith Road
North Vancouver BC V7J 1J3

Date Received: 22-OCT-20
Report Date: 29-OCT-20 14:33 (MT)
Version: FINAL

Client Phone: 604-986-7723

Certificate of Analysis

Lab Work Order #: L2520199

Project P.O. #: NOT SUBMITTED
Job Reference: 20050 HOSMER
C of C Numbers:
Legal Site Desc:

Patryk Wojciak, B.Sc., P.Chem.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L2520199-1	L2520199-2	L2520199-3	L2520199-4	
	Description	Groundwater	Groundwater	Groundwater	Groundwater	
	Sampled Date	21-OCT-20	21-OCT-20	21-OCT-20	21-OCT-20	
	Sampled Time	08:00	08:00	08:00	08:00	
	Client ID	E265104	E265105	MW6	MW7	
Grouping	**Analyte**					
WATER						
Physical Tests	Hardness (as CaCO3) (mg/L)	361	456	481	292	
	Total Suspended Solids (mg/L)	9.2	146	87.0	2650 DLHC	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	304	385	457	495	
	Ammonia as N (mg/L)	3.88 DLHC	8.01 DLHC	53 DLHC	56.0 DLHC	
	Bicarbonate (HCO3) (mg/L)	371	469	558	603	
	Carbonate (CO3) (mg/L)	<5.0	<5.0	<5.0	<5.0	
	Chloride (Cl) (mg/L)	59.2	70.7 DLHC	217 DLHC	120 DLHC	
	Conductivity (EC) (uS/cm)	683	809	1530 DLHC	1140 DLHC	
	Fluoride (F) (mg/L)	0.171	0.23 DLHC	0.33 DLHC	0.44 DLHC	
	Hydroxide (OH) (mg/L)	<5.0	<5.0	<5.0	<5.0	
	Nitrate and Nitrite (as N) (mg/L)	4.19	0.536	16.7	0.348	
	Nitrate (as N) (mg/L)	4.18	0.529 DLHC	16.6 DLHC	0.328 DLHC	
	Nitrite (as N) (mg/L)	0.0071	0.0068 DLHC	0.138 DLHC	0.0197 DLHC	
	pH (pH)	7.93	7.90	7.96	8.05	
	Sulfate (SO4) (mg/L)	5.13	17.0 DLHC	24.1 DLHC	0.63 DLHC	
Bacteriological Tests	MPN - E. Coli (MPN/100mL)	<1	<1	<1	<1	
	Coliform Bacteria - Fecal (CFU/100mL)	<1	<2 DLM	<2 DLM	<100 DLA	
	MPN - Total Coliforms (MPN/100mL)	<1	3	<1	<100 DLM	
Dissolved Metals	Dissolved Mercury Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Dissolved Metals Filtration Location	FIELD	FIELD	FIELD	FIELD	
	Aluminum (Al)-Dissolved (mg/L)	0.0010	0.0021	0.0022	0.0058	
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	<0.00010	0.00030	0.00024	
	Arsenic (As)-Dissolved (mg/L)	0.00014	0.00039	0.00356	0.0170	
	Barium (Ba)-Dissolved (mg/L)	0.353	0.352	0.365	0.458	
	Beryllium (Be)-Dissolved (mg/L)	<0.000020	<0.000020	<0.000020	<0.000020	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	<0.000050	
	Boron (B)-Dissolved (mg/L)	0.035	0.038	0.132	0.105	
	Cadmium (Cd)-Dissolved (mg/L)	0.000368	0.000119	0.0000675	0.0000183	
	Calcium (Ca)-Dissolved (mg/L)	111	136	152	89.8	
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	<0.00010	0.00015	0.00022	
	Cobalt (Co)-Dissolved (mg/L)	0.00060	0.00199	0.00810	0.00367	
	Copper (Cu)-Dissolved (mg/L)	0.00130	0.00048	0.00195	0.00046	
	Iron (Fe)-Dissolved (mg/L)	0.012	1.32	6.24	13.9	
	Lead (Pb)-Dissolved (mg/L)	0.000098	<0.000050	0.000068	0.000135	
	Lithium (Li)-Dissolved (mg/L)	0.0114	0.0146	0.0265	0.0186	
	Magnesium (Mg)-Dissolved (mg/L)	20.3	28.3	24.9	16.3	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	L2520199-1	L2520199-2	L2520199-3	L2520199-4	
Description	Groundwater	Groundwater	Groundwater	Groundwater	
Sampled Date	21-OCT-20	21-OCT-20	21-OCT-20	21-OCT-20	
Sampled Time	08:00	08:00	08:00	08:00	
Client ID	E265104	E265105	MW6	MW7	
Grouping / **Analyte**					
WATER					
Dissolved Metals Manganese (Mn)-Dissolved (mg/L)	0.441	0.930	1.18	0.437	
Mercury (Hg)-Dissolved (mg/L)	<0.0000050	<0.0000050	<0.0000050	<0.0000050	
Molybdenum (Mo)-Dissolved (mg/L)	0.000819	0.00112	0.00999	0.0112	
Nickel (Ni)-Dissolved (mg/L)	0.00512	0.00934	0.0463	0.00840	
Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	0.071	
Potassium (K)-Dissolved (mg/L)	6.70	6.24	30.4	28.2	
Selenium (Se)-Dissolved (mg/L)	0.000310	0.000995	0.000758	0.000353	
Silicon (Si)-Dissolved (mg/L)	3.99	4.68	7.11	6.37	
Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	<0.000010	
Sodium (Na)-Dissolved (mg/L)	27.6	18.5	75.4	56.0	
Strontium (Sr)-Dissolved (mg/L)	0.498	0.830	1.74	1.39	
Sulfur (S)-Dissolved (mg/L)	1.79	7.08	7.49	<0.50	
Thallium (Tl)-Dissolved (mg/L)	0.000143	0.000113	0.000141	<0.000010	
Tin (Sn)-Dissolved (mg/L)	<0.00010	<0.00010	0.00016	<0.00010	
Titanium (Ti)-Dissolved (mg/L)	<0.00030	<0.00030	<0.00030	<0.00030	
Uranium (U)-Dissolved (mg/L)	0.000527	0.000770	0.00162	0.000101	
Vanadium (V)-Dissolved (mg/L)	<0.00050	<0.00050	0.00058	0.00229	
Zinc (Zn)-Dissolved (mg/L)	0.0051	0.0077	0.0134	0.0030	
Zirconium (Zr)-Dissolved (mg/L)	<0.00030	<0.00030	0.00042	0.00074	

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2520199-1, -2, -3, -4
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L2520199-1, -2, -3, -4
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L2520199-1, -2, -3, -4
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L2520199-1, -2, -3, -4
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L2520199-1, -2, -3, -4
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L2520199-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BE-D-L-CCMS-CL	Water	Diss. Be (low) in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

CL-L-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

F-L-IC-CL	Water	Fluoride	APHA 4110 B-Ion Chromatography
FCC-MF-CL	Water	Fecal Coliform Count-MF	APHA 9222D

This analysis is carried out using procedures adapted from APHA Method 9222 "Membrane Filter Technique for Members of the Coliform Group". Coliform bacteria is enumerated by culturing and colony counting. A known sample volume is filtered through a 0.45 micron membrane filter. The test involves an initial 24 hour incubation at 44.5 degrees C of the filter with the appropriate growth medium. This method is specific for thermotolerant bacteria (Fecal) and is used for non-turbid water with a low background bacteria level.

HARDNESS-CALC-CL	Water	Hardness	APHA 2340 B

Hardness (also known as Total Hardness) is calculated from the sum of Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. Dissolved Calcium and Magnesium concentrations are preferentially used for the hardness calculation.

HG-D-CVAA-CL	Water	Dissolved Mercury in Water by CVAAS	APHA 3030B/EPA 1631E (mod)

Water samples are filtered (0.45 um), preserved with hydrochloric acid, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.

MET-D-CCMS-CL	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NH3-L-F-CL	Water	Ammonia, Total (as N)	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-CL	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-CL	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

PH/EC/ALK-CL	Water	pH, Conductivity and Total Alkalinity	APHA 4500H,2510,2320

All samples analyzed by this method for pH will have exceeded the 15 minute recommended hold time from time of sampling (field analysis is recommended for pH where highly accurate results are needed)
pH measurement is determined from the activity of the hydrogen ions using a hydrogen electrode and a reference electrode.
Alkalinity measurement is based on the sample's capacity to neutralize acid
Conductivity measurement is based on the sample's capacity to convey an electric current

Reference Information

SO4-L-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

TC-EC-MPN-CL	Water	Total Coliforms and E. Coli by MPN	APHA METHOD 9223

This analysis is carried out using procedures adapted from APHA Method 9223 "Enzyme Substrate Coliform Test". E. coli and Total Coliform are determined simultaneously. The
sample is mixed with a mixture hydrolyzable substrates and then sealed in a multi-well packet. The packet is incubated for 18 or 24 hours and then the number of wells exhibiting a positive response are counted. The final result is obtained by comparing the positive responses to a probability table.

TSS-L-CL	Water	Total Suspended Solids	APHA 2540 D-Gravimetric

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total suspended solids (TSS) are determined by filtering a sample through a glass fibre filter, and by drying the filter at 104 deg. C.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2520199 Report Date: 29-OCT-20

Client: Sperling Hansen Associates Inc.
#8 - 1225 East Keith Road
North Vancouver BC V7J 1J3
Contact: Scott Garthwaite

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BE-D-L-CCMS-CL	**Water**							
Batch R5268866								
WG3432311-3 DUP		**L2520199-4**						
Beryllium (Be)-Dissolved		<0.000020	<0.000020	RPD-NA	mg/L	N/A	20	26-OCT-20
WG3432311-2 LCS								
Beryllium (Be)-Dissolved			105.0		%		80-120	26-OCT-20
WG3432311-1 MB								
Beryllium (Be)-Dissolved			<0.000020		mg/L		0.00002	26-OCT-20
WG3432311-4 MS		**L2520199-4**						
Beryllium (Be)-Dissolved			111.9		%		70-130	26-OCT-20
CL-L-IC-N-CL	**Water**							
Batch R5269524								
WG3433177-6 LCS								
Chloride (Cl)			104.1		%		85-115	23-OCT-20
WG3433177-5 MB								
Chloride (Cl)			<0.10		mg/L		0.1	23-OCT-20
F-L-IC-CL	**Water**							
Batch R5269524								
WG3433177-6 LCS								
Fluoride (F)			104.2		%		85-115	23-OCT-20
WG3433177-5 MB								
Fluoride (F)			<0.020		mg/L		0.02	23-OCT-20
FCC-MF-CL	**Water**							
Batch R5267378								
WG3431182-3 MB								
Coliform Bacteria - Fecal			<1		CFU/100mL		1	22-OCT-20
HG-D-CVAA-CL	**Water**							
Batch R5269634								
WG3433221-14 LCS								
Mercury (Hg)-Dissolved			101.0		%		80-120	27-OCT-20
WG3433221-18 LCS								
Mercury (Hg)-Dissolved			103.0		%		80-120	27-OCT-20
WG3433221-13 MB								
Mercury (Hg)-Dissolved			<0.000005(		mg/L		0.000005	27-OCT-20
WG3433221-17 MB								
Mercury (Hg)-Dissolved			<0.000005(		mg/L		0.000005	27-OCT-20
MET-D-CCMS-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R5268866								
WG3432311-3 DUP		**L2520199-4**						
Aluminum (Al)-Dissolved		0.0058	0.0063		mg/L	7.9	20	26-OCT-20
Antimony (Sb)-Dissolved		0.00024	0.00024		mg/L	0.7	20	26-OCT-20
Arsenic (As)-Dissolved		0.0170	0.0171		mg/L	1.0	20	26-OCT-20
Barium (Ba)-Dissolved		0.458	0.452		mg/L	1.2	20	26-OCT-20
Bismuth (Bi)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	26-OCT-20
Boron (B)-Dissolved		0.105	0.106		mg/L	1.0	20	26-OCT-20
Cadmium (Cd)-Dissolved		0.0000183	0.0000187		mg/L	2.2	20	26-OCT-20
Calcium (Ca)-Dissolved		89.8	91.3		mg/L	1.6	20	26-OCT-20
Chromium (Cr)-Dissolved		0.00022	0.00024		mg/L	10	20	26-OCT-20
Cobalt (Co)-Dissolved		0.00367	0.00365		mg/L	0.5	20	26-OCT-20
Copper (Cu)-Dissolved		0.00046	0.00045		mg/L	3.1	20	26-OCT-20
Iron (Fe)-Dissolved		13.9	13.8		mg/L	0.4	20	26-OCT-20
Lead (Pb)-Dissolved		0.000135	0.000136		mg/L	1.1	20	26-OCT-20
Lithium (Li)-Dissolved		0.0186	0.0180		mg/L	3.1	20	26-OCT-20
Magnesium (Mg)-Dissolved		16.3	16.3		mg/L	0.4	20	26-OCT-20
Manganese (Mn)-Dissolved		0.437	0.447		mg/L	2.2	20	26-OCT-20
Molybdenum (Mo)-Dissolved		0.0112	0.0112		mg/L	0.1	20	26-OCT-20
Nickel (Ni)-Dissolved		0.00840	0.00840		mg/L	0.1	20	26-OCT-20
Phosphorus (P)-Dissolved		0.071	0.071		mg/L	0.8	20	26-OCT-20
Potassium (K)-Dissolved		28.2	27.9		mg/L	1.0	20	26-OCT-20
Selenium (Se)-Dissolved		0.000353	0.000334		mg/L	5.8	20	26-OCT-20
Silicon (Si)-Dissolved		6.37	6.31		mg/L	0.9	20	26-OCT-20
Silver (Ag)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	26-OCT-20
Sodium (Na)-Dissolved		56.0	56.0		mg/L	0.1	20	26-OCT-20
Strontium (Sr)-Dissolved		1.39	1.41		mg/L	1.4	20	26-OCT-20
Sulfur (S)-Dissolved		<0.50	<0.50	RPD-NA	mg/L	N/A	20	26-OCT-20
Thallium (Tl)-Dissolved		<0.000010	<0.000010	RPD-NA	mg/L	N/A	20	26-OCT-20
Tin (Sn)-Dissolved		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	26-OCT-20
Titanium (Ti)-Dissolved		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	26-OCT-20
Uranium (U)-Dissolved		0.000101	0.000100		mg/L	1.5	20	26-OCT-20
Vanadium (V)-Dissolved		0.00229	0.00231		mg/L	0.8	20	26-OCT-20
Zinc (Zn)-Dissolved		0.0030	0.0031		mg/L	1.4	20	26-OCT-20
Zirconium (Zr)-Dissolved		0.00074	0.00074		mg/L	0.3	20	26-OCT-20
WG3432311-2 LCS								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch	**R5268866**							
WG3432311-2	**LCS**							
Aluminum (Al)-Dissolved			104.2		%		80-120	26-OCT-20
Antimony (Sb)-Dissolved			101.1		%		80-120	26-OCT-20
Arsenic (As)-Dissolved			101.8		%		80-120	26-OCT-20
Barium (Ba)-Dissolved			105.4		%		80-120	26-OCT-20
Bismuth (Bi)-Dissolved			104.8		%		80-120	26-OCT-20
Boron (B)-Dissolved			109.5		%		80-120	26-OCT-20
Cadmium (Cd)-Dissolved			103.3		%		80-120	26-OCT-20
Calcium (Ca)-Dissolved			102.3		%		80-120	26-OCT-20
Chromium (Cr)-Dissolved			102.4		%		80-120	26-OCT-20
Cobalt (Co)-Dissolved			103.1		%		80-120	26-OCT-20
Copper (Cu)-Dissolved			101.7		%		80-120	26-OCT-20
Iron (Fe)-Dissolved			100.2		%		80-120	26-OCT-20
Lead (Pb)-Dissolved			106.0		%		80-120	26-OCT-20
Lithium (Li)-Dissolved			103.7		%		80-120	26-OCT-20
Magnesium (Mg)-Dissolved			106.1		%		80-120	26-OCT-20
Manganese (Mn)-Dissolved			104.6		%		80-120	26-OCT-20
Molybdenum (Mo)-Dissolved			104.3		%		80-120	26-OCT-20
Nickel (Ni)-Dissolved			100.9		%		80-120	26-OCT-20
Phosphorus (P)-Dissolved			107.6		%		70-130	26-OCT-20
Potassium (K)-Dissolved			101.2		%		80-120	26-OCT-20
Selenium (Se)-Dissolved			98.6		%		80-120	26-OCT-20
Silicon (Si)-Dissolved			104.2		%		60-140	26-OCT-20
Silver (Ag)-Dissolved			103.5		%		80-120	26-OCT-20
Sodium (Na)-Dissolved			104.4		%		80-120	26-OCT-20
Strontium (Sr)-Dissolved			108.1		%		80-120	26-OCT-20
Sulfur (S)-Dissolved			98.6		%		80-120	26-OCT-20
Thallium (Tl)-Dissolved			106.6		%		80-120	26-OCT-20
Tin (Sn)-Dissolved			103.2		%		80-120	26-OCT-20
Titanium (Ti)-Dissolved			97.8		%		80-120	26-OCT-20
Uranium (U)-Dissolved			105.9		%		80-120	26-OCT-20
Vanadium (V)-Dissolved			105.6		%		80-120	26-OCT-20
Zinc (Zn)-Dissolved			100.1		%		80-120	26-OCT-20
Zirconium (Zr)-Dissolved			100.8		%		80-120	26-OCT-20
WG3432311-1	**MB**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R5268866								
WG3432311-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	26-OCT-20
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	26-OCT-20
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	26-OCT-20
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	26-OCT-20
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	26-OCT-20
Boron (B)-Dissolved			<0.010		mg/L		0.01	26-OCT-20
Cadmium (Cd)-Dissolved			<0.000005C		mg/L		0.000005	26-OCT-20
Calcium (Ca)-Dissolved			<0.050		mg/L		0.05	26-OCT-20
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	26-OCT-20
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	26-OCT-20
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	26-OCT-20
Iron (Fe)-Dissolved			<0.010		mg/L		0.01	26-OCT-20
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	26-OCT-20
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	26-OCT-20
Magnesium (Mg)-Dissolved			<0.0050		mg/L		0.005	26-OCT-20
Manganese (Mn)-Dissolved			<0.00010		mg/L		0.0001	26-OCT-20
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	26-OCT-20
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	26-OCT-20
Phosphorus (P)-Dissolved			<0.050		mg/L		0.05	26-OCT-20
Potassium (K)-Dissolved			<0.050		mg/L		0.05	26-OCT-20
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	26-OCT-20
Silicon (Si)-Dissolved			<0.050		mg/L		0.05	26-OCT-20
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	26-OCT-20
Sodium (Na)-Dissolved			<0.050		mg/L		0.05	26-OCT-20
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	26-OCT-20
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	26-OCT-20
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	26-OCT-20
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	26-OCT-20
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	26-OCT-20
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	26-OCT-20
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	26-OCT-20
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	26-OCT-20
Zirconium (Zr)-Dissolved			<0.00020		mg/L		0.0002	26-OCT-20
WG3432311-4 MS		**L2520199-4**						

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL	**Water**							
Batch R5268866								
WG3432311-4 MS		**L2520199-4**						
Aluminum (Al)-Dissolved			111.1		%		70-130	26-OCT-20
Antimony (Sb)-Dissolved			110.1		%		70-130	26-OCT-20
Arsenic (As)-Dissolved			111.4		%		70-130	26-OCT-20
Barium (Ba)-Dissolved			N/A	MS-B	%		-	26-OCT-20
Bismuth (Bi)-Dissolved			107.8		%		70-130	26-OCT-20
Boron (B)-Dissolved			116.4		%		70-130	26-OCT-20
Cadmium (Cd)-Dissolved			110.4		%		70-130	26-OCT-20
Calcium (Ca)-Dissolved			N/A	MS-B	%		-	26-OCT-20
Chromium (Cr)-Dissolved			108.7		%		70-130	26-OCT-20
Cobalt (Co)-Dissolved			111.2		%		70-130	26-OCT-20
Copper (Cu)-Dissolved			108.7		%		70-130	26-OCT-20
Iron (Fe)-Dissolved			109.5		%		70-130	26-OCT-20
Lead (Pb)-Dissolved			111.0		%		70-130	26-OCT-20
Lithium (Li)-Dissolved			109.4		%		70-130	26-OCT-20
Magnesium (Mg)-Dissolved			N/A	MS-B	%		-	26-OCT-20
Manganese (Mn)-Dissolved			N/A	MS-B	%		-	26-OCT-20
Molybdenum (Mo)-Dissolved			112.9		%		70-130	26-OCT-20
Nickel (Ni)-Dissolved			108.3		%		70-130	26-OCT-20
Phosphorus (P)-Dissolved			109.9		%		70-130	26-OCT-20
Potassium (K)-Dissolved			105.0		%		70-130	26-OCT-20
Selenium (Se)-Dissolved			111.5		%		70-130	26-OCT-20
Silicon (Si)-Dissolved			108.3		%		70-130	26-OCT-20
Silver (Ag)-Dissolved			110.6		%		70-130	26-OCT-20
Sodium (Na)-Dissolved			N/A	MS-B	%		-	26-OCT-20
Strontium (Sr)-Dissolved			N/A	MS-B	%		-	26-OCT-20
Thallium (Tl)-Dissolved			110.0		%		70-130	26-OCT-20
Tin (Sn)-Dissolved			110.2		%		70-130	26-OCT-20
Titanium (Ti)-Dissolved			107.0		%		70-130	26-OCT-20
Uranium (U)-Dissolved			112.5		%		70-130	26-OCT-20
Vanadium (V)-Dissolved			112.0		%		70-130	26-OCT-20
Zinc (Zn)-Dissolved			110.0		%		70-130	26-OCT-20
Zirconium (Zr)-Dissolved			111.5		%		70-130	26-OCT-20
NH3-L-F-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-L-F-CL	**Water**							
Batch R5269964								
WG3433389-22 LCS								
Ammonia as N			104.4		%		85-115	27-OCT-20
WG3433389-21 MB								
Ammonia as N			<0.0050		mg/L		0.005	27-OCT-20
NO2-L-IC-N-CL	**Water**							
Batch R5269524								
WG3433177-6 LCS								
Nitrite (as N)			105.4		%		90-110	23-OCT-20
WG3433177-5 MB								
Nitrite (as N)			<0.0010		mg/L		0.001	23-OCT-20
NO3-L-IC-N-CL	**Water**							
Batch R5269524								
WG3433177-6 LCS								
Nitrate (as N)			103.9		%		90-110	23-OCT-20
WG3433177-5 MB								
Nitrate (as N)			<0.0050		mg/L		0.005	23-OCT-20
PH/EC/ALK-CL	**Water**							
Batch R5266696								
WG3430997-17 LCS								
Conductivity (EC)			94.1		%		90-110	23-OCT-20
Alkalinity, Total (as CaCO3)			101.0		%		85-115	23-OCT-20
WG3430997-16 MB								
Conductivity (EC)			<2.0		uS/cm		2	23-OCT-20
Bicarbonate (HCO3)			<5.0		mg/L		5	23-OCT-20
Carbonate (CO3)			<5.0		mg/L		5	23-OCT-20
Hydroxide (OH)			<5.0		mg/L		5	23-OCT-20
Alkalinity, Total (as CaCO3)			<2.0		mg/L		2	23-OCT-20
SO4-L-IC-N-CL	**Water**							
Batch R5269524								
WG3433177-6 LCS								
Sulfate (SO4)			101.9		%		85-115	23-OCT-20
WG3433177-5 MB								
Sulfate (SO4)			<0.050		mg/L		0.05	23-OCT-20
TC-EC-MPN-CL	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TC-EC-MPN-CL	**Water**							
Batch R5267285								
WG3431152-7 MB								
MPN - E. Coli			<1		MPN/100mL		1	22-OCT-20
MPN - Total Coliforms			<1		MPN/100mL		1	22-OCT-20
TSS-L-CL	**Water**							
Batch R5268672								
WG3431607-8 LCS								
Total Suspended Solids			98.5		%		85-115	25-OCT-20
WG3431607-7 MB								
Total Suspended Solids			<1.0		mg/L		1	25-OCT-20

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

L2520199-COFC

tody (COC) / Analytical Request Form

COC Number: 20 -

www.alsglobal.com

anada Toll Free: 1 800 668 9878

Page of

Report To	Contact and company name below will appear on the final report
Company:	Sperling Hansen Associates Inc.
Contact:	Scott Garthwaite
Phone:	778-471-7088
	Company address below will appear on the final report
Street:	1225 East Keith Road
City/Province:	North Vancouver, B.C.
Postal Code:	V7J 1J3
Invoice To	Same as Report To ☑ ☑ NO
	Copy of Invoice with Report ☑ ☐ NO
Company:	
Contact:	

Reports / Recipients

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

Invoice Recipients

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: rhajjafari@sperlinghansen.com
Email 2:

Turnaround Time (TAT) Requested

☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimum
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minimum
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minimum
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minimum
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Additional fees may apply to rush requests on weekends, statutory holidays and non-

AFFIX ALS BARCODE LABEL HERE (ALS use only)

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

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

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:	20050 Hosmer	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (ALS use only): **ALS Contact:** Dean Watt **Sampler:** Tyler McBride

Analysis Request

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

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Anions	Total Alkalinity	TSS	Dissolved Metals (F/P)	Total Metals (P)	Ammonia	Fecal and Total Coliform	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	E265104	21-10-20		Groundwater	5	X	X	X	X		X	X			
	E265105	21-10-20		Groundwater	5	X	X	X	X		X	X			
	~~E265106~~	—		Groundwater											
	MW6	21-10-20		Groundwater	5	X	X	X	X		X	X			
	MW7	21-10-20		Groundwater	5	X	X	X	X		X	X			

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

Are samples taken from a Regulated DW System?
☐ ☑ NO

Are samples for human consumption/ use?
☐ ☑ NO

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

British Columbia Contaminated Sites Regulation Stage 10 Amendment (NOV, 2017)
British Columbia Approved and Working Water Quality Guidelines (MAY, 2015)

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☑ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED
Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO
Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
4							

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by: Tyler McBride	Date: Oct 21, 2020	Time:	Received by:	Date: 10/22	Time: 8:50	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

END OF REPORT