

June 29, 2017

File: 2016-8113.010.000

Brady Nelless
Regional Director
BC Ministry of Environment
Northern Regional Operations
Bag 5000
3726 Alfred Avenue
Smithers, BC V0J 2N0

**Re: GRACE-MAR FARMS SPRING 2017 WATER SAMPLING RESULTS
MINISTRY OF ENVIRONMENT FILE NO. 350101 - ACTION PLAN ITEM #14**

Dear Mr. Nelless:

1 BACKGROUND

Grace-Mar Farms Ltd. (Grace-Mar) operates a feeding operation for heifers at 5904 Salmon River Road, Armstrong, BC. Grace-Mar operated a dairy operation at the same location up to Feb 28, 2017, when the milking cows were moved to their Fraser Valley operation. On May 12, 2016, the BC Ministry of Environment (MOE) issued a Pollution Abatement Order ("the Order") to Grace-Mar (File AMS#350101, MOE 2016). The Order required that Grace-Mar carry out a comprehensive monitoring program, complete an environmental assessment (EIA), prepare an Action Plan to detail measures to be taken to abate any environmental impacts identified in the EIA, and submit formal written summaries for three years identifying what actions from the Action Plan were undertaken. The EIA and Action Plan were submitted to MOE on November 17, 2016 and April 6, 2017, respectively.

2 SCOPE OF WORK AND OBJECTIVES

As one of the specified actions in the Action Plan submitted to MOE in March 2017 and subsequently accepted, Grace-Mar retained Associated Environmental Consultants Inc. (Associated) to complete groundwater and surface water quality sampling from nine locations (Associated 2017). The Action (#14) is to:

"Sample groundwater from MW1, MW2, MW3S, MW3D, WT94334, WT94335, WT48878, WT82426¹ and Floyd's Swamp. Analyze for nitrate-N, nitrite-N, ammonia, total Kjeldahl nitrogen (TKN), total nitrogen, and chloride, low detection level phosphorous."

¹ Note: there was typographical mistake in the March 2017 Action Plan. WT42426 should have read WT82426 and is therefore changed above. Associated informed MOE of this error.

An Associated Engineering Company

June 29, 2017
Brady Nelless
BC Ministry of Environment
- 2 -

As described in the Order, formal summary letters must be submitted to MOE annually for three years to confirm that certain Actions have been completed. The reports are to:

- i) summarize in reasonable detail what actions from the Action Plan were undertaken;
- ii) identify of all agriculture operational changes that occurred;
- iii) summarize in reasonable detail monitoring results;
- iv) summarize environmental impact assessment (first year only); and
- v) recommend additional mitigation and restoration measures, if appropriate.

The first formal summary letter is due June 30, 2017. This letter meets the requirements of the first formal summary letter for Action #14. The letter includes methods, results and discussion, quality assurance/quality control, and any additional measures.

3 METHODS

Water quality samples were collected by Marta Green of Associated, following standard BC methods (MWLAP 2013), from the locations listed in Table 1 and shown on Figure 1. These locations differ slightly from those listed in the Action Plan in that WPID 28093 and Mr. James Krebber's Well were sampled instead of WT82426 and WT48878. This was because during the field visit, Associated confirmed that WT82426 and WT48878 either do not exist, or are in a different location than shown on the BC Water Resource Atlas. Instead, WPID 28093 and Mr. Krebber's Well were sampled because they represent the closest domestic wells to MW1 (which was the goal in the Action Plan). Samples were collected on May 24, 2017, with the exception of Mr. Krebber's Well, which could not be accessed during the May site visit and was instead sampled on June 20, 2017. Field sheets from the sampling events are attached.



Figure1_June2017.mxd / 6/29/2017 / 2:40:04 PM



- Study area
- Parcel boundary
- Field
- MOE registered wells with Well Tag (WT) number - * indicates location confirmed by owner
- ⊕ Existing
- ⊕ Well not found during site visit
- ⊕ Monitoring wells
- ⊕ Additional water supply well not on MOE registry

PROJECT NO.:	2016-8113.010.003	FIGURE 1: CLOSE-UP OF FACILITIES
DATE:	June 2017	
DRAWN BY:	BdJ	
		Grace-Mar Farms Ltd.
		Action Plan

June 29, 2017
Brady Nelless
BC Ministry of Environment
- 4 -

Table 1: Spring 2017 Sampling Locations

Sample Location	Sample Description
MW1	Monitoring well (installed in 2016)
MW2	Monitoring well (installed in 2016)
MW3S	Monitoring well (installed in 2016)
MW3D	Monitoring well (installed in 2016)
WTN 94334	Industrial well owned by Grace-Mar Farms. Used for livestock watering and barn washing.
WTN 94335	Industrial well owned by Grace-Mar Farms. Used for livestock watering and barn washing.
WPID 28093	Domestic, Irrigation and Industrial Use well owned by James Krebber. Used for domestic purposes (rental home) and livestock watering.
James Krebber's Well (no well tag number or well plate identifier)	Domestic well owned by James Krebber. Used for domestic purposes.
Floyd's Swamp	Surface water

Note: WTN refers to well tag number, which is a number assigned to a well log that is voluntarily submitted to MOE. WPID refers to well plate identifier, which is a steel plate affixed to the top of the casing on some wells by the well driller.

Water samples were shipped under chain-of-custody protocol to CARO Analytical Services (CARO) in Kelowna, BC for analysis of the parameters listed in the Action Plan: nitrate-N, nitrite-N, ammonia, TKN, total nitrogen, chloride, and total phosphorous (Associated 2017). A field duplicate sample² was also collected during the May 2017 sampling event.

The groundwater results were compared with the BC Approved and Working Water Quality Guidelines (BCAWQG/BCWWQG) for irrigation (I), livestock (L), and drinking water (DW) (MOE 2017a,b) and the Guidelines for Canadian Drinking Water Quality (GCDWQ) Maximum Acceptable Concentrations (MAC) and Aesthetic Objectives (AO) (Health Canada 2017). The results from Floyd's Swamp were compared with the same guidelines plus the BCAWQG/BCWWQG for aquatic life (AL) (MOE 2017a,b).

² Collection and analysis of duplicate samples provides information on the combined (field and analytical) precision of the sampling and the analytical program. Data are assessed by calculating the relative percent difference between the primary and duplicate sample, and comparing the data to acceptable thresholds (MWLAP 2013).

June 29, 2017
Brady Nelles
BC Ministry of Environment
- 5 -

4 RESULTS AND DISCUSSION

4.1 WATER QUALITY DATA

The groundwater results, tabulated and compared with applicable guidelines, are presented in Table 2. Also included in the tables are the results for nitrate-N, nitrite-N, ammonia-N, TKN, total nitrogen, chloride and total phosphorus from the October 2016 sampling event, for comparison purposes. Table 3 presents the results from Floyd's Swamp, which was only tested in May 2017. The original laboratory reports are attached.

The May 2017 groundwater quality data (Table 2) generally met applicable guidelines with the exception of the nitrate-N concentration in Mr. Krebber's Well, which was detected at 13.0 mg/L (the GCDWQ MAC and BCAWQG DW is 10 mg/L). The field-measured pH (6.95) in Mr. Krebber's Well was just below the lower end the GCDWQ Operational Guideline range of 7.0-10.5. pH is not considered to directly affect health; however, pH changes can influence the bio-availability of other parameters. The GCDWQ Operational Guideline for pH is set to maximize the effectiveness of treatment and to control corrosion/leaching from pipes (Health Canada 2015).

Of general note, nitrate-N, which exceeded the GCDWQ MAC and BCAWQG DW guideline in October 2016 in MW1 and MW3S, was not detected in either of these wells in May 2017. Interpretation of the results will occur after the next scheduled sampling event, which is planned for fall 2017.

The water quality data from Floyd's Swamp (Table 3) met the applicable guidelines with the exception of temperature (15.3°C), which exceeded the BCAWQG DW and GCDWQ AO (both 15°C), and nitrite-N (0.720 mg/L), which exceeded the BCAWQ AL (0.60 mg/L when chloride is >10 mg/L).

Based on the sampling completed for this report, completed to address Action #14, there are no changes to the overall conclusions of the November 2016 EIA report. The spring sampling confirmed that nitrate-N concentrations in local groundwater can be variable – nitrate-N was not detected in two wells where it previously exceeded the DW guideline (MW1 and MW3S), but was found to be above-guideline in a well that was not sampled before (Krebber). Additional interpretation and update of the environmental assessment findings will be completed after the second round of sampling, and reported in the required June 2018 summary letter.

An Associated Engineering Company

Table 2: Grace-Mar Groundwater Quality Results (Action #14 Sampling)
Fall 2016 and Spring 2017 Data

Sampling Location									MW1		MW2		MW3S		MW3D		WPID 28093	WTN 94335	WTN 94334			James Krebber Home
Date Sampled									18-Oct-16	24-May-17	04-Oct-16	24-May-17	04-Oct-16	24-May-17	05-Oct-16	24-May-17	24-May-17	24-May-17	04-Oct-16	24-May-17	24-May-17	20-Jun-17
Sample Type									Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Duplicate	Normal
Analyte	Unit	Guideline ¹																				
		BCAWQG I	BCWWQG I	BCAWQG L	BCWWQG L	BCAWQG DW	GCDWQ MAC	GCDWQ AO														
Field Results																						
Conductivity	µS/cm	NG	700 ^{3.1}	NG	NG	NG	NG	NG	1441	880	1320	1080	1720	1410	1510	1280	1180	1110	1550	1580	1580	1730
Oxidation reduction potential	mV	NG	NG	NG	NG	NG	NG	NG	66	13	34	15	83	16	18	24	16	99	38	78	78	110
pH		5.0 - 9.0 ^{2.1}	NG	5.0 - 9.5 ^{4.1}	NG	6.5 - 8.5 ^{5.1}	NG	7.0 - 10.5 ^{7.1}	7.17	7.5	7.06	7.3	6.80	7.1	7.23	7.4	7.4	8.0	7.16	7.4	7.4	6.95
Temperature	°C	N ^{2.2}	NG	N ^{4.2}	NG	15 ^{5.2}	NG	15	10.1	7.9	12.9	8.4	9.7	9.0	9.4	9.1	10.0	9.5	10.9	9.7	9.7	12.2
Lab Results																						
General																						
Chloride	mg/L	100	NG	600 ^{4.3}	NG	250 ^{5.3}	NG	250	47.5	22.6	41.9	35.6	54.5	50.5	30.3	30.3	6.72	36.2	18.9	26.1	26.4	28.1
Nutrients																						
Ammonia (total, as N)	mg/L	NG	NG	NG	NG	NG	NG	NG	0.031	0.030	0.050	0.022	<0.020	0.031	0.257	0.176	0.025	0.036	0.330	0.375	0.356	<0.020
Nitrate (as N)	mg/L	NG	NG	100 ^{4.4}	NG	10 ^{5.4}	10	NG	<u>21.0</u>	<0.010	7.82	<0.010	<u>16.6</u>	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<u>13.0</u>
Nitrate + Nitrite (as N)	mg/L	NG	NG	100 ^{4.5}	NG	NG	10 ^{6.1}	NG	21.0	<0.0100	7.91	0.0420	16.7	0.0292	<0.010	0.0147	<0.0100	<0.0100	<0.010	<0.0100	<0.0100	13.0
Nitrite (as N)	mg/L	NG	NG	10 ^{4.6}	NG	1 ^{5.5}	1	NG	<0.010	<0.010	0.094	0.042	0.016	0.029	<0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010	0.028
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	21.5	0.457	8.61	0.335	17.2	0.423	0.468	0.429	0.0890	0.275	0.552	0.563	0.558	13.5
Total kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	0.56	0.457	0.69	0.293	0.52	0.394	0.47	0.414	0.089	0.275	0.55	0.563	0.558	0.446
Phosphorus (total, by ICPMS/ICPOES method)	mg/L	NG	NG	NG	NG	N ^{5.6}	NG	NG	0.04		0.03		<0.02		0.05				0.05			
Phosphorus (total, APHA method)	mg/L	NG	NG	NG	NG	N ^{5.6}	NG	NG	0.025	0.0452		0.0096		<0.0020	0.026	0.0399	0.0027	0.0056		0.0401	0.0408	<0.0020

¹ See attachments for guideline notes.

Legend	
<	Less than reported detection limit
NG	No Guideline
N	Narrative type of guideline or standard, or Result Note.
Calc	Calculated guideline. The guideline is dependent on the value of one or more other analytes, and is calculated from a formula or table.
BCAWQG I	Highlighted value exceeds the BC Approved Water Quality Guidelines for irrigation (BCAWQG I)
BCWWQG I	Highlighted value exceeds the BC Working Water Quality Guidelines for irrigation (BCWWQG I)
BCAWQG L	Highlighted value exceeds the BC Approved Water Quality Guidelines for livestock (BCAWQG L)
BCWWQG L	Highlighted value exceeds the BC Working Water Quality Guidelines for livestock (BCWWQG L)
BCAWQG DW	Highlighted value exceeds the BC Approved Water Quality Guidelines for drinking water (BCAWQG DW)
GCDWQ MAC	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)
GCDWQ AO	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)



Table 3: Grace-Mar Surface Water Quality Results (Action #14 Sampling)
Spring 2017 Data

Sampling Location											Floyd's Swamp
Date Sampled											24-May-17
Sample Type											Normal
Analyte	Unit	Guideline									
		BCAWQG AL	BCWWQG AL	BCAWQG I	BCWWQG I	BCAWQG L	BCWWQG L	BCAWQG DW	GCDWQ MAC	GCDWQ AO	
Field Results											
Conductivity	µS/cm	NG	NG	NG	700 ^{3.1}	NG	NG	NG	NG	NG	1490
Oxidation reduction potential	mV	NG	NG	NG	NG	NG	NG	NG	NG	NG	3
pH		N ^{1.1}	NG	5.0 - 9.0 ^{2.1}	NG	5.0 - 9.5 ^{4.1}	NG	6.5 - 8.5 ^{5.1}	NG	7.0 - 10.5 ^{7.1}	7.7
Temperature	°C	19 ^{1.2}	NG	N ^{2.2}	NG	N ^{4.2}	NG	15 ^{5.2}	NG	15	15.3
Lab Results											
General											
Chloride	mg/L	600 ^{1.3}	NG	100	NG	600 ^{4.3}	NG	250 ^{5.3}	NG	250	30.4
Nutrients											
Ammonia (total, as N)	mg/L	Calc ^{1.4}	NG	NG	NG	NG	NG	NG	NG	NG	1.14
Nitrate (as N)	mg/L	32.8 ^{1.5}	NG	NG	NG	100 ^{4.4}	NG	10 ^{5.4}	10	NG	<0.010
Nitrate + Nitrite (as N)	mg/L	32.8 ^{1.6}	NG	NG	NG	100 ^{4.5}	NG	NG	10 ^{6.1}	NG	0.720
Nitrite (as N)	mg/L	Calc ^{1.7}	NG	NG	NG	10 ^{4.6}	NG	1 ^{5.5}	1	NG	0.720
Total nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	4.72
Total kjeldahl nitrogen	mg/L	NG	NG	NG	NG	NG	NG	NG	NG	NG	4.00
Phosphorus (total, APHA 4500-P)	mg/L	N ^{1.8}	NG	NG	NG	NG	NG	N ^{5.6}	NG	NG	0.410

¹ See attachments for guideline notes.

Legend

<	Less than reported detection limit
NG	No Guideline
N	Narrative type of guideline or standard, or Result Note.
Calc	Calculated guideline. The guideline is dependent on the value of one or more other analytes, and is calculated from a formula or table.
BCAWQG AL	Highlighted value exceeds the BC Approved Water Quality Guidelines for aquatic life (BCAWQG AL)
BCWWQG AL	Highlighted value exceeds the BC Working Water Quality Guidelines for aquatic life (BCWWQG AL)
BCAWQG I	Highlighted value exceeds the BC Approved Water Quality Guidelines for irrigation (BCAWQG I)
BCWWQG I	Highlighted value exceeds the BC Working Water Quality Guidelines for irrigation (BCWWQG I)
BCAWQG L	Highlighted value exceeds the BC Approved Water Quality Guidelines for livestock (BCAWQG L)
BCWWQG L	Highlighted value exceeds the BC Working Water Quality Guidelines for livestock (BCWWQG L)
BCAWQG DW	Highlighted value exceeds the BC Approved Water Quality Guidelines for drinking water (BCAWQG DW)
GCDWQ MAC	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)
GCDWQ AO	Highlighted value exceeds the Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)



June 29, 2017
Brady Nelless
BC Ministry of Environment
- 8 -

4.2 QUALITY ASSURANCE/QUALITY CONTROL DATA (QA/QC)

The relative percent difference (RPD) calculations from the duplicate sample set collected from WTN 94334 in May 2017 indicated good reproducibility, suggesting acceptable precision of the analytical data. The highest calculated RPD was 5.2%, and the average was 1.1%.

Information about the laboratory's QA/QC are provided as part of the attached laboratory reports. The laboratory used for the analysis (CARO) is accredited with the Canadian Association for Laboratory Accreditation.

5 RECOMMENDATIONS

Two changes to the monitoring program are recommended as follows:

1. Continue to sample WPID 28093 and Mr. Krebber's Well, which were sampled instead of WT82426 and WT48878 because these wells do not exist where they were originally thought to be located. The goal of sampling these two wells (WT48878 and 82426) was to sample the closest domestic well to MW1, because MW1 exceeded guidelines for nitrate-N. Collecting samples from the wells nearest to MW1 are the next step to better understand the source of the nitrate-N, and also to assess groundwater quality in nearby receptors. Mr. Krebber, owner of the property on which WT82426 and 48878 were thought to have been located, confirmed that his home well and WPID 28093, which is the source water for his rental home and cattle watering, are the nearest water supply wells to MW1.
2. Sample during high groundwater period (e.g.: spring or early summer) and low groundwater period (e.g: fall/winter) in 2017 and then re-assess frequency. The rationale for this change is the current schedule has sampling occurring in March and November in 2017 and then re-assess frequency. The goal of sampling in May and November was to sample twice a year coinciding with periods of high groundwater and low water respectively. High water was late this year. Grace-Mar therefore requests a change to the schedule in Action 14 to provide more flexibility to better capture the range in the hydrological cycle. This will improve the ability to assess environmental effects from land use activities.

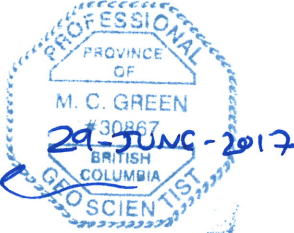

An Associated Engineering Company

June 29, 2017
Brady Nelless
BC Ministry of Environment
- 9 -

6 CLOSURE

We trust that this report satisfactorily meets the requirements of Action Plan Item #14. The next sampling event will occur in fall 2017. Please contact the undersigned if you have any questions.

Yours truly,



Marta Green, P. Geo.
Senior Hydrogeologist

ATTACHMENTS

Field Sheets
Laboratory Reports
Guideline Notes (for Tables 2 and 3)

An Associated Engineering Company

June 29, 2017
Brady Nelles
BC Ministry of Environment
- 10 -

REFERENCES

Associated Environmental Consultants Inc. (Associated). 2017. Grace-Mar Farms Ltd. Action Plan: AMS# 350101 (UA Hullcar Aquifer). March 2017.

British Columbia Ministry of Environment (MOE). 2017a. British Columbia Approved Water Quality Guidelines Summary Report. Ministry of Environment, Water Protection and Sustainability Branch. Updated January 2017. Available at: http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf

British Columbia Ministry of Environment (MOE). 2017b. British Columbia Working Water Quality Guidelines. Ministry of Environment, Water Protection and Sustainability Branch. Updated June 2017. Available at: http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/bc_env_working_water_quality_guidelines.pdf

British Columbia Ministry of Water, Land and Air Protection (MWLAP). 2013. British Columbia Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples. 2013 Edition. Available at: http://www2.gov.bc.ca/assets/gov/environment/research-monitoring-and-reporting/monitoring/emre/field_sample_man2013.pdf

Health Canada. 2015. Guidelines for Canadian Drinking Water Quality. Guideline Technical Document – pH. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. Available at: <https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-ph.html>

Health Canada. 2017. Guidelines for Canadian Drinking Water Quality – Summary Table. Prepared by the Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. Updated February 2017. Available at: <https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table-health-canada-2012.html>

An Associated Engineering Company



June 29, 2017
Brady Nelles
BC Ministry of Environment

ATTACHMENT 1: FIELD SHEETS

An Associated Engineering Company

Site/Facility Name:	GRACEMAR	Client:	
Well ID:	MW1	Project Number:	2016-8113.000
Date:	MAY 24, 2017	Sampled by:	MG
Casing Diameter:		Weather:	
Well Stick-up:		Remarks:	
Condition of well:	good		
	needs attention	Is the well marked/flagged?	Yes No

DTB:	7.883	m	Pressure:	
DTW:	3.575	m	negative	positive
Difference:	4.3	m	none	
	X 2	L/m		
Volume of water in well:	8.6	Litres	15cm (6") casing has 18L/m	
Volume of water to purge:	25	Litres	10cm (4") casing has 8L/m	
Volume actually purged:		Litres	5cm (2") casing has 2L/m	

UTM Coordinates:
Easting (6 digits)
Northing (7 digits)
Zone:

None Other: peristaltic low flow

Was sheen observed during purging or sampling?
 Yes No

[illegible]

Sample Descriptions:

Sample date: 6/24/2017 Sample time: 9:00

Appearance: _____ Sample Colour: 11

Order of bottles collected: nutrient yellow clear

List any Parameters not Sampled/bottles missed:

Were Samples Filtered and Preserved? Yes ☐ No ☒

Duplicate Sample? Yes ☐ No ☒ Duplicate Sample ID:

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour



Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	
Well ID:	MW2	Project Number:	2016 8113
Date:	12-19-2017	Sampled by:	MF
Casing Diameter:		Weather:	cloudy w/ rain showers
Well Stick-up:	orange	Remarks:	
Condition of well:	good		
	needs attention		
		Is the well marked/flagged? Yes No	

DTB:	4.6	m	Pressure:	
DTW:	1.34	m	negative	positive
Difference:	3.3	m	none	
	X 2	L/m		
Volume of water in well:	7	Litres	15cm (6") casing has 18L/m	
Volume of water to purge:		Litres	10cm (4") casing has 8L/m	
Volume actually purged:		Litres	5cm (2") casing has 2L/m	

UTM Coordinates:
Easting (6 digits)
Northing (7 digits)
Zone:

Purge method: Bailer Pump None Other:
Purged to dry: Yes No
Purge water disposal: Ground Container

Was sheen observed during purging or sampling?
Yes No

Field Parameters

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st	3	11:00	7.4	8.3	1290	2				
2nd	4	11:05	7.4	8.3	1230	2				
3rd	5	11:07	7.3	8.3	1190	3				
4th	6	11:10	7.3	8.4	1160	9				
5th	7	11:17	7.3	8.4	1090	14				turned flow down
6th	8	11:20	7.3	8.4	1080	15				
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: 12-19-2017 Sample time: (11:10-11:20) MW2 11:20
Appearance: Sample Colour: 11

Order of bottles collected: yellow, 11

List any Parameters not Sampled/bottles missed:

Were Samples Filtered and Preserved? Yes No

Duplicate Sample? Yes No Duplicate Sample ID:

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour

Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	
Well ID:	MWBS	Project Number:	
Date:	MAY 24 2017	Sampled by:	
Casing Diameter:	2"	Weather:	
Well Stick-up:	orange	Remarks:	
Condition of well:	good	needs attention	
Is the well marked/flagged?		Yes	No

DTB:	9.7	m	Pressure:	
DTW:	5.755	m	negative	positive
Difference:	3.6	m	none	
	X 2	L/m		
Volume of water in well:	7	Litres	15cm (6") casing has 18L/m	
Volume of water to purge:	21	Litres	10cm (4") casing has 8L/m	
Volume actually purged:		Litres	5cm (2") casing has 2L/m	

UTM Coordinates:
Easting (6 digits)
Northing (7 digits)
Zone:

Purge method: Bailer Pump None Other:

Purged to dry: Yes No

Purge water disposal: Ground Container

Was sheen observed during purging or sampling?

Yes No

Field Parameters

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st	1	10:10	7.2	8.9	1490	15				
2nd	3	10:15	7.1	8.6	1480	16				
3rd	4	10:18	7.1	8.9	1480	16				
4th	5	10:18	7.1	8.8	1450	16				
5th	6	10:24	7.1	9.1	1410	16				
6th	7	10:31	7.1	9.0	1410	16				
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: MAY 24 2017 Sample time: (10:20 on bottles) 10:31

Appearance: Sample Colour: 16

Order of bottles collected: yellow, clear

List any Parameters not Sampled/bottles missed:

Were Samples Filtered and Preserved? Yes No

Duplicate Sample? Yes No Duplicate Sample ID:

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour

Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	
Well ID:	MW30	Project Number:	
Date:	May 23 2017	Sampled by:	Ma
Casing Diameter:		Weather:	9°C windy
Well Stick-up:	71	Remarks:	
Condition of well:	good		
		Is the well marked/flagged? Yes No	

DTB:	17	m	Pressure:	
DTW:	5.805	m	negative	positive
Difference:	11	m	none	
	71 X 2	L/m		
Volume of water in well:	22	Litres	15cm (6") casing has 18L/m	
Volume of water to purge:		Litres	10cm (4") casing has 8L/m	
Volume actually purged:		Litres	5cm (2") casing has 2L/m	

UTM Coordinates:
Easting (6 digits)
Northing (7 digits)
Zone:

Purge method: Bailer Pump None Other:

Purged to dry: Yes No

Purge water disposal: Ground Container

Was sheen observed during purging or sampling? Yes No

Field Parameters

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st	2	9:40	7.4	9.1	1320	17	clr	clr	none	
2nd	3	9:46	7.5	9.1	1310	19	clr	clr	none	
3rd	4	9:49	7.4	9.1	1300	20	clr	clr	"	
4th	5	9:52	7.4	9.1	1280	24	clr	clr	"	
5th										
6th										
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: May 23 2017 Sample time: 9:52

Appearance: clr Sample Colour: clr

Order of bottles collected: yellow, clear

List any Parameters not Sampled/bottles missed:

Were Samples Filtered and Preserved? Yes No

Duplicate Sample? Yes No Duplicate Sample ID:

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour

Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	
Well ID:	Floyd Swamp	Project Number:	206 013
Date:	May 24 2012	Sampled by:	Me
Casing Diameter:	surface water	Weather:	rainy + windy 8C
Well Stick-up:		Remarks:	
Condition of well:	good needs attention		
		Is the well marked/flagged?	Yes No

DTB:		m	Pressure:	
DTW:		m	negative positive	
Difference:		m	none	
	X 2	L/m		
Volume of water in well:		Litres	15cm (6") casing has 18L/m	UTM Coordinates:
Volume of water to purge:		Litres	10cm (4") casing has 8L/m	Easting (6 digits)
Volume actually purged:		Litres	5cm (2") casing has 2L/m	Northing (7 digits)
				Zone:

Purge method: Bailer Pump None Other:

Purged to dry: Yes No

Purge water disposal: Ground Container

Was sheen observed during purging or sampling? Yes No

Field Parameters *Surface water sample*

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st		11:35	7.7	15.3	1490	3	some brown flecks seen			
2nd										
3rd										
4th										
5th										
6th										
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: May 24 2012 Sample time: 11:40 (1135 on bottle)

Appearance: Sample Colour: slight faint brown

Order of bottles collected: yellow then white, from white.

List any Parameters not Sampled/bottles missed: _____

Were Samples Filtered and Preserved? Yes No

Duplicate Sample? Yes No Duplicate Sample ID: _____

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour

Invoked to bench depth then sampled.

Taken 3m to edge of water, pole reached 2m from there, from face

2nd fence post from SW fence post corner.

Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	
Well ID:	W910 28093	Project Number:	2016-8113
Date:	Nov 24, 2017	Sampled by:	MF
Casing Diameter:		Weather:	cloudy 10C
Well Stick-up:		Remarks:	
Condition of well:	good		
		Is the well marked/flagged? Yes No	

DTB: No info		m	Pressure:		UTM Coordinates:
DTW: No access		m	negative	positive	Easting (6 digits)
Difference:		m	none		
	X 2	L/m			Northing (7 digits)
Volume of water in well:		Litres	15cm (6") casing has 18L/m		
Volume of water to purge:		Litres	10cm (4") casing has 8L/m		
Volume actually purged:		Litres	5cm (2") casing has 2L/m		Zone:

Purge method: Bailer Pump None Other:

Purged to dry: Yes No

Purge water disposal: Ground Container

Was seen observed during purging or sampling? Yes No

Field Parameters

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st										
2nd		1:34	7.4	10.3	1190	19				
3rd		1:36	7.4	9.8	1200	15				
4th		1:44	7.3	10.2	1190	17				
5th		1:46	7.4	10.0	1180	16				
6th										
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: clear Sample time: (1:40 on bottle) 1:46

Appearance: yellow, clear Sample Colour:

Order of bottles collected: yellow, clear

List any Parameters not Sampled/bottles missed:

Were Samples Filtered and Preserved? Yes No as directed on bottle

Duplicate Sample? Yes No Duplicate Sample ID:

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour

Serves 3 homes - this is only well around, as far as Jason know - this is nearest well nearby.

Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	GRASMARK
Well ID:	WR94334	Project Number:	2016-8113
Date:	May 24 2017	Sampled by:	ma
Casing Diameter:		Weather:	cloudy 10c rain showers
Well Stick-up:		Remarks:	
Condition of well:	good needs attention		
		Is the well marked/flagged?	Yes No

DTB:		m	Pressure:	
DTW:		m	negative	positive
Difference:		m	none	
	X 2	L/m		
Volume of water in well:		Litres	15cm (6") casing has 18L/m	
Volume of water to purge:		Litres	10cm (4") casing has 8L/m	
Volume actually purged:		Litres	5cm (2") casing has 2L/m	

UTM Coordinates:
Easting (6 digits)
Northing (7 digits)
Zone:

Purge method: Bailer Pump None Other:
Purged to dry: Yes No
Purge water disposal: Ground Container

Was sheen observed during purging or sampling?
 Yes No

Field Parameters

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st		12:37	7.4	9.7	1560	78				turn off tap on
2nd		12:43	7.4	9.8	1370	78				
3rd		12:45	7.4	9.8	1560	79				
4th		12:49	7.4	9.7	1580	78				
5th										
6th										
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: MAY 24 2017 Sample time: 12:49 (12:40 on bottle)
 Appearance: clear Sample Colour: clear

Order of bottles collected: yellow, clear

List any Parameters not Sampled/bottles missed: _____

Were Samples Filtered and Preserved? Yes No

Duplicate Sample? (Yes) No Duplicate Sample ID: Dup1

Additional Notes:
 - site access
 - hidden well location
 - safety concerns
 - unusual well behaviour
from 'inside perforator' take sample here - see 'water' sign



[Handwritten signature]

Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	GRACEMAR
Well ID:	W94335 "Bunk's well"	Project Number:	2016-8113
Date:	May 24 2017	Sampled by:	Mr
Casing Diameter:	6 inch	Weather:	rain showers 10C
Well Stick-up:		Remarks:	no w/p 10' + only 1ft aboveground *
Condition of well:	good		
	needs attention		
		Is the well marked/flagged?	Yes No

DTB:	120ft (from well top) 36m	m	Pressure:	
DTW:	4.677	m	negative	positive
Difference:		m	none	
	X 2	L/m		
Volume of water in well:		Litres	15cm (6") casing has 18L/m	UTM Coordinates:
Volume of water to purge:		Litres	10cm (4") casing has 8L/m	Easting (6 digits)
Volume actually purged:		Litres	5cm (2") casing has 2L/m	Northing (7 digits)
				Zone:

Purge method: Bailer ☒ Pump ☐ None ☐ Other: peristaltic set w ~ 5m

Purged to dry: Yes ☐ No ☐

Purge water disposal: Ground ☐ Container ☐

Was seen observed during purging or sampling? Yes ☐ No ☐

Field Parameters

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st		1230								Start pump
2nd	12	1255	8.1	9.5	1110	91				a little bit rusty
3rd	13	1259	8.1	9.4	1120	93				still
4th		1305	8.0	9.5	1110	99				
5th										
6th										
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: May 24 2017 Sample time: 13205

Appearance: Sample Colour: slight rust colour.

Order of bottles collected: yellow, clear

List any Parameters not Sampled/bottles missed:

Were Samples Filtered and Preserved? Yes No as required

Duplicate Sample? Yes No Duplicate Sample ID:

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour

well isn't used much, but uncertain as to what controls control that pump vs the main dairy pump, so only option is peristaltic pump best

Field Sampling Sheet - Groundwater

Site/Facility Name:		Client:	
Well ID:	JAMES KREPPER Home	Project Number:	2016 P/13 010
Date:	JUNE 20 2017	Sampled by:	MG
Casing Diameter:	6"	Weather:	29°C Windy
Well Stick-up:	2 ft	Remarks:	
Condition of well:	good		
		Is the well marked/flagged? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	

DTB:	No info	m	Pressure:
DTW:	but sprinkler has	m	negative positive
Difference:	been on all day	m	none
	X 2	L/m	
Volume of water in well:		Litres	15cm (6") casing has 18L/m
Volume of water to purge:		Litres	10cm (4") casing has 8L/m
Volume actually purged:		Litres	5cm (2") casing has 2L/m

UTM Coordinates:
Easting (6 digits)
50.480709
119.278428
Northing (7 digits)
Zone:

Purge method: Bailer Pump None Other:
Purged to dry: Yes No
Purge water disposal: Ground Container

Was seen observed during purging or sampling?
Yes No

Field Parameters

	Volume (L)	Time	pH	Temp °C	Cond µS/cm	ORP (mv)	Turbidity	Colour	Odour	Comments
1st		2:50	7.01	12.3	1722	117	clear			
2nd		2:53	6.99	12.2	1727	117	clear			
3rd		2:55	6.94	12.2	1732	116	"			
4th		2:57	6.93	12.2	1726	114	"			
5th		3:01	6.95	12.2	1730	110	"			
6th										
7th										
8th										

write additional lines on the back

Sample Descriptions:

Sample date: JUNE 20 2017 Sample time: 3:01

Appearance: Sample Colour:

Order of bottles collected:

List any Parameters not Sampled/bottles missed:

Were Samples Filtered and Preserved? Yes No

Duplicate Sample? Yes No Duplicate Sample ID:

Additional Notes:

- site access
- hidden well location
- safety concerns
- unusual well behaviour



June 29, 2017
Brady Nelles
BC Ministry of Environment

ATTACHMENT 2: LABORATORY REPORTS

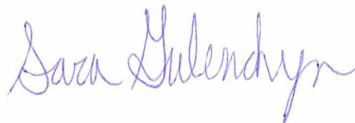
An Associated Engineering Company

REPORTED TO	Associated Environmental Consultants Inc. (Vernon) #200 - 2800 29th Street Vernon, BC V1T 9P9	TEL	(250) 545-3672
		FAX	(250) 545-3654
ATTENTION	Marta Green	WORK ORDER	7052134
PO NUMBER	2016-8113.010.003	RECEIVED / TEMP	2017-05-25 09:30 / 4°C
PROJECT	2016-8113.010.003	REPORTED	2017-06-01
PROJECT INFO	Gracemar	COC NUMBER	B39719

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.



Authorized By:

Sara Gulenchyn, B.Sc, P.Chem.
Client Service Coordinator

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

Locations:

#110 4011 Viking Way
Richmond, BC V6V 2K9
Tel: 604-279-1499

#102 3677 Highway 97N
Kelowna, BC V1X 5C3
Tel: 250-765-9646

17225 109 Avenue
Edmonton, AB T5S 1H7
Tel: 780-489-9100

www.caro.ca

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

Analysis Information Analysis Descriptions, Method References, Glossary of Terms	Page 3
--	--------

Sample Analytical Data Test Results, Reporting Limits, Analysis Dates, Sample & Analysis Notes	Page 4
--	--------

Quality Control Data Method Blanks, Duplicates, Spikes, Reference Materials	Appendix 1
---	------------

Analytical Summary Tabulated data in condensed format to assist with comparisons	Appendix 2
--	------------

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

Analysis Description	Method Reference	Technique	Location
Ammonia, Total in Water	APHA 4500-NH ₃ G*	Automated Colorimetry (Phenate)	Kelowna
Anions by IC in Water	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Nitrogen, Total Kjeldahl in Water	APHA 4500-Norg D*	Block Digestion and Flow Injection Analysis	Kelowna
Phosphorus, Total by Colorimetry in Water	APHA 4500-P B.5* / APHA 4500-P F	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna

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

Method Reference Descriptions:

APHA Standard Methods for the Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Water Works Association/Water Environment Federation

Glossary of Terms:

MRL Method Reporting Limit
 < Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
 AO Aesthetic objective
 MAC Maximum acceptable concentration (health based)
 OG Operational guideline (treated water)
 mg/L Milligrams per litre

Standards / Guidelines Referenced in this Report:

Guidelines for Canadian Drinking Water Quality (Feb 2017)

Website: http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf

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

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
---------	-------------------	----------------------	--------------	-------	----------	----------	-------

Sample ID: MW1 (7052134-01) [Water] Sampled: 2017-05-24 09:00

Anions

Chloride	22.6	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26	

General Parameters

Ammonia, Total (as N)	0.030	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.457	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0452	N/A	0.0020	mg/L	2017-05-29	2017-05-31	

Calculated Parameters

Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.457	N/A	0.0500	mg/L	N/A	N/A	

Sample ID: MW2 (7052134-02) [Water] Sampled: 2017-05-24 11:10

Anions

Chloride	35.6	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)	0.042	MAC = 1	0.010	mg/L	N/A	2017-05-26	

General Parameters

Ammonia, Total (as N)	0.022	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.293	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0096	N/A	0.0020	mg/L	2017-05-29	2017-05-31	

Calculated Parameters

Nitrate+Nitrite (as N)	0.0420	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.335	N/A	0.0500	mg/L	N/A	N/A	

Sample ID: MW3S (7052134-03) [Water] Sampled: 2017-05-24 10:20

Anions

Chloride	50.5	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)	0.029	MAC = 1	0.010	mg/L	N/A	2017-05-26	

General Parameters

Ammonia, Total (as N)	0.031	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.394	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	< 0.0020	N/A	0.0020	mg/L	2017-05-29	2017-05-31	

Calculated Parameters

Nitrate+Nitrite (as N)	0.0292	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.423	N/A	0.0500	mg/L	N/A	N/A	

Sample ID: MW3D (7052134-04) [Water] Sampled: 2017-05-24 09:52

Anions

Chloride	30.3	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
----------	------	----------	------	------	-----	------------	--

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
---------	-------------------	----------------------	--------------	-------	----------	----------	-------

Sample ID: MW3D (7052134-04) [Water] Sampled: 2017-05-24 09:52, Continued

Anions, Continued

Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26
Nitrite (as N)	0.015	MAC = 1	0.010	mg/L	N/A	2017-05-26

General Parameters

Ammonia, Total (as N)	0.176	N/A	0.020	mg/L	N/A	2017-05-29
Nitrogen, Total Kjeldahl	0.414	N/A	0.050	mg/L	2017-05-30	2017-06-01
Phosphorus, Total (as P)	0.0399	N/A	0.0020	mg/L	2017-05-29	2017-05-31

Calculated Parameters

Nitrate+Nitrite (as N)	0.0147	N/A	0.0100	mg/L	N/A	N/A
Nitrogen, Total	0.429	N/A	0.0500	mg/L	N/A	N/A

Sample ID: Floyd Swamp (7052134-05) [Water] Sampled: 2017-05-24 11:35

Anions

Chloride	30.4	AO ≤ 250	0.10	mg/L	N/A	2017-05-26
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26
Nitrite (as N)	0.720	MAC = 1	0.010	mg/L	N/A	2017-05-26

General Parameters

Ammonia, Total (as N)	1.14	N/A	0.020	mg/L	N/A	2017-05-29
Nitrogen, Total Kjeldahl	4.00	N/A	0.050	mg/L	2017-05-30	2017-06-01
Phosphorus, Total (as P)	0.410	N/A	0.0020	mg/L	2017-05-29	2017-05-31

Calculated Parameters

Nitrate+Nitrite (as N)	0.720	N/A	0.0100	mg/L	N/A	N/A
Nitrogen, Total	4.72	N/A	0.500	mg/L	N/A	N/A

Sample ID: WPID 28093 (7052134-06) [Water] Sampled: 2017-05-24 13:40

Anions

Chloride	6.72	AO ≤ 250	0.10	mg/L	N/A	2017-05-26
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26

General Parameters

Ammonia, Total (as N)	0.025	N/A	0.020	mg/L	N/A	2017-05-29
Nitrogen, Total Kjeldahl	0.089	N/A	0.050	mg/L	2017-05-30	2017-06-01
Phosphorus, Total (as P)	0.0027	N/A	0.0020	mg/L	2017-05-29	2017-05-31

Calculated Parameters

Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A
Nitrogen, Total	0.0890	N/A	0.0500	mg/L	N/A	N/A

Sample ID: WT 94334 (7052134-07) [Water] Sampled: 2017-05-24 12:40

Anions

Chloride	26.1	AO ≤ 250	0.10	mg/L	N/A	2017-05-26
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
---------	-------------------	----------------------	--------------	-------	----------	----------	-------

Sample ID: WT 94334 (7052134-07) [Water] Sampled: 2017-05-24 12:40, Continued

Anions, Continued

Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26	
----------------	---------	---------	-------	------	-----	------------	--

General Parameters

Ammonia, Total (as N)	0.375	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.563	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0401	N/A	0.0020	mg/L	2017-05-29	2017-05-31	

Calculated Parameters

Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.563	N/A	0.0500	mg/L	N/A	N/A	

Sample ID: WT 94335 (7052134-08) [Water] Sampled: 2017-05-24 13:05

Anions

Chloride	36.2	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26	

General Parameters

Ammonia, Total (as N)	0.036	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.275	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0056	N/A	0.0020	mg/L	2017-05-29	2017-05-31	

Calculated Parameters

Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.275	N/A	0.0500	mg/L	N/A	N/A	

Sample ID: Dup (7052134-09) [Water] Sampled: 2017-05-24 00:00

Anions

Chloride	26.4	AO ≤ 250	0.10	mg/L	N/A	2017-05-26	
Nitrate (as N)	< 0.010	MAC = 10	0.010	mg/L	N/A	2017-05-26	
Nitrite (as N)	< 0.010	MAC = 1	0.010	mg/L	N/A	2017-05-26	

General Parameters

Ammonia, Total (as N)	0.356	N/A	0.020	mg/L	N/A	2017-05-29	
Nitrogen, Total Kjeldahl	0.558	N/A	0.050	mg/L	2017-05-30	2017-06-01	
Phosphorus, Total (as P)	0.0408	N/A	0.0020	mg/L	2017-05-29	2017-05-31	

Calculated Parameters

Nitrate+Nitrite (as N)	< 0.0100	N/A	0.0100	mg/L	N/A	N/A	
Nitrogen, Total	0.558	N/A	0.0500	mg/L	N/A	N/A	

APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

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

- **Method Blank (Blk):** Laboratory reagent water is carried through sample preparation and analysis steps. Method Blanks indicate that results are free from contamination, i.e. not biased high from sources such as the sample container or the laboratory environment
- **Duplicate (Dup):** Preparation and analysis of a replicate aliquot of a sample. Duplicates provide a measure of the analytical method's precision, i.e. how reproducible a result is. Duplicates are only reported if they are associated with your sample data.
- **Blank Spike (BS):** A known amount of standard is carried through sample preparation and analysis steps. Blank Spikes, also known as laboratory control samples (LCS), are prepared from a different source of standard than used for the calibration. They ensure that the calibration is acceptable (i.e. not biased high or low) and also provide a measure of the analytical method's accuracy (i.e. closeness of the result to a target value).
- **Standard Reference Material (SRM):** A material of similar matrix to the samples, externally certified for the parameter(s) listed. Standard Reference Materials ensure that the preparation steps in the method are adequate to achieve acceptable recoveries of the parameter(s) tested.

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

Analyte	Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
Anions, Batch B7E1863									
Blank (B7E1863-BLK1)			Prepared: 2017-05-26, Analyzed: 2017-05-26						
Chloride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
Blank (B7E1863-BLK2)			Prepared: 2017-05-26, Analyzed: 2017-05-26						
Chloride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
LCS (B7E1863-BS1)			Prepared: 2017-05-26, Analyzed: 2017-05-26						
Chloride	16.0	0.10 mg/L	16.0		100	90-110			
Nitrate (as N)	4.28	0.010 mg/L	4.00		107	93-108			
Nitrite (as N)	1.94	0.010 mg/L	2.00		97	85-114			
LCS (B7E1863-BS2)			Prepared: 2017-05-26, Analyzed: 2017-05-26						
Chloride	16.4	0.10 mg/L	16.0		103	90-110			
Nitrate (as N)	4.29	0.010 mg/L	4.00		107	93-108			
Nitrite (as N)	1.97	0.010 mg/L	2.00		99	85-114			
Duplicate (B7E1863-DUP2)			Source: 7052134-09		Prepared: 2017-05-26, Analyzed: 2017-05-26				
Chloride	26.4	0.10 mg/L		26.4			< 1	10	
Nitrate (as N)	< 0.010	0.010 mg/L		< 0.010				10	
Nitrite (as N)	< 0.010	0.010 mg/L		< 0.010				6	
Matrix Spike (B7E1863-MS2)			Source: 7052134-09		Prepared: 2017-05-26, Analyzed: 2017-05-26				
Chloride	42.8	0.10 mg/L	16.0	26.4	102	75-125			
Nitrate (as N)	3.97	0.010 mg/L	4.00	< 0.010	99	75-125			
Nitrite (as N)	1.91	0.010 mg/L	2.00	< 0.010	96	80-120			

General Parameters, Batch B7E1814

APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

Analyte	Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
General Parameters, Batch B7E1814, Continued									
Blank (B7E1814-BLK1)			Prepared: 2017-05-29, Analyzed: 2017-05-29						
Ammonia, Total (as N)	< 0.020	0.020 mg/L							
Blank (B7E1814-BLK2)			Prepared: 2017-05-29, Analyzed: 2017-05-29						
Ammonia, Total (as N)	< 0.020	0.020 mg/L							
LCS (B7E1814-BS1)			Prepared: 2017-05-29, Analyzed: 2017-05-29						
Ammonia, Total (as N)	0.914	0.020 mg/L	1.00		91	86-111			
LCS (B7E1814-BS2)			Prepared: 2017-05-29, Analyzed: 2017-05-29						
Ammonia, Total (as N)	0.913	0.020 mg/L	1.00		91	86-111			
General Parameters, Batch B7E2013									
Blank (B7E2013-BLK1)			Prepared: 2017-05-29, Analyzed: 2017-05-31						
Phosphorus, Total (as P)	< 0.0020	0.0020 mg/L							
Blank (B7E2013-BLK2)			Prepared: 2017-05-29, Analyzed: 2017-05-31						
Phosphorus, Total (as P)	< 0.0020	0.0020 mg/L							
LCS (B7E2013-BS1)			Prepared: 2017-05-29, Analyzed: 2017-05-31						
Phosphorus, Total (as P)	0.106	0.0020 mg/L	0.100		106	80-112			
LCS (B7E2013-BS2)			Prepared: 2017-05-29, Analyzed: 2017-05-31						
Phosphorus, Total (as P)	0.0956	0.0020 mg/L	0.100		96	80-112			
Duplicate (B7E2013-DUP2)			Source: 7052134-08		Prepared: 2017-05-29, Analyzed: 2017-05-31				
Phosphorus, Total (as P)	0.0053	0.0020 mg/L		0.0056				30	
Matrix Spike (B7E2013-MS2)			Source: 7052134-08		Prepared: 2017-05-29, Analyzed: 2017-05-31				
Phosphorus, Total (as P)	0.474	0.0020 mg/L	0.500	0.0056	94	69-122			
General Parameters, Batch B7E2127									
Blank (B7E2127-BLK1)			Prepared: 2017-05-30, Analyzed: 2017-06-01						
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
LCS (B7E2127-BS1)			Prepared: 2017-05-30, Analyzed: 2017-06-01						
Nitrogen, Total Kjeldahl	1.00	0.050 mg/L	1.00		100	84-121			
LCS (B7E2127-BS2)			Prepared: 2017-05-30, Analyzed: 2017-06-01						
Nitrogen, Total Kjeldahl	0.933	0.050 mg/L	1.00		93	84-121			

APPENDIX 2: ANALYTICAL SUMMARY

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.003

WORK ORDER REPORTED 7052134
2017-06-01

		7052134-01	7052134-02	7052134-03	7052134-04	7052134-05	7052134-06
		Water	Water	Water	Water	Water	Water
		2017-05-24	2017-05-24	2017-05-24	2017-05-24	2017-05-24	2017-05-24
		MW1	MW2	MW3S	MW3D	Floyd Swamp	WPID 28093
Anions	Chloride (mg/L)	22.6	35.6	50.5	30.3	30.4	6.72
	Nitrate (as N) (mg/L)	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
	Nitrite (as N) (mg/L)	< 0.010	0.042	0.029	0.015	0.720	< 0.010
General Parameters	Ammonia, Total (as N) (mg/L)	0.030	0.022	0.031	0.176	1.14	0.025
	Nitrogen, Total Kjeldahl (mg/L)	0.457	0.293	0.394	0.414	4.00	0.089
	Phosphorus, Total (as P) (mg/L)	0.0452	0.0096	< 0.0020	0.0399	0.410	0.0027
Calculated Parameters	Nitrate+Nitrite (as N) (mg/L)	< 0.0100	0.0420	0.0292	0.0147	0.720	< 0.0100
	Nitrogen, Total (mg/L)	0.457	0.335	0.423	0.429	4.72	0.0890

		7052134-07	7052134-08	7052134-09
		Water	Water	Water
		2017-05-24	2017-05-24	2017-05-24
		WT 94334	WT 94335	Dup
Anions	Chloride (mg/L)	26.1	36.2	26.4
	Nitrate (as N) (mg/L)	< 0.010	< 0.010	< 0.010
	Nitrite (as N) (mg/L)	< 0.010	< 0.010	< 0.010
General Parameters	Ammonia, Total (as N) (mg/L)	0.375	0.036	0.356
	Nitrogen, Total Kjeldahl (mg/L)	0.563	0.275	0.558
	Phosphorus, Total (as P) (mg/L)	0.0401	0.0056	0.0408
Calculated Parameters	Nitrate+Nitrite (as N) (mg/L)	< 0.0100	< 0.0100	< 0.0100
	Nitrogen, Total (mg/L)	0.563	0.275	0.558



CHAIN OF CUSTODY RECORD

COC# **B 39719** PAGE OF

RELINQUISHED BY:	DATE:	RECEIVED BY:	DATE:
	TIME:	<i>W/I</i>	<i>05/25/17</i>
			TIME: <i>30</i>

PROJECT:
GRACEMAR

PROJECT INFO:
2016-8113.010.003

- **TURNAROUND TIME REQUESTED:**

REGULATORY APPLICATION:

Regs on Report? ☐

Routine: (5-7 Days) ☐Canadian Drinking Water Quality Guidelines ☐

Rush: 1 Day* ☐ 2 Day* ☐ 3 Day* ☐

BC Drinking Water Protection Act / Req. ☐

Other*

BC CSR ☐ AB TIER 1 ☐ CCME ☐ OTHER* ☐

***Contact Lab To Confirm. Surcharge May Apply**

AL ☐ PL ☐ RL ☐ CL ☐ IL ☐ AW ☐ IW ☐ LW ☐

ANALYSES REQUESTED:

COMPANY: ASSOCIATED
ADDRESS: ENVIRONMENTAL
200-2800 29th ST
CONTACT: MARTA GREEN
TEL/FAX: 250 503 7330
DELIVERY METHOD: EMAIL ☐ MAIL ☐ OTHER* ☐
DATA FORMAT: EXCEL ☐ WATERTRAX ☐ ESdat ☐
EQUS ☐ BC EMS ☐ OTHER* ☐
EMAIL 1: greenm@aer.ca
EMAIL 2: planner@aer.ca
EMAIL 3:

INVOICE TO: SAME AS REPORT TO ☒

COMPANY: _____

ADDRESS: _____

CONTACT: _____

TEL/FAX: _____

DELIVERY METHOD: EMAIL ☐ MAIL ☐ OTHER* ☐

EMAIL 1: _____

EMAIL 2: _____

EMAIL 3: _____

PO #: 2016-8113-010,003

**** NEW **** If you would like to sign up for ClientConnect and/or EnviroChain, CARO's online service offerings, check here: ☐

SAMPLED BY: _____		MATRIX:				SAMPLING:		COMMENTS:		BTX <input type="checkbox"/> VPH <input type="checkbox"/> VOC <input type="checkbox"/> PHC F2 <input type="checkbox"/> PAH <input type="checkbox"/> L/HEPH <input type="checkbox"/> PHENOLS Chlorinated <input type="checkbox"/> PCB <input type="checkbox"/> GLYCOL <input type="checkbox"/> PESTICIDES <input type="checkbox"/> A <input type="checkbox"/> METALS - WATER T <input type="checkbox"/> METALS - WATER D <input type="checkbox"/> METALS - SOIL (SA <input type="checkbox"/> pH <input type="checkbox"/> EC <input type="checkbox"/> ALI <input type="checkbox"/> TSS <input type="checkbox"/> VSS <input type="checkbox"/> T <input type="checkbox"/> BOD <input type="checkbox"/> COD <input type="checkbox"/> TOG <input type="checkbox"/> MOG <input type="checkbox"/> FECAL COLIFORMS <input type="checkbox"/> TOTAL COLIFORMS <input type="checkbox"/> ASBESTOS <input type="checkbox"/>																				HOLD		
CLIENT SAMPLE ID:	DRINKING WATER	OTHER WATER	SOIL	OTHER	# CONTAINERS	DATE	TIME	CHLORINATED	FILTERED	PRESERVED	(e.g. flow/volume media ID/notes)																					
MW1	X				2	MAY 24/2017	900				as needed																					
MW2	X				1		1110																									
MW3S	X				1		1020																									
MW3D	X				1		952																									
Floyd Swamp	X				1		1135																									
WPID 28093	X				1		140																									
WT 94334	X				1		1240																									
WT 94335	X				1		1305																									
Dup 1	X				1																											

SHIPPING INSTRUCTIONS: Return Cooler(s) ☐

Supplies Needed:

SAMPLE RETENTION INSTRUCTIONS (Discarded 30 days after Report unless otherwise specified):

60 Days ☐ 90 Days ☐ Longer Date (Surcharges will Apply):

* OTHER INSTRUCTIONS:

PAYMENT:

CHEQUE ☐
CREDIT ☐
DEBIT ☐
CASH ☐

SAMPLE RECEIPT CONDITION:

COOLER 1 (°C): 4.4 ICE: Y ☒ N ☐
COOLER 2 (°C): _____ ICE: Y ☐ N ☐
COOLER 3 (°C): _____ ICE: Y ☐ N ☐

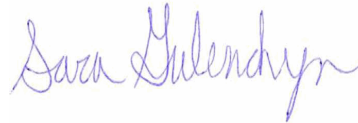
CERTIFICATE OF ANALYSIS

REPORTED TO	Associated Environmental Consultants Inc. (Vernon) #200 - 2800 29th Street Vernon, BC V1T 9P9	TEL	(250) 545-3672
		FAX	(250) 545-3654
ATTENTION	Nicole Penner	WORK ORDER	7061861
PO NUMBER		RECEIVED / TEMP	2017-06-21 11:15 / 7°C
PROJECT	2016-8113.010.004	REPORTED	2017-06-23
PROJECT INFO	Grace-Mar Farms	COC NUMBER	B50531

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.



Authorized By: **Sara Gulenchyn, B.Sc, P.Chem.**
Client Service Coordinator

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

Locations:

#110 4011 Viking Way
Richmond, BC V6V 2K9
Tel: 604-279-1499

#102 3677 Highway 97N
Kelowna, BC V1X 5C3
Tel: 250-765-9646

17225 109 Avenue
Edmonton, AB T5S 1H7
Tel: 780-489-9100

www.caro.ca

ANALYSIS INFORMATION

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.004

WORK ORDER REPORTED 7061861
2017-06-23

Analysis Description	Method Reference	Technique	Location
Ammonia, Total in Water	APHA 4500-NH ₃ G*	Automated Colorimetry (Phenate)	Kelowna
Anions by IC in Water	APHA 4110 B	Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Nitrogen, Total Kjeldahl in Water	APHA 4500-Norg D*	Block Digestion and Flow Injection Analysis	Kelowna
Phosphorus, Total by Colorimetry in Water	APHA 4500-P B.5* / APHA 4500-P F	Persulfate Digestion / Automated Colorimetry (Ascorbic Acid)	Kelowna

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

Method Reference Descriptions:

APHA Standard Methods for the Examination of Water and Wastewater, 22nd Edition, American Public Health Association/American Water Works Association/Water Environment Federation

Glossary of Terms:

MRL Method Reporting Limit
 < Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
 mg/L Milligrams per litre

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.004

WORK ORDER REPORTED 7061861
2017-06-23

Analyte	Result / Recovery	MRL / Limits	Units	Prepared	Analyzed	Notes
---------	-------------------	--------------	-------	----------	----------	-------

Sample ID: James Krebber Home (7061861-01) [Water] Sampled: 2017-06-20 15:01

Anions

Chloride	28.1	0.10	mg/L	N/A	2017-06-22	
Nitrate (as N)	13.0	0.010	mg/L	N/A	2017-06-23	
Nitrite (as N)	0.028	0.010	mg/L	N/A	2017-06-22	

General Parameters

Ammonia, Total (as N)	< 0.020	0.020	mg/L	N/A	2017-06-21	
Nitrogen, Total Kjeldahl	0.446	0.050	mg/L	2017-06-21	2017-06-22	
Phosphorus, Total (as P)	< 0.0020	0.0020	mg/L	2017-06-22	2017-06-23	

Calculated Parameters

Nitrate+Nitrite (as N)	13.0	0.100	mg/L	N/A	N/A	
Nitrogen, Total	13.5	0.100	mg/L	N/A	N/A	
Nitrogen, Organic	0.446	0.0500	mg/L	N/A	N/A	

APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.004

WORK ORDER REPORTED 7061861
2017-06-23

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

- **Method Blank (Blk):** Laboratory reagent water is carried through sample preparation and analysis steps. Method Blanks indicate that results are free from contamination, i.e. not biased high from sources such as the sample container or the laboratory environment
- **Duplicate (Dup):** Preparation and analysis of a replicate aliquot of a sample. Duplicates provide a measure of the analytical method's precision, i.e. how reproducible a result is. Duplicates are only reported if they are associated with your sample data.
- **Blank Spike (BS):** A known amount of standard is carried through sample preparation and analysis steps. Blank Spikes, also known as laboratory control samples (LCS), are prepared from a different source of standard than used for the calibration. They ensure that the calibration is acceptable (i.e. not biased high or low) and also provide a measure of the analytical method's accuracy (i.e. closeness of the result to a target value).
- **Standard Reference Material (SRM):** A material of similar matrix to the samples, externally certified for the parameter(s) listed. Standard Reference Materials ensure that the preparation steps in the method are adequate to achieve acceptable recoveries of the parameter(s) tested.

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

Analyte	Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
---------	--------	-----------	-------------	---------------	-------	-----------	-------	-----------	-------

Anions, Batch B7F1555

Blank (B7F1555-BLK1)		Prepared: 2017-06-22, Analyzed: 2017-06-22							
Chloride	< 0.10	0.10 mg/L							
Nitrate (as N)	< 0.010	0.010 mg/L							
Nitrite (as N)	< 0.010	0.010 mg/L							
LCS (B7F1555-BS1)		Prepared: 2017-06-22, Analyzed: 2017-06-22							
Chloride	16.2	0.10 mg/L	16.0		101	90-110			
Nitrate (as N)	4.12	0.010 mg/L	4.00		103	93-108			
Nitrite (as N)	1.98	0.010 mg/L	2.00		99	85-114			

General Parameters, Batch B7F1511

Blank (B7F1511-BLK1)		Prepared: 2017-06-21, Analyzed: 2017-06-21							
Ammonia, Total (as N)	< 0.020	0.020 mg/L							
Blank (B7F1511-BLK2)		Prepared: 2017-06-21, Analyzed: 2017-06-21							
Ammonia, Total (as N)	< 0.020	0.020 mg/L							
LCS (B7F1511-BS1)		Prepared: 2017-06-21, Analyzed: 2017-06-21							
Ammonia, Total (as N)	1.00	0.020 mg/L	1.00		100	90-115			
LCS (B7F1511-BS2)		Prepared: 2017-06-21, Analyzed: 2017-06-21							
Ammonia, Total (as N)	1.02	0.020 mg/L	1.00		102	90-115			

General Parameters, Batch B7F1605

Blank (B7F1605-BLK1)		Prepared: 2017-06-21, Analyzed: 2017-06-22							
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							
Blank (B7F1605-BLK2)		Prepared: 2017-06-21, Analyzed: 2017-06-22							
Nitrogen, Total Kjeldahl	< 0.050	0.050 mg/L							

APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2016-8113.010.004

WORK ORDER REPORTED 7061861
2017-06-23

Analyte	Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
---------	--------	-----------	-------------	---------------	-------	-----------	-------	-----------	-------

General Parameters, Batch B7F1605, Continued

LCS (B7F1605-BS1)			Prepared: 2017-06-21, Analyzed: 2017-06-22						
Nitrogen, Total Kjeldahl	1.16	0.050 mg/L	1.00		116	84-121			
LCS (B7F1605-BS2)			Prepared: 2017-06-21, Analyzed: 2017-06-22						
Nitrogen, Total Kjeldahl	0.972	0.050 mg/L	1.00		97	84-121			

General Parameters, Batch B7F1695

Blank (B7F1695-BLK1)			Prepared: 2017-06-22, Analyzed: 2017-06-23						
Phosphorus, Total (as P)	< 0.0020	0.0020 mg/L							
Blank (B7F1695-BLK2)			Prepared: 2017-06-22, Analyzed: 2017-06-23						
Phosphorus, Total (as P)	< 0.0020	0.0020 mg/L							
LCS (B7F1695-BS1)			Prepared: 2017-06-22, Analyzed: 2017-06-23						
Phosphorus, Total (as P)	0.0977	0.0020 mg/L	0.100		98	80-112			
LCS (B7F1695-BS2)			Prepared: 2017-06-22, Analyzed: 2017-06-23						
Phosphorus, Total (as P)	0.0968	0.0020 mg/L	0.100		97	80-112			



- ☐ 110-4011 Viking Way, Richmond, BC V6V 2K9
Tel: (604) 279-1499 Fax: (604) 279-1599
- ☒ 102-3677 Highway 97N, Kelowna, BC V1X 5C3
Tel: (250) 765-9646 Fax: (250) 765-3893
- ☐ 17225 109 Avenue NW, Edmonton, AB T5S 1H7
Tel: (780) 489-9100 Fax: (780) 489-9700

CHAIN OF CUSTODY RECORD

COC# **B 50531** PAGE **OF**

RELINQUISHED BY: <i>Nicole Penner</i>	DATE: <i>8 Jun 21, 2017</i> TIME: <i>8:10am</i>	RECEIVED BY: <i>ES Ace</i>	DATE: <i>8 Jun 21, 2017</i> TIME: <i>11:21</i>
PROJECT: <i>2016-8113, 010, 004</i>		PROJECT INFO:	

REPORT TO:
COMPANY: *ASSOCIATED*
ADDRESS: *200-2800 29th St*
VERNON BC
CONTACT: *MARTA GREEN*
TEL/FAX: *250 503 7330*
DELIVERY METHOD: EMAIL ☐ MAIL ☐ OTHER* ☐
DATA FORMAT: EXCEL ☐ WATERTRAX ☐ ESdat ☐
EQUS ☐ BC EMS ☐ OTHER* ☐
EMAIL 1: *greenm@ar.ca*
EMAIL 2: *penner@ar.ca*
EMAIL 3:

INVOICE TO: SAME AS REPORT TO ☒
COMPANY:
ADDRESS:
CONTACT:
TEL/FAX:
DELIVERY METHOD: EMAIL ☐ MAIL ☐ OTHER* ☐
EMAIL 1:
EMAIL 2:
EMAIL 3:
PO #:

TURNAROUND TIME REQUESTED: Routine: (5-7 Days) <input type="checkbox"/> Rush: 1 Day* <input type="checkbox"/> 2 Day* <input checked="" type="checkbox"/> 3 Day* <input type="checkbox"/> Other* *Contact Lab To Confirm. Surcharge May Apply	REGULATORY APPLICATION: Canadian Drinking Water Quality Guidelines <input checked="" type="checkbox"/> Regs on Report? <input type="checkbox"/> BC Drinking Water Protection Act / Reg. <input type="checkbox"/> BC CSR <input type="checkbox"/> AB TIER 1 <input type="checkbox"/> CCME <input checked="" type="checkbox"/> OTHER* <input type="checkbox"/> AL <input type="checkbox"/> PL <input type="checkbox"/> RL <input type="checkbox"/> CL <input type="checkbox"/> IL <input type="checkbox"/> AW <input type="checkbox"/> IW <input type="checkbox"/> LW <input type="checkbox"/>
--	--

ANALYSES REQUESTED:

** NEW ** If you would like to sign up for ClientConnect and/or EnviroChain, CARO's online service offerings, check here: ☐

SAMPLED BY: *M. Green*

MATRIX:

SAMPLING:

COMMENTS:

DRINKING WATER	OTHER WATER	SOIL	OTHER
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CONTAINERS

DATE

TIME

CHLORINATED

FILTERED

PRESERVED

(e.g. flow/volume media ID/notes)

BTEX ☐ VPH ☐ PHC F1 ☐VOC ☐ VPH ☐EPH ☐ PHC F2-F4 ☐PAH ☐ L/HEPH ☐PHENOLS Chlorinated ☐ Non-Chlor. ☐PCB ☐ GLYCOLS ☐ HAA ☐PESTICIDES ☐ ACID HERBICIDES ☐METALS - WATER TOTAL ☐ Hg ☐METALS - WATER DISSOLVED ☐ Hg ☐METALS - SOIL (SALM) ☐ inc. pH ☐pH ☐ EC ☐ ALK ☐TSS ☐ VSS ☐ TDS ☐BOD ☐ COD ☐TOG ☐ MOG ☐FECAL COLIFORMS ☐ HPC ☐TOTAL COLIFORMS ☐ E. coli ☐

ASBESTOS

*Nitrate, nitrite**Ammonia, TKN**Organic N, Total N**Chloride**Total phosphorus (low level)**Hold*

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

SAMPLE RETENTION INSTRUCTIONS (Discarded 30 days after Report unless otherwise specified):
60 Days ☐ 90 Days ☐ Longer Date (Surcharges will Apply):
* OTHER INSTRUCTIONS:
Rush samples - 2 Day TAT (50% surcharge)
Upload to WWS

PAYMENT:

CHEQUE ☐
CREDIT ☐
DEBIT ☐
CASH ☐
INVOICE ☐

SAMPLE RECEIPT CONDITION:

COOLER 1 (°C): *7.1* ICE: *X* N ☐
COOLER 2 (°C): ICE: Y ☐ N ☐
COOLER 3 (°C): ICE: Y ☐ N ☐
CUSTODY SEALS INTACT: NA ☐ Y ☐ N ☐



June 29, 2017
Brady Nelles
BC Ministry of Environment

ATTACHMENT 3: GUIDELINE NOTES FOR TABLES 2 AND 3

An Associated Engineering Company

Grace-Mar Water Quality Sampling (Action #14)
Guideline Notes for Table 2 and Table 3

1. Notes for BC Approved Water Quality Guidelines for freshwater aquatic life (BCAWQG AL)

General Notes:

The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used. / For some parameters, guidelines are specified as two values: the maximum value or the acute criterion, and the 30-day average value or the chronic criterion. The maximum value was used in this report for parameters that have both guideline values.

Note 1.1 for pH:

pH less than 6.5: No statistically significant decrease in pH from background.

pH from 6.5 to 9.0: Unrestricted change permitted within this range.

pH over 9.0: No statistically significant increase in pH from background.

See BC MOE Overview Report for additional details.

Note 1.2 for Temperature:

The maximum daily temperature of 19 degrees Celsius is for streams with unknown fish distribution. See BC MOE Overview Report for additional details for streams with unknown fish distribution, and specific guidelines for streams with known fish distribution, and guideline for lakes and impoundments.

Note 1.3 for Chloride:

To protect freshwater aquatic life from acute and lethal effects, the maximum concentration of chloride (mg/L as NaCl) at any time should not exceed 600 mg/L.

To protect freshwater aquatic life from chronic effects, the average (arithmetic mean computed from five weekly samples collected over a 30-day period) concentration of chloride (mg/L as NaCl) should not exceed 150 mg/L.

Note 1.4 for Ammonia (total, as N):

The maximum guideline for ammonia varies as a function of pH and temperature. See Table 3 in Overview Report Update September 2009.

The 30-day average guideline for ammonia varies as a function of pH and temperature. See Table 4 in Overview Report Update September 2009. / The lab pH and field temperature results were used for determining the maximum ammonia for this report. If a lab pH result was not available then the field pH result was used.

Note 1.5 for Nitrate (as N):

The guideline maximum for nitrate (as N) is 32.8 mg/l.

The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period.

Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.

Note 1.6 for Nitrate + Nitrite (as N):

The guideline maximum for nitrate (as N) is 32.8 mg/l.

The 30-day average guideline for nitrate (as N) is 3.0 mg /L. The 30-day average (chronic) concentration is based on 5 weekly samples collected within a 30-day period.

Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed these values.

Note 1.7 for Nitrite (as N):

The guideline maximum for nitrite as N is:

0.06 mg/L if chloride less than 2 mg/L

0.12 mg/L if chloride is 2 to 4 mg/L

0.18 mg/L if chloride is 4 to 6 mg/L

0.24 mg/L if chloride is 6 to 8 mg/L

0.30 mg/L if chloride is 8 to 10 mg/L

0.60 mg/L if chloride is greater than 10 mg/L.

The guideline 30-day average for nitrite as N is:

0.02 mg/L if chloride less than 2 mg/L

0.04 mg/L if chloride is 2 to 4 mg/L

0.06 mg/L if chloride is 4 to 6 mg/L

0.08 mg/L if chloride is 6 to 8 mg/L

0.10 mg/L if chloride is 8 to 10 mg/L

0.20 mg/L if chloride is greater than 10 mg/L.

Grace-Mar Water Quality Sampling (Action #14)
Guideline Notes for Table 2 and Table 3

Note 1.8 for Phosphorus (total, APHA 4500-P):

Streams: None proposed for streams.

Lakes: It is not possible to specify a single phosphorous concentration to achieve protection of aquatic life in lakes. A range of total phosphorous concentrations (5-15 µg/L) is suggested as the criterion which can be used as the basis for site specific water quality objectives.

2. Notes for BC Approved Water Quality Guidelines for irrigation (BCAWQG I)

General Notes:

The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used.

Note 2.1 for pH:

The recommended criterion for irrigation waters is a pH ranging between 5.0 and 9.0. This guideline recognizes that soil acidity, alkalinity and salinity are a concern in agriculture.

Note 2.2 for Temperature:

The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.

3. Notes for Working Water Quality Guidelines for British Columbia for irrigation (BCWWQG I)

General Notes:

Reference: Working Water Quality Guidelines for British Columbia (2015). WWQG values are long-term (i.e. average) concentrations unless identified as a short-term maximum in the "Notes" for a specific analyte. Long-term WWQGs represent average substance concentrations calculated from 5 samples in 30 days. WWQG are given for total substance concentrations unless otherwise noted.

Note 3.1 for Conductivity:

The guideline varies from 700 to 5000 µS/cm depending on the type of crop. The most stringent guideline has been used for this report.

4. Notes for BC Approved Water Quality Guidelines for livestock (BCAWQG L)

General Notes:

The Water Quality Guidelines (Criteria) Reports by BC Ministry of Environment were used as references for the guidelines. (Internet address: http://www.env.gov.bc.ca/wat/wq/wq_guidelines.html). Overview Reports (BC MOE) were used as the references for the guidelines unless the note for specific analyte indicates that the Technical Appendix (BC MOE) was used.

Note 4.1 for pH:

pH does not interfere with the palatability of water or the health of livestock.

Note 4.2 for Temperature:

The recommended guideline for temperature is + or - 1 degree Celsius change from natural ambient background.

Note 4.3 for Chloride:

The water quality guideline for chloride for livestock watering is 600 mg/L.

Note 4.4 for Nitrate (as N):

Overview Report Update, September 2009.

Note 4.5 for Nitrate + Nitrite (as N):

The guideline maximum for nitrate as nitrogen is 100 mg/l. Where nitrate and nitrite are present, the total nitrate+nitrite nitrogen should not exceed this value. Overview Report Update, September 2009.

Note 4.6 for Nitrite (as N):

Overview Report Update, September 2009.

5. Notes for BC Approved Water Quality Guidelines for drinking water (BCAWQG DW)

General Notes:

References: Table 1. British Columbia Ministry of Environment water quality guidelines for drinking water sources. January 2017; and Table 2. British Columbia Ministry of Environment drinking water quality guidelines for turbidity. January 2017.

Overview Reports (BC MOE) and Technical Appendix (BC MOE) were also used as references for some parameters.

Grace-Mar Water Quality Sampling (Action #14)

Guideline Notes for Table 2 and Table 3

Note 5.1 for pH:

Designed to minimize solubilization of heavy metals and salts from water distribution pipes and the precipitation of carbonate salts in the distribution system, and maximize the effectiveness of chlorination. However, natural source water outside the guidelines may be safe to drink from a public health perspective.

Note 5.2 for Temperature:

The guideline for maximum temperature for drinking water is 15 degrees.

Note 5.3 for Chloride:

The guideline maximum for chloride in drinking water (for aesthetic reasons) is 250 mg/L.

Note 5.4 for Nitrate (as N):

Overview Report Update, September 2009

Note 5.5 for Nitrite (as N):

Overview Report Update, September 2009

Note 5.6 for Phosphorus (total, APHA 4500-P):

For lakes used as a source of drinking water, the total phosphorous concentration should not exceed 10 µg/L. No guideline is recommended for streams.

6. Notes for Guidelines for Canadian Drinking Water Quality - Maximum Acceptable Concentrations (GCDWQ MAC)

Note 6.1 for Nitrate + Nitrite (as N):

The MAC for Nitrate (as N) is 10 mg/L

7. Notes for Guidelines for Canadian Drinking Water Quality - Aesthetic Objectives (GCDWQ AO)

Note 7.1 for pH:

The operational guideline for pH is a range of 7.0 to 10.5 in finished drinking water.