

Issue Date:	October 16, 2017	File:	2017-8011.000
To:	Ewen Stewart		
From:	Fawn Ross, R.P.Bio.		
Client:	Anmore Estates Ltd./LMS3080		
Project Name	Anmore Green Estates Hydrogeological Investigation		
Project No.	2017-8011.000		
Subject:	Results of September 2017 Soil Testing		

TECHNICAL MEMORANDUM

1 INTRODUCTION

Anmore Green Estates (AGE) is a 51-home community in Anmore, BC. The AGE Strata Corporation LMS 3080 (the Strata) is the owner and operator of the community's wastewater treatment system, which is directly west of the community (Figure 1). Infrastructure includes a secondary sewage treatment plant and two sub-surface disposal fields. The wastewater treatment system is permitted and operated under Permit PE-04606.¹

On December 21, 2016, a Ministry of Environment (MOE) representative² completed a site inspection, and found that the Strata was not compliant on several permit conditions. The identified conditions and their corresponding requested action items were detailed in a Warning Letter issued March 7, 2016. On October 10, 2017, Associated Environmental Consultants Inc. (Associated) prepared an Action Plan³ on behalf of AGE in response to the Warning Letter to document progress to date and the proposed actions moving forward. One of MOE's requested actions was to "work with qualified professionals to determine if there is breakthrough of septic discharge." To meet this requirement, Associated designed and implemented a comprehensive sampling plan to determine if septic breakout is occurring, and if so, determine if pollution may be occurring that could be a risk to human health. The comprehensive sampling plan, which is detailed in the Action Plan, includes soil and groundwater seepage testing (if sufficient water is present) of key wastewater parameters.

The purpose of this memo is to summarize the results of the first sampling event (September 27, 2017), which included soil testing from eight locations.

2 METHODS

On September 27, 2017, Fawn Ross, R.P.Bio., and Marta Green, P.Geo., of Associated visited the site and collected soil samples from areas south and west of the wastewater treatment system. Site conditions at the time of sampling were relatively dry; therefore, no water samples were collected.

Sample sites included areas where previous reports documented fecal coliform exceedances and 'background' areas (i.e., those that are not likely influenced by the wastewater treatment system). At eight different locations, a trowel was used to collect soil from two depths (2-5 cm and 5-10 cm) for a total of 16 samples (Figure 1). Soil samples were logged following a modified Unified Soil Classification System.

¹ Ministry of Water Lands and Air Protection (MWLAP). 2002. Permit PE-04606. PE-4606. Province of British Columbia.

² David Hebert, Environmental Protection Officer Site meeting with Ewen Stewart of Anmore Green Estates Ltd. December 21, 2017

³ Associated Environmental Consultants Inc. (Associated). 2017. Action Plan for the Anmore Green Estates (Permit PE-4606). Prepared on behalf of AGE Strata Corporation. October 11, 2017.

The samples were shipped to CARO Analytical Services (CARO) (an accredited laboratory) for analysis of *E. coli*, fecal coliforms, chloride, total phosphorus, ammonia, nitrate, nitrite, organic nitrogen, total Kjeldahl nitrogen, and total nitrogen. A second set of soil samples, collected from the same locations, were sent to Dr. Natalie Prystajec⁴, an Associated Professor at University of British Columbia (UBC) Vancouver Faculty of Medicine, where they were placed on-hold in a freezer at -80°C. If the soil results from CARO indicate that septic indicators are present in elevated concentrations (e.g., elevated levels of *E. coli*), the UBC laboratory will be asked to analyze the second set of samples for the presence of human sourced viruses (norovirus type I and type II, rotavirus, adenovirus, astrovirus, and sapovirus) and the results will be used along with the CARO data to determine the likelihood that septic pollution is present.

3 RESULTS

A description of each of the eight soil sample locations (SS17-1 through -8) and the CARO results are presented in Table 1, and Figure 1 (attached) shows the locations of the samples.

Based on the results, Associated has requested that the UBC laboratory test samples from locations SS17-2, SS17-3, SS17-4, SS17-5, and SS17-7 (a and b samples) for viruses. Sites SS17-3, SS17-4, SS17-5, and SS17-7 were selected due to their levels of *E. coli* and fecal coliforms. Site SS17-2 was selected as a background comparison sample because *E. coli* and fecal coliforms were not detected and its site conditions are similar to SS17-3, SS17-4, and SS17-5.

The remaining samples will not be tested for viruses at this time, but will continue to be stored at the UBC Laboratory, and can be ran in the future if required.

The results of the virus tests are pending, and will be provided when available.

Attachments

Table 1: September 27, 2107 Soil Results

Figure 1: September 2017 Soil Sampling Locations

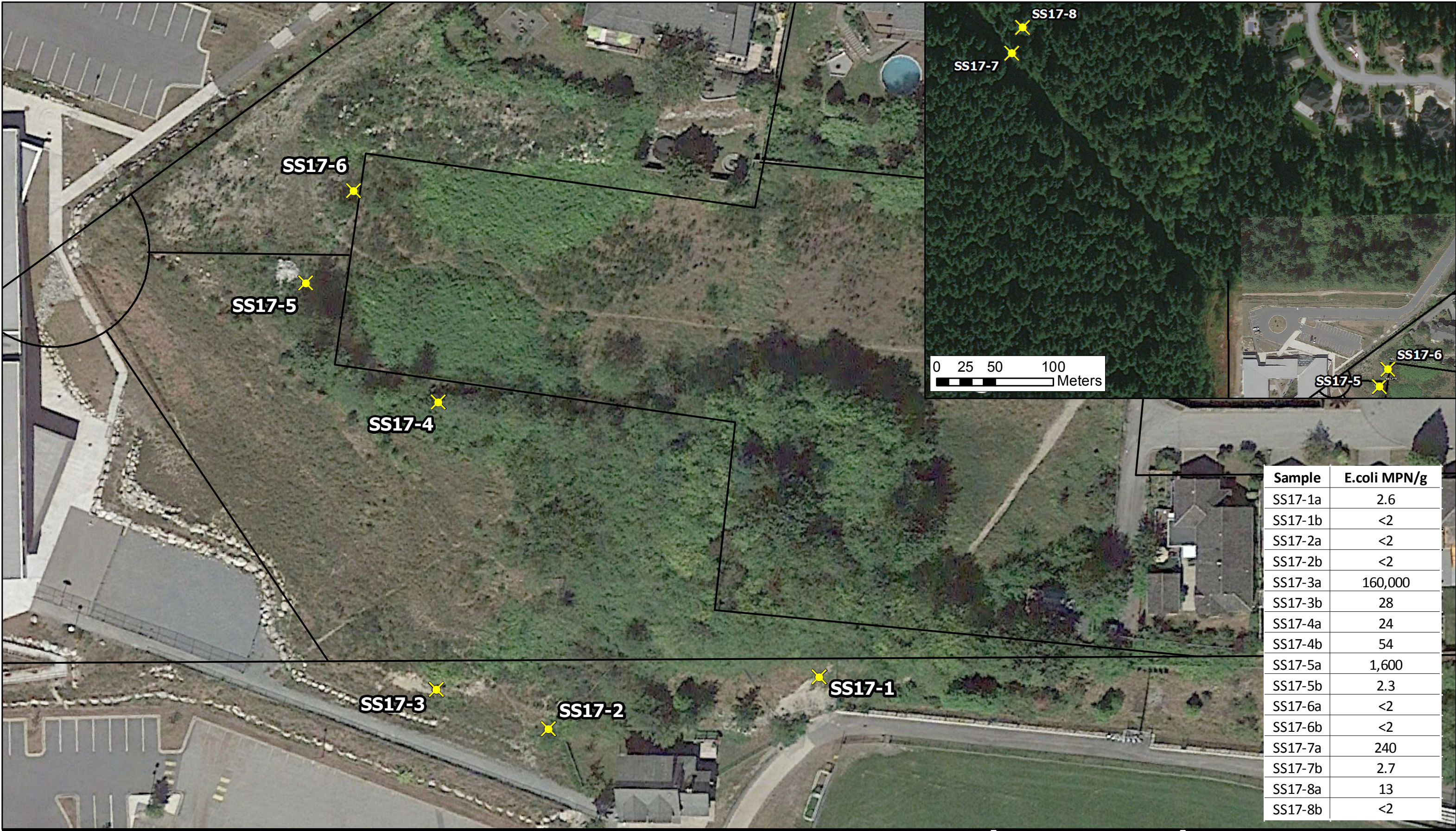
CARO Laboratory Analytical Report

⁴ Dr. Natalie Prystajec is a Clinical Assistant Professor at the University of British Columbia, Faculty of Medicine, who specializes in Environmental Microbiology.

Table 1: September 27, 2107 Soil Results

Site	Site Description	Soil Description ¹	Sample ²	Analytic Result									
				Moisture	Phosphorus Total (as P)	Chloride ³	Ammonia (as N) ³	Nitrate (as N) ³	Nitrite (as N) ³	TKN	Total Nitrogen	<i>E. coli</i>	Fecal Coliforms
				% wet	mg/kg	mg/kg dry	mg/kg	mg/kg dry	mg/kg dry	%	%	MPN/g	MPN/g wet
SS17-1	Dry bank, below eastern disposal field	Dark brown SANDY ORGANIC SOIL WITH GRAVEL (OL), loose, dry to moist	1a	6.9	350	<10.0	<2.0	0.729	<0.500	0.024	0.0239	2.6	2.6
		Brown SILTY SAND WITH GRAVEL (SM), loose, dry to moist	1b	5	301	58.4	<2.0	0.672	<0.500	<0.010	<0.0100	<2	<2
SS17-2	Steep cut bank, south of western disposal field	Dark brown SANDY ORGANIC SOIL WITH GRAVEL (OL), loose, dry	2a	13.4	423	<10.0	<2.0	15.6	<0.500	0.177	0.177	<2	<2
		Brown SILTY SAND WITH GRAVEL (SM), loose, dry	2b	11.3	300	<10.0	<2.0	8.2	<0.500	0.075	0.0745	<2	<2
SS17-3	Location with staining below western disposal field	Dark brown SANDY ORGANIC SOIL WITH GRAVEL (OL), loose, moist	3a	36.1	1070	<10.0	<2.0	6.96	<0.500	0.304	0.304	160,000	160,000
		Brown SILTY SAND WITH GRAVEL (SM), loose, moist	3b	21	522	<10.0	<2.0	1.26	<0.500	0.104	0.104	28	28
SS17-4	Moist area at base of berm south of western disposal field	Dark brown SANDY ORGANIC SOIL WITH GRAVEL (OL), loose, moist	4a	44.1	1930	23.8	<2.0	1.32	<0.500	0.411	0.411	24	24
		Brown SILTY SAND WITH GRAVEL (SM), loose, moist	4b	28.2	587	20.6	<2.0	0.873	<0.500	0.069	0.0695	54	54
SS17-5	Seepage area south of western disposal field	Brown sand, SILTY SAND WITH GRAVEL (SM), trace rootlets, loose, moist	5a	33.5	450	<10.0	<2.0	4.75	<0.500	0.175	0.175	1,600	1,600
		Grey SILTY SAND WITH GRAVEL (SM), dense, moist	5b	13.6	258	<10.0	<2.0	0.747	<0.500	0.026	0.0262	2.3	2.3
SS17-6	West of western disposal field	Brown SILTY SAND WITH GRAVEL (SM), dense, moist to dry	6a	12.1	325	<10.0	<2.0	2.44	<0.500	0.104	0.104	<2	<2
		Light brown SILTY SAND WITH GRAVEL (SM), dense, moist to dry	6b	12.8	353	<10.0	<2.0	1.11	<0.500	0.05	0.0503	<2	<2
SS17-7	On recreation trail northwest of project area	Dark brown, SANDY ORGANIC SOIL WITH GRAVEL (OL), loose, moist	7a	30	232	13.8	<2.0	7.59	<0.500	0.143	0.143	240	240
		Brown SILTY SAND WITH GRAVEL (SM), trace rootlets loose, moist	7b	36.9	220	<10.0	<2.0	5.31	<0.500	0.145	0.145	2.7	2.7
SS17-8	Moist area off recreation trail northwest of project area	Dark brown ORGANIC SOIL (OL), loose/soft, moist	8a	67	641	10.4	<2.0	66.2	<0.500	0.714	0.714	13	13
		Dark brown ORGANIC SOIL (OL), loose/soft, moist	8b	70.6	723	13.7	<2.0	111	<0.500	0.356	0.356	<2	<2

Notes
¹ Soil descriptions follow the Unified Soil Classification System, adopted from ASTM D2488.
² 'a' indicates samples were collected from 2-5 cm depth and 'b' indicates sample was collected from 5-10 cm depth.
³ Water-soluble



Sample	E.coli MPN/g
SS17-1a	2.6
SS17-1b	<2
SS17-2a	<2
SS17-2b	<2
SS17-3a	160,000
SS17-3b	28
SS17-4a	24
SS17-4b	54
SS17-5a	1,600
SS17-5b	2.3
SS17-6a	<2
SS17-6b	<2
SS17-7a	240
SS17-7b	2.7
SS17-8a	13
SS17-8b	<2

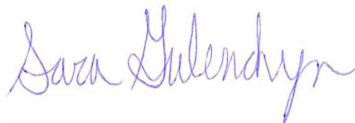
Sample Locations.mxd / 10/16/2017 / 12:31:33 PM

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	7092530
PO NUMBER		RECEIVED / TEMP	2017-09-27 16:44 / 12°C
PROJECT	2017-8011 Anmore Hydrogeo	REPORTED	2017-10-05
PROJECT INFO			

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)
2017-8011 Anmore Hydrogeo

WORK ORDER REPORTED 7092530
2017-10-05

Analysis Description	Method Reference	Technique	Location
Ammonia, Water-Soluble in Soil	Carter 15.2.2 / APHA 4500-NH3 G*	Fixed Ratio H2O Ext (1:5) / Automated Colorimetry (Phenate)	Kelowna
Anions by IC in Soil	Carter 15.2.2 / APHA 4110 B	Fixed Ratio H2O Ext (1:5) / Ion Chromatography with Chemical Suppression of Eluent Conductivity	Kelowna
Coliforms, Fecal (MPN) in Soil	MFHPB-19	Most Probable Number	Sublet
E. coli (MPN) in Soil	MFHPB-19	Most Probable Number	Sublet
Moisture in Soil	ASTM D2974-87*	Gravimetry (Dried at 105C)	N/A
Nitrogen, Total Kjeldahl in Soil	APHA 4500-Norg D*	Block Digestion and Flow Injection Analysis	Kelowna
Phosphorus, Total by Colorimetry in Soil	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
ASTM	ASTM International Test Methods
MFHPB	HPB Methods for the Microbiological Analysis of Foods, Health Canada

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)
%	Percent
% dry	Percent (dry weight basis)
% wet	Percent (as received basis)
mg/kg dry	Milligrams per kilogram (dry weight basis)
MPN/g	Most Probable Number per gram (dry weight basis)
MPN/g wet	Most Probable Number per gram (wet weight basis)

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)
2017-8011 Anmore Hydrogeo

WORK ORDER REPORTED 7092530
2017-10-05

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: SS17-1a (7092530-01) [Soil] Sampled: 2017-09-27 00:00

General Parameters							
Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	6.9	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	0.729	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.024	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	350	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	
Calculated Parameters							
Nitrogen, Total	0.0239	N/A	0.0100	%	N/A	N/A	
Fertility / Nutrient Parameters							
Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01	
Microbiological Parameters							
Coliforms, Fecal (MPN)	2.6	N/A	2	MPN/g wet	2017-09-27	2017-09-28	
E. coli	2.6	N/A	2	MPN/g	2017-09-27	2017-09-28	

Sample ID: SS17-1b (7092530-02) [Soil] Sampled: 2017-09-27 00:00

General Parameters							
Chloride, Water-Soluble	58.4	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	5.0	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	0.672	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	< 0.010	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	301	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	
Calculated Parameters							
Nitrogen, Total	< 0.0100	N/A	0.0100	%	N/A	N/A	
Fertility / Nutrient Parameters							
Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01	
Microbiological Parameters							
Coliforms, Fecal (MPN)	<2	N/A	2	MPN/g wet	2017-09-27	2017-09-28	
E. coli	<2	N/A	2	MPN/g	2017-09-27	2017-09-28	

Sample ID: SS17-2a (7092530-03) [Soil] Sampled: 2017-09-27 00:00

General Parameters							
Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	13.4	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	15.6	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.177	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	423	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	
Calculated Parameters							
Nitrogen, Total	0.177	N/A	0.0100	%	N/A	N/A	

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2017-8011 Anmore Hydrogeo

WORK ORDER REPORTED 7092530
2017-10-05

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: SS17-2a (7092530-03) [Soil] Sampled: 2017-09-27 00:00, Continued

Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	<2	N/A	2	MPN/g wet	2017-09-27	2017-09-28
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E. coli	<2	N/A	2	MPN/g	2017-09-27	2017-09-28
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Sample ID: SS17-2b (7092530-04) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03
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Moisture	11.3	N/A	0.1	% wet	N/A	2017-10-05
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Nitrate, Water-Soluble (as N)	8.20	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrogen, Total Kjeldahl	0.075	N/A	0.002	% dry	2017-10-01	2017-10-04
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Phosphorus, Total (as P)	300	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30
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Calculated Parameters

Nitrogen, Total	0.0745	N/A	0.0100	%	N/A	N/A
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	<2	N/A	2	MPN/g wet	2017-09-27	2017-09-28
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E. coli	<2	N/A	2	MPN/g	2017-09-27	2017-09-28
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Sample ID: SS17-3a (7092530-05) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03
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Moisture	36.1	N/A	0.1	% wet	N/A	2017-10-05
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Nitrate, Water-Soluble (as N)	6.96	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrogen, Total Kjeldahl	0.304	N/A	0.002	% dry	2017-10-01	2017-10-04
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Phosphorus, Total (as P)	1070	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30
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Calculated Parameters

Nitrogen, Total	0.304	N/A	0.0100	%	N/A	N/A
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	160,000	N/A	2	MPN/g wet	2017-09-27	2017-09-28
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E. coli	160,000	N/A	2	MPN/g	2017-09-27	2017-09-28
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Sample ID: SS17-3b (7092530-06) [Soil] Sampled: 2017-09-27 00:00

General Parameters

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2017-8011 Anmore Hydrogeo

WORK ORDER REPORTED 7092530
2017-10-05

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: SS17-3b (7092530-06) [Soil] Sampled: 2017-09-27 00:00, Continued

General Parameters, Continued

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	21.0	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	1.26	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.104	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	522	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	

Calculated Parameters

Nitrogen, Total	0.104	N/A	0.0100	%	N/A	N/A	
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01	
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Microbiological Parameters

Coliforms, Fecal (MPN)	28	N/A	2	MPN/g wet	2017-09-27	2017-09-28	
E. coli	28	N/A	2	MPN/g	2017-09-27	2017-09-28	

Sample ID: SS17-4a (7092530-07) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	23.8	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	44.1	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	1.32	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.411	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	1930	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	

Calculated Parameters

Nitrogen, Total	0.411	N/A	0.0100	%	N/A	N/A	
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01	
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Microbiological Parameters

Coliforms, Fecal (MPN)	24	N/A	2	MPN/g wet	2017-09-27	2017-09-28	
E. coli	24	N/A	2	MPN/g	2017-09-27	2017-09-28	

Sample ID: SS17-4b (7092530-08) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	20.6	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	28.2	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	0.873	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.069	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	587	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	

Calculated Parameters

Nitrogen, Total	0.0695	N/A	0.0100	%	N/A	N/A	
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SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2017-8011 Anmore Hydrogeo

WORK ORDER REPORTED 7092530
2017-10-05

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: SS17-4b (7092530-08) [Soil] Sampled: 2017-09-27 00:00, Continued

Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	54	N/A	2	MPN/g wet	2017-09-27	2017-09-28
E. coli	54	N/A	2	MPN/g	2017-09-27	2017-09-28

Sample ID: SS17-5a (7092530-09) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03
Moisture	33.5	N/A	0.1	% wet	N/A	2017-10-05
Nitrate, Water-Soluble (as N)	4.75	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
Nitrogen, Total Kjeldahl	0.175	N/A	0.002	% dry	2017-10-01	2017-10-04
Phosphorus, Total (as P)	450	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30

Calculated Parameters

Nitrogen, Total	0.175	N/A	0.0100	%	N/A	N/A
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	1,600	N/A	2	MPN/g wet	2017-09-27	2017-09-28
E. coli	1,600	N/A	2	MPN/g	2017-09-27	2017-09-28

Sample ID: SS17-5b (7092530-10) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03
Moisture	13.6	N/A	0.1	% wet	N/A	2017-10-05
Nitrate, Water-Soluble (as N)	0.747	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
Nitrogen, Total Kjeldahl	0.026	N/A	0.002	% dry	2017-10-01	2017-10-04
Phosphorus, Total (as P)	258	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30

Calculated Parameters

Nitrogen, Total	0.0262	N/A	0.0100	%	N/A	N/A
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	2.3	N/A	2	MPN/g wet	2017-09-27	2017-09-28
E. coli	2.3	N/A	2	MPN/g	2017-09-27	2017-09-28

Sample ID: SS17-6a (7092530-11) [Soil] Sampled: 2017-09-27 00:00

General Parameters

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
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Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: SS17-6a (7092530-11) [Soil] Sampled: 2017-09-27 00:00, Continued

General Parameters, Continued

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	12.1	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	2.44	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.104	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	325	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	

Calculated Parameters

Nitrogen, Total	0.104	N/A	0.0100	%	N/A	N/A	
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01	
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Microbiological Parameters

Coliforms, Fecal (MPN)	<2	N/A	2	MPN/g wet	2017-09-27	2017-09-28	
E. coli	<2	N/A	2	MPN/g	2017-09-27	2017-09-28	

Sample ID: SS17-6b (7092530-12) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	12.8	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	1.11	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.050	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	353	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	

Calculated Parameters

Nitrogen, Total	0.0503	N/A	0.0100	%	N/A	N/A	
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01	
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Microbiological Parameters

Coliforms, Fecal (MPN)	<2	N/A	2	MPN/g wet	2017-09-27	2017-09-28	
E. coli	<2	N/A	2	MPN/g	2017-09-27	2017-09-28	

Sample ID: SS17-7a (7092530-13) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	13.8	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	30.0	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	7.59	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.143	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	232	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	

Calculated Parameters

Nitrogen, Total	0.143	N/A	0.0100	%	N/A	N/A	
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SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2017-8011 Anmore Hydrogeo

WORK ORDER REPORTED 7092530
2017-10-05

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: SS17-7a (7092530-13) [Soil] Sampled: 2017-09-27 00:00, Continued

Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	240	N/A	2	MPN/g wet	2017-09-27	2017-09-28
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E. coli	240	N/A	2	MPN/g	2017-09-27	2017-09-28
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Sample ID: SS17-7b (7092530-14) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	< 10.0	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03
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Moisture	36.9	N/A	0.1	% wet	N/A	2017-10-05
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Nitrate, Water-Soluble (as N)	5.31	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrogen, Total Kjeldahl	0.145	N/A	0.002	% dry	2017-10-01	2017-10-04
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Phosphorus, Total (as P)	220	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30
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Calculated Parameters

Nitrogen, Total	0.145	N/A	0.0100	%	N/A	N/A
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	2.7	N/A	2	MPN/g wet	2017-09-27	2017-09-28
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E. coli	2.7	N/A	2	MPN/g	2017-09-27	2017-09-28
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Sample ID: SS17-8a (7092530-15) [Soil] Sampled: 2017-09-27 00:00

General Parameters

Chloride, Water-Soluble	10.4	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03
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Moisture	67.0	N/A	0.1	% wet	N/A	2017-10-05
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Nitrate, Water-Soluble (as N)	66.2	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03
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Nitrogen, Total Kjeldahl	0.714	N/A	0.002	% dry	2017-10-01	2017-10-04
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Phosphorus, Total (as P)	641	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30
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Calculated Parameters

Nitrogen, Total	0.714	N/A	0.0100	%	N/A	N/A
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01
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Microbiological Parameters

Coliforms, Fecal (MPN)	13	N/A	2	MPN/g wet	2017-09-27	2017-09-28
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E. coli	13	N/A	2	MPN/g	2017-09-27	2017-09-28
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Sample ID: SS17-8b (7092530-16) [Soil] Sampled: 2017-09-27 00:00

General Parameters

SAMPLE ANALYTICAL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2017-8011 Anmore Hydrogeo

WORK ORDER 7092530
REPORTED 2017-10-05

Analyte	Result / Recovery	Standard / Guideline	MRL / Limits	Units	Prepared	Analyzed	Notes
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Sample ID: SS17-8b (7092530-16) [Soil] Sampled: 2017-09-27 00:00, Continued

General Parameters, Continued

Chloride, Water-Soluble	13.7	N/A	1.0	mg/kg dry	2017-10-03	2017-10-03	
Moisture	70.6	N/A	0.1	% wet	N/A	2017-10-05	
Nitrate, Water-Soluble (as N)	111	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrite, Water-Soluble (as N)	< 0.500	N/A	0.050	mg/kg dry	2017-10-03	2017-10-03	
Nitrogen, Total Kjeldahl	0.356	N/A	0.002	% dry	2017-10-01	2017-10-04	
Phosphorus, Total (as P)	723	N/A	1.0	mg/kg dry	2017-09-29	2017-09-30	

Calculated Parameters

Nitrogen, Total	0.356	N/A	0.0100	%	N/A	N/A	
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Fertility / Nutrient Parameters

Ammonia, Water-Soluble (as N)	< 2.0	N/A	2.0	mg/kg dry	2017-09-29	2017-10-01	
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Microbiological Parameters

Coliforms, Fecal (MPN)	<2	N/A	2	MPN/g wet	2017-09-27	2017-09-28	
E. coli	<2	N/A	2	MPN/g	2017-09-27	2017-09-28	

APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2017-8011 Anmore Hydrogeo

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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
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Fertility / Nutrient Parameters, Batch B7I2099

Blank (B7I2099-BLK1)		Prepared: 2017-09-29, Analyzed: 2017-10-01							
Ammonia, Water-Soluble (as N)	< 2.0	2.0 mg/kg wet							
LCS (B7I2099-BS1)		Prepared: 2017-09-29, Analyzed: 2017-10-01							
Ammonia, Water-Soluble (as N)	< 2.0	2.0 mg/kg wet	1.00		104	85-115			
Duplicate (B7I2099-DUP1)		Source: 7092530-01		Prepared: 2017-09-29, Analyzed: 2017-10-01					
Ammonia, Water-Soluble (as N)	< 2.0	2.0 mg/kg dry		< 2.0				7	

General Parameters, Batch B7I2133

Blank (B7I2133-BLK1)		Prepared: 2017-09-29, Analyzed: 2017-09-30							
Phosphorus, Total (as P)	< 1.0	1.0 mg/kg wet							
Reference (B7I2133-SRM1)		Prepared: 2017-09-29, Analyzed: 2017-10-02							
Phosphorus, Total (as P)	2540	1.0 mg/kg wet	2850		89	27.5-154			

General Parameters, Batch B7J0007

Blank (B7J0007-BLK1)		Prepared: 2017-10-01, Analyzed: 2017-10-04							
Nitrogen, Total Kjeldahl	< 0.010	0.002 % wet							
Duplicate (B7J0007-DUP1)		Source: 7092530-01		Prepared: 2017-10-01, Analyzed: 2017-10-04					
Nitrogen, Total Kjeldahl	0.024	0.002 % dry		0.024				20	
Reference (B7J0007-SRM1)		Prepared: 2017-10-01, Analyzed: 2017-10-04							
Nitrogen, Total Kjeldahl	0.194	0.002 % wet	0.226		86	58.8-150			

General Parameters, Batch B7J0129

Duplicate (B7J0129-DUP1)		Source: 7092530-01		Prepared: 2017-10-05, Analyzed: 2017-10-05					
Moisture	5.5	0.1 % wet		6.9			22.6	8.3	

APPENDIX 1: QUALITY CONTROL DATA

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
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Analyte	Result	MRL Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
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General Parameters, Batch B7J0129, Continued

Reference (B7J0129-SRM1)

Prepared: 2017-10-05, Analyzed: 2017-10-05

Moisture	31.7	0.1 % wet	31.5		100.6	80-120			
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General Parameters, Batch B7J0158

Blank (B7J0158-BLK1)

Prepared: 2017-10-03, Analyzed: 2017-10-03

Chloride, Water-Soluble	< 1.0	1.0 mg/kg dry							
Nitrate, Water-Soluble (as N)	< 0.050	0.050 mg/kg dry							
Nitrite, Water-Soluble (as N)	< 0.050	0.050 mg/kg dry							

LCS (B7J0158-BS1)

Prepared: 2017-10-03, Analyzed: 2017-10-03

Chloride, Water-Soluble	16.1	1.0 mg/kg dry	16.0		101	90-109			
Nitrate, Water-Soluble (as N)	4.09	0.050 mg/kg dry	4.00		102	93-110			
Nitrite, Water-Soluble (as N)	1.92	0.050 mg/kg dry	2.00		96	86-111			

Duplicate (B7J0158-DUP1)

Source: 7092530-01

Prepared: 2017-10-03, Analyzed: 2017-10-03

Chloride, Water-Soluble	< 10.0	1.0 mg/kg dry	< 10.0					18	
Nitrate, Water-Soluble (as N)	0.815	0.050 mg/kg dry	0.729					20	
Nitrite, Water-Soluble (as N)	< 0.500	0.050 mg/kg dry	< 0.500					14	

APPENDIX 2: ANALYTICAL SUMMARY

REPORTED TO PROJECT Associated Environmental Consultants Inc. (Vernon)
2017-8011 Anmore Hydrogeo

WORK ORDER REPORTED 7092530
2017-10-05

		7092530-01	7092530-02	7092530-03	7092530-04	7092530-05	7092530-06
		Soil	Soil	Soil	Soil	Soil	Soil
		2017-09-27	2017-09-27	2017-09-27	2017-09-27	2017-09-27	2017-09-27
		SS17-1a	SS17-1b	SS17-2a	SS17-2b	SS17-3a	SS17-3b
General Parameters	Chloride, Water-Soluble (mg/kg dry)	< 10.0	58.4	< 10.0	< 10.0	< 10.0	< 10.0
	Moisture (% wet)	6.9	5.0	13.4	11.3	36.1	21.0
	Nitrate, Water-Soluble (as N) (mg/kg dry)	0.729	0.672	15.6	8.20	6.96	1.26
	Nitrite, Water-Soluble (as N) (mg/kg dry)	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500
	Nitrogen, Total Kjeldahl (% dry)	0.024	< 0.010	0.177	0.075	0.304	0.104
	Phosphorus, Total (as P) (mg/kg dry)	350	301	423	300	1070	522
Calculated Parameters	Nitrogen, Total (%)	0.0239	< 0.0100	0.177	0.0745	0.304	0.104
Fertility / Nutrient	Ammonia, Water-Soluble (as N) (mg/kg dry)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Microbiological Parameters	Coliforms, Fecal (MPN) (MPN/g wet)	2.6	<2	<2	<2	160,000	28
	E. coli (MPN/g)	2.6	<2	<2	<2	160,000	28

		7092530-07	7092530-08	7092530-09	7092530-10	7092530-11	7092530-12
		Soil	Soil	Soil	Soil	Soil	Soil
		2017-09-27	2017-09-27	2017-09-27	2017-09-27	2017-09-27	2017-09-27
		SS17-4a	SS17-4b	SS17-5a	SS17-5b	SS17-6a	SS17-6b
General Parameters	Chloride, Water-Soluble (mg/kg dry)	23.8	20.6	< 10.0	< 10.0	< 10.0	< 10.0
	Moisture (% wet)	44.1	28.2	33.5	13.6	12.1	12.8
	Nitrate, Water-Soluble (as N) (mg/kg dry)	1.32	0.873	4.75	0.747	2.44	1.11
	Nitrite, Water-Soluble (as N) (mg/kg dry)	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500	< 0.500
	Nitrogen, Total Kjeldahl (% dry)	0.411	0.069	0.175	0.026	0.104	0.050
	Phosphorus, Total (as P) (mg/kg dry)	1930	587	450	258	325	353
Calculated Parameters	Nitrogen, Total (%)	0.411	0.0695	0.175	0.0262	0.104	0.0503
Fertility / Nutrient	Ammonia, Water-Soluble (as N) (mg/kg dry)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Microbiological Parameters	Coliforms, Fecal (MPN) (MPN/g wet)	24	54	1,600	2.3	<2	<2
	E. coli (MPN/g)	24	54	1,600	2.3	<2	<2

		7092530-13	7092530-14	7092530-15	7092530-16
		Soil	Soil	Soil	Soil
		2017-09-27	2017-09-27	2017-09-27	2017-09-27
		SS17-7a	SS17-7b	SS17-8a	SS17-8b
General Parameters	Chloride, Water-Soluble (mg/kg dry)	13.8	< 10.0	10.4	13.7
	Moisture (% wet)	30.0	36.9	67.0	70.6
	Nitrate, Water-Soluble (as N) (mg/kg dry)	7.59	5.31	66.2	111
	Nitrite, Water-Soluble (as N) (mg/kg dry)	< 0.500	< 0.500	< 0.500	< 0.500
	Nitrogen, Total Kjeldahl (% dry)	0.143	0.145	0.714	0.356
	Phosphorus, Total (as P) (mg/kg dry)	232	220	641	723
Calculated Parameters	Nitrogen, Total (%)	0.143	0.145	0.714	0.356
Fertility / Nutrient	Ammonia, Water-Soluble (as N) (mg/kg dry)	< 2.0	< 2.0	< 2.0	< 2.0
Microbiological Parameters	Coliforms, Fecal (MPN) (MPN/g wet)	240	2.7	13	<2
	E. coli (MPN/g)	240	2.7	13	<2