Keystone Environmental
Knowledge-Driven Results

May 11, 2018

Mr. Stephen Judd, P.Eng.
Manager of Infrastructure Engineering Services
City of Port Moody
100 Newport Drive
Port Moody, BC V3H 5C3

Dear Mr. Judd:

Re: Soil, Sediment and Surface Water Analytical Results
1300 David Avenue, Port Moody, BC
Project 13953

1. BACKGROUND

Keystone Environmental Ltd. (Keystone Environmental) is pleased to present this letter summarizing the analytical results of soil, sediment and surface water samples collected on City of Port Moody (the City) property and infrastructure located down-gradient from a residential septic field owned by Anmore Green Estates. The soil, sediment and surface water samples were collected on March 29, 2018.

A BC Ministry of Environment (MoE) letter titled *"Warning Letter, Permit, 4606"* dated March 7, 2017 (BC MoE, 2017a), reported non-compliance issues associated with the unconfirmed septic discharge associated with the Anmore Green Estates Strata Corporation LMS 3080 (Strata) septic field operating permit PE-04606, located within the Village of Anmore, adjacent to the northeast of Heritage Woods Secondary School, at 1300 David Avenue, Port Moody, BC. Associated Environmental Consultants Ltd. (Associated Environmental) developed an "action plan" for the Strata (AE, 2017a) to address the non-compliance issues. The action plan noted that soil and water sampling frequency would be determined by changes in precipitation, with monitoring during all seasons, and specifically, further communication with MoE if:

- *Escherichia coli* (*E. coli*) or fecal coliforms in water quality data from discharge points exceed the BC Approved Water Quality Guidelines for Primary-Contact Recreation and/or the Guidelines for Canadian Recreational Water Quality;

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- Human-sourced viruses are detected in soil where septic breakthrough is believed to have occurred

In September 2017, Associated Environmental (AE, 2017b) collected eight soil samples from areas south and west of the wastewater treatment system for analysis of parameters outlined in their action plan, with the exception of human-source viruses. Analytical results reported four of the six Site sample locations tested positive for *Escherichia coli*. (*E. coli*) and fecal coliforms ranging from 2.3 to 160,000 MPN/g (230–16,000,000 MPN/100g), in addition to the two background sample locations northwest of the Site on a recreational trail. Provincial and federal human health protection values for the parameters analyzed are specific to water samples, and not applicable to the soil samples. Water samples were not collected by Associated Environmental during the September 2017 sampling event due to dry conditions.

The City of Port Moody noted that the soil samples collected by Associated Environmental focused on the embankment, located on the downgradient slope of the septic field on School District 43 (SD43) property. The City wishes to understand the extent and potential risk to public health from potential releases of septic waste into the City's storm water drainage system and watercourses, and whether the surface of the playing fields of the school have been affected.

As a result, Keystone Environmental personnel collected soil, sediment and surface water samples on City property, and from associated infrastructure (i.e., storm water collection basins), on March 29, 2018 and submitted these samples to Maxxam Analytical for analysis of *E. coli*, fecal coliforms, and total coliforms. Additionally, targeted field duplicate soil, sediment, and water samples were also submitted for analysis of total and human *Bacteroides*. This report provides the results of this investigation and describes visual observations of environment conditions encountered during the sampling program.

2. METHODS

For this sampling program, Keystone Environmental adopted a similar sampling approach as Associated Environmental (2017a; 2017b) but did not include analyses of nutrients that can be present naturally, and instead included parameters directly relevant to septic discharges. Keystone Environmental collected the following samples during the March 29, 2018 sampling event:

- Soil
  - Keystone Environmental collected 6 soil samples from 3 locations in proximity to the baseball playing field.
- Sediment
  - Keystone Environmental collected 8 sediment samples (7 characterization samples plus 1 field duplicate) from 4 creek locations (2 background and 2 possible exposure locations within Wilkes Creek to the west and Turner Creek to the east of the septic field), as well as 3 catch basin locations located downgradient from the playing field.
- Surface Water
  - Keystone Environmental collect 8 surface water samples (7 characterization samples plus 1 field duplicate) from 3 catch basin locations to characterize potential loading onto the property, and from 4 creek locations (2 background and 2 possible exposure locations from Wilkes and Turner Creeks).

Keystone Environmental staff arrived on Site at 11 am on March 29, 2018. Light rain was encountered throughout the sampling program. Based on a review of the Port Moody weather station [IBCPORTM8], 5.3 mm of precipitation fell on March 29, 2018 and 0.0 mm of precipitation fell on March 28, 2018. In the week leading up to the sampling event (i.e., March 22 to March 29), approximately 66.6 mm of precipitation was reported at the Port Moody weather station [IBCPORTM8] (www.wunderground.com).

Sample locations were logged using a global position system (GPS). Sample locations for soil and sediment samples are provided in **Figure 1 of Appendix A**. Surface water sampling locations are provided on **Figure 2 of Appendix A**. Visual observations at each sampling location were recorded in field note books to document environmental conditions, soil, sediment and/or water characteristics, and to record measurements of pH, temperature, dissolved oxygen, conductivity and turbidity of surface water samples using hand held meters.

Soil samples were collected from three locations in proximity to the playing fields at two depths (~3 cm and ~5 cm) per location, for a total of 6 samples. Soil samples were collected using a shovel. Surface organic material (e.g., grass) was first cleared from the surface soils, and then samples were collected from appropriate depths directly from the shovel. Soil characteristics were recorded in field note books prior to sample collection. Soil samples were labelled as follows:

- SS18-03 (0.3): soil sample located north of the baseball field at a depth of 3 cm below ground
- SS18-03 (0.5): soil sample located north of the baseball field at a depth of 5 cm below ground
- SS18-04 (0.3): soil sample located on the northern edge of the baseball field at a depth of 3 cm below ground
- SS18-04 (0.5): soil sample located on the northern edge of the baseball field at a depth of 5 cm below ground
- SS18-08 (0.3): soil sample collected from the base of the hill leading to the septic field on the north end of the school parking lot at a depth of 3 cm below ground
- SS18-08 (0.5): soil sample collected from the base of the hill leading to the septic field on the north end of the school parking lot at a depth of 5 cm below ground

Nine surficial sediment samples (~0-5 cm) were also collected from one depth at eight locations. Samples were labelled as follows:

- SED18-01: background sample collected from Wilkes Creek
- SED18-02: background sample collected from Turner Creek
- SED18-05: southern catch basin sample located west of the tennis courts
- SED18-06: catch basin sample located north of the soccer field
- SED18-07: catch basin sample located northwest of the baseball field
- SED18-09: Wilkes Creek sample located downgradient of the septic field

- SED18-10: Turner Creek sample located downgradient of the City's storm water collection system

Surficial sediment samples collected from the creeks SED18-01, SED18-02, SED18-09 and SED18-10, as well as SED18-07 (the most upgradient catch basin location), were collected using a similar approach as the soil samples and were collected directly from the shovel. Due to the depth of the catch basins at SED18-05 and SED18-06, a ponar dredge sediment sampler was used to collect surficial sediment samples at these locations. The samples were emptied into a stainless-steel pan, at which point sediment characteristics were noted and recorded prior to sample collection.

At approximately 1 pm, Keystone Environmental staff met with a member of the City of Port Moody Engineering Department to provide access to the catch basin sampling locations (SED18-05 to SED18-07). The employee was unable to access the large settling tank located below the tennis courts and, therefore, SED18-05 was collected from a catch basin located approximately 10 m west of the large settling tank location. The SED18-05 catch basin was located upgradient of the large settling tank and, thus, was considered to be representative of conditions that may occur downgradient in the larger settling tank.

Surface water sampling was also performed concurrently at each of the sediment sampling locations. Surface water (e.g., ponding or overland flow) was not observed at soil sampling locations, and thus were not collected. Surface water samples were collected in general accordance with the BC field sampling manual. Field measurements of pH, temperature, conductivity, dissolved oxygen, and turbidity were collected using hand held meters at each surface water sampling location.

Soil, water and sediment samples were submitted to Maxxam Analytical for analysis of *E. coli*, fecal coliforms, and total coliforms. Additional soil/sediment and water samples were collected concurrently at each location for possible future analysis of total *Bacteroides* and human *Bacteroides*. These additional samples were collected to help to differentiate between human and animal sources of bacteria. Following review of the *E. coli*, fecal coliforms, and total coliforms analytical results, five sediment samples (SED18-05, SED18-06, SED18-07, SED18-09, and SED18-10), one soil sample (SS18-08 (0.5)), and two surface water samples (SW18-05 and SW18-06) were selected to be analyzed for total and human *Bacteriodes*.

3. APPROACH

For this report, Keystone Environmental assumed that the public, mainly school children and park users may be exposed to fecal bacteria in two ways:

- To fecal bacteria in surface water (resulting from groundwater seepages from the septic field) through dermal skin contact, and incidental ingestion of surface water from splashes and hand mouth-transfer
- To fecal bacteria in soil/sediment through dermal skin contact and incidental ingestion of soil via hand mouth-transfer

To gauge the potential for human health risks, Keystone Environmental compared surface water *E. coli* results to human health based provincial and federal benchmarks; the BC MoE Approved Water Quality Guidelines for Primary-Contact Recreation (BC MoE 2017b) and Health Canada Guidelines for Canadian Recreational Water Quality (Health Canada, 2012). The 2017 BC MoE guidelines involved adopting the Health Canada guidelines, and supersede the 2001 BC MoE Water Quality Criteria for Microbiological Indicators Overview Report (BC MoE, 2001). The PCR criterion is used as the safety limit to trigger beach and public area closures in Metro Vancouver (Vancouver Coastal Health, 2018).

With respect to soil and sediment quality, a human health benchmark for fecal coliforms in soil and sediment has not been formally established in Canada. The BC Organic Matter Recycling Regulation specifies a limit of 1,000 MPN/100g, which is consistent with the Council of Ministers of the Environment (CCME) guideline for compost quality, but this value is specific to biosolids and compost, and is not applicable to soils alone (OMRR, 2018). CCME indicates the "use of *E. coli* content as a direct indicator of pathogen levels is not yet supported by all regulatory agencies in Canada, but it may be used to help verify the reason for the high fecal coliform levels" (CCME, 2005). As such, soil results in this report were used to infer presence/absence of fecal coliforms and human *Bacteroids*. Soil samples submitted for analysis of these parameters were presented as quantity detected, either Most Probable Number (MPN/100g) or Cell Equivalents (CEs/g).

For the purposes of this report, data supporting a potential septic discharge was inferred if human *Bacteroides* were detected in soil, sediment, or surface water down-gradient to the septic field, as total coliforms can occur naturally in the environment, and the presence of *E. coli* can be associated with both human and animal feces (Health Canada, 2012).

4. RESULTS

Soil and sediment sample results are provided in **Appendix B**. Surface water sample results are provided in **Appendix C**. Laboratory analytical reports presented in **Appendix D**.

4.1 Physical Conditions

During the March 29, 2018 sampling event, groundwater seeps were not observed to be leaching from the hill side of the Strata's septic field onto City property. Additionally, pooling of surface water on the playing fields located south of the Strata's septic field was not observed.

Table 1 describes soil and sediment characteristics observed during the sampling program.

Table 1 Soil and Sediment Characteristics of Collected Samples

Sample	Characteristics	Odour
SED18-01	Dark brown to black, predominately fines, with some organic matter	No odour
SED18-02	Brown to black sandy silt, with some organics	No odour
SS18-03 (0.3)	Brown to black sandy soil with some fines and clumps of light gray moist fines	No odour
SS18-03 (0.5)	Brown and grey sand, moist with minimal organics	No odour
SS18-04 (0.3)	Brown to black sand with some organics	No odour
SS18-04 (0.5)	Brown to grey sand, moist, with minimal organics	No odour
SED18-05	Predominately black fines (silt and clay)	organic/decomposition like odour
SED18-06	Grey to black sandy sediments with some organics	Slight organic/decomposition like odour
SED18-07	Brown to black sandy sediment with some fines	Slight organic/decomposition like odour
SS18-08 (0.3)	Dark brown/black sand, with some organics	No odour
SS18-08 (0.5)	Brown and grey sandy soil with some organics	No odour
SED18-09	Reddish brown sandy sediments	No odour
SED18-10	Reddish brown sandy sediments	No odour

Table 2 describes water quality encountered during the sampling program.

Table 2 Water Quality Characteristics of Collected Surface Water Samples

Sample	Characteristics	pH	Dissolved Oxygen (mg/L)	Conductivity (µS/cm)	Turbidity (NTU)	Temperature (^{o}C)
SW18-01	Clear, no odour	6.7	10.4	8.6	4.20	6.5
SW18-02	Clear, no odour	7.5	11.6	8.4	4.20	7.5
SW18-05	Turbid, organic odour	6.7	10.8	245	34.9	10.0
SW18-06	Clear, no odour	7.5	10.4	128	32.4	8.5
SW18-07	Clear, no odour	7.0	10.4	68	32.2	10.0
SW18-09	Clear, no odour	7.6	11.8	71	4.84	6.0
SW18-10	Clear, no odour	7.1	11.6	82	5.91	7.0

4.2 Surface Water

Analytical results reported detectable *E. coli* and fecal coliforms in two of the three surface water samples (SW18-05 and SW18-06) collected from the catch basin locations. *E. coli* concentrations were less than provincial and federal PCR guidelines, with exception of SW18-06, which had an *E. coli* concentration of 940 CFU/100mL (CFU = Colony Forming Units). Notably, measurements of *E. coli*, total coliforms, and fecal coliforms in surface water

collected at SW18-05, the catch basin sample located downgradient of SW18-06, had an *E. coli* concentration of 100 CFU/100mL, which was less than provincial and federal PCR guidelines (**Appendix C**). Total *Bacteriodes* analyses on SW18-06 and SW18-05 resulted in measured concentrations of non-detect and 27,526 CEs/100 mL, respectively. Notably, human *Bacteriodes* analyses were non-detect in both cases.

Surface water samples collected from background locations in Wilkes and Turner Creeks had *E. coli* concentrations less than provincial and federal PCR guidelines, and creek samples collected downgradient of the septic field (SW18-09 and SW18-10) had non-detectable total coliform and *E. coli* concentrations.

4.3 Soil

Total coliform concentrations were detected in one of the three soil sampling locations, SS18-08 (at both depths SS18-08 (0.3) and SS18-08 (0.5)), however *E. coli* concentrations were less than the detection limit at this location. Additionally, results of the human *Bacteriode* analysis at SS18-08 (0.5) were also non-detectable.

Regulatory criteria for *E. coli*, total coliforms or human *Bacteroides* are not available for soil and sediment samples.

4.4 Sediment

Total coliform concentrations were detected in five of the seven sediment sampling locations: SED18-05, SED18-06, SED18-07, SED18-09, and SED18-10. Additionally, sediment *E. coli* concentrations were measured at detectable concentrations in samples collected downgradient of the septic field in Wilkes and Turner Creeks (SED18-09 and SED18-10) at 210 and 45 MPN/100g, respectively. The results of the human *Bacteriodes* analyses for SED18-05, SED18-06, SED18-07, SED18-09, and SED18-10 were determined to be non-detectable.

Regulatory criteria for *E. coli*, total coliforms or human *Bacteroides* are not available for soil and sediment samples.

5. CONCLUSION AND RECOMMENDATIONS

The findings of the soil, sediment and surface water sampling program did not provide evidence that the septic field was discharging beyond the septic field limits during the sampling program, as soil, sediment, and surface water samples collected from locations downgradient of the septic field with detectable total coliforms, fecal coliforms, and/or *E. coli* concentrations did not contain detectable human *Bacteroides*. These results suggest that the coliforms and *E. coli* concentrations measured in the downgradient samples may have been from animal sources.

Surface water samples that were co-located with sediment sampling locations had concentrations of *E. coli* at concentrations less than provincial and federal PCR guidelines, with the exception of SW18-06. This water sample, as well as the co-located sediment sample (SED18-06), were tested for human *Bacteriodes* and, the results were non-detect, suggesting that the elevated *E. coli* concentrations measured at this location were likely of animal origin.

6. CLOSURE

This letter has been prepared solely for the internal use of the City of Port Moody pursuant to the agreement between Keystone Environmental Ltd. and the City of Port Moody. By using this report, the City of Port Moody agrees that they will review and use the letter in its entirety. Any use which other parties make of this letter, or any reliance on or decisions made based on it, are the responsibility of such parties. Keystone Environmental Ltd. accepts no responsibility for damages, if any, suffered by other parties as a result of decisions made or actions based on this letter.

If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

Keystone Environmental Ltd.

Brett Lucas, M.Sc., R.P.Bio.
Risk Assessor / Toxicologist

Craig Patterson, R.P.Bio.
Project Manager

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ATTACHMENTS:

- Appendix A: Figures
- Appendix B: Soil and Sediment Analytical Results
- Appendix C: Surface Water Analytical Results
- Appendix D: Analytical Laboratory Reports

REFERENCES

Associated Environmental Ltd. (AE). 2017a. Action Plan for the Anmore Green Estates (Permit PE 4606). Associated Environmental Ltd. October 11, 2017.

AE. 2017b. Technical Memorandum Re: Results of September 2017 Soil Testing. Associated Environmental Ltd. October 16, 2017.

BC Ministry of Environment (BC MoE). 2001. Water Quality. Water Quality Criteria for Microbiological Indicators Overview Report. BC Ministry of Environment. August 7, 2001.

BC MoE. 2013. Field Sampling Manual. BC Ministry of Environment. 2013 edition.

BC MoE. 2017a. Warning Letter, Permit, 4606. BC Ministry of Environment. March 7, 2017.

BC MoE. 2017b. Recreational Water Quality Guidelines. Guideline Summary. Ministry of Environment, Water Protection and Sustainability Branch. December 2017.

Canadian Council Ministers of the Environment (CCME). 2005. Guidelines for Compost Quality. Canadian Council Ministers of the Environment. PN 1340. 2005.

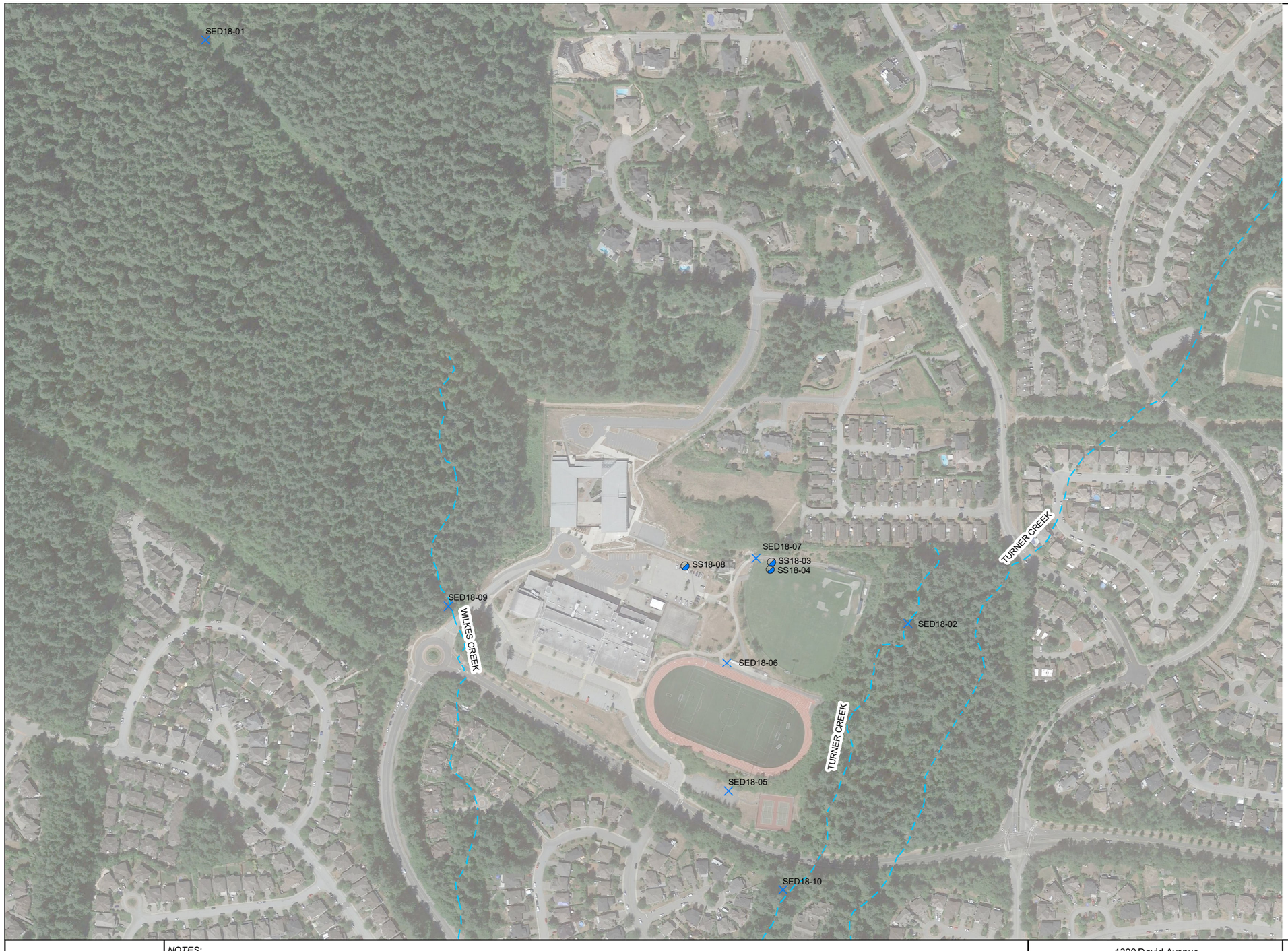
Health Canada. 2012. Guidelines for Canadian Recreational Water Quality. Third Edition. Prepared by the Federal-Provincial-Territorial Working Group on Recreational Water Quality of the Federal-Provincial-Territorial Committee on Health and the Environment. April 2012.

Organic Matter Recycling Regulation (OMRR). 2018. Organic Matter Recycling Regulation. Includes amendments up to BC Reg. 243/2016, November 1, 2017 to February 13, 2018.

Vancouver Coastal Health. 2018. Beach Water Quality Reports. http://www.vch.ca/public-health/environmental-health-inspections/pools-beaches/beach-water-quality-reports (Accessed February 15, 2018).

APPENDIX A

FIGURES



LEGEND

- KEYSTONE SEDIMENT SAMPLE (2018)
- KEYSTONE SURFICIAL SOIL SAMPLE (2018)
- CREEK

Keystone Environmental

NOTES:
1. THIS DRAWING IS FOR GENERAL INFORMATION ONLY. LOT BOUNDARIES AND FEATURES ARE APPROXIMATE.
2. DATE OF AERIAL PHOTO IS 2017.

50 0 250 m

SCALE: 1:4,000 (approx.)

1300 David Avenue
Port Moody, BC
City of Port Moody

REVISION No.	DATE	PROJECT No.
00	May. 2018	13953-103

Figure 1
Soil & Sediment Sample Plan

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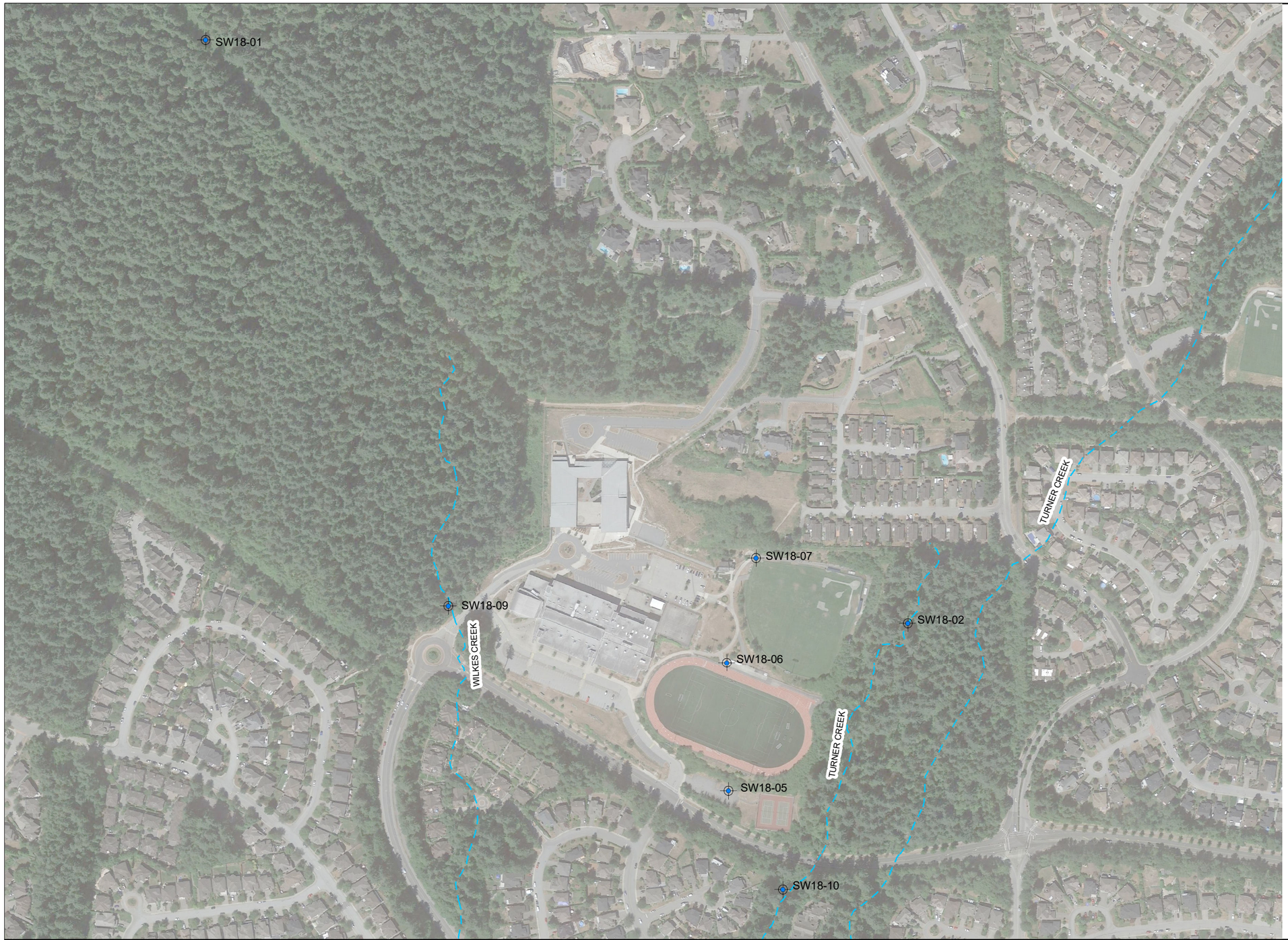

LEGEND

- KEYSTONE SURFACE WATER SAMPLE (2018)
- CREEK

Keystone Environmental

NOTES:
1. THIS DRAWING IS FOR GENERAL INFORMATION ONLY. LOT BOUNDARIES AND FEATURES ARE APPROXIMATE.
2. DATE OF AERIAL PHOTO IS 2017.

50 0 250 m

SCALE: 1:4,000 (approx.)

1300 David Avenue
Port Moody, BC
City of Port Moody

REVISION No.	DATE	PROJECT No.
00	May. 2018	13953-103

Figure 2
Surface Water Sample Locations

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APPENDIX B

SOIL AND SEDIMENT ANALYTICAL RESULTS

SOIL AND SEDIMENT ANALYTICAL RESULTS
Microbiological

1300 David Avenue, Port Moody, BC
Project #: 13953
April 2018

Standards	SAMPLE ID	Units	SED18-01	SED18-A	RPD or MS	SED18-02	SED18-05	SED18-06	SED18-07	SED18-09	SED18-10	SS18-03 (0.3)
	DATE SAMPLED		29-Mar-18	29-Mar-18	for	29-Mar-18	29-Mar-18	29-Mar-18	29-Mar-18	29-Mar-18	29-Mar-18	29-Mar-18
	LAB CERTIFICATE		B823570	B823570	SED18-01	B823570	B823570	B823570	B823570	B823570	B823570	B823570
	LAB SAMPLE ID		TE7252	TE8792	and	TE7253	TE7258	TE7259	TE7260	TE7263	TE7264	TE7254
	SAMPLE DEPTH (mbg)		~0-0.05	Duplicate of	SED18-A	~0-0.05	~0-0.05	~0-0.05	~0-0.05	~0-0.05	~0-0.05	0.03
	SOIL DESCRIPTION		Brown Fines	SED18-01		Black Sandy Silt	Black Fines	Black Sand	Black Sand	Redish Sand	Redish Sand	Brown Sand
	Microbiology											
n/s	*E. coli*	MPN/100g	<20	<20	--	<20	<20	<20	<20	210	45	<20
n/s	Total Coliform	MPN/100g	<20	<20	--	<20	240,000	45	3,300	210	140	<20
n/s	Human *Bacteriodes*	CEs/g	--	--	--	--	ND	ND	ND	ND	ND	--
n/s	Total *Bacteriodes*	CEs/g	--	--	--	--	902,216	25,780	5,749	ND	ND	--

Notes:

MPN/100g	Most Probable Number per 100 grams
CEs/100g	Cell Equivalents per 100 grams
n/s	No standards
RPD	Relative Percent Difference
MS	Maximum Spread
ND	Non Detect
mbg	Metres below ground

SOIL AND SEDIMENT ANALYTICAL RESULTS
Microbiological

1300 David Avenue, Port Moody, BC
Project #: 13953
April 2018

Standards	SAMPLE ID	Units	SS18-03 (0.5)	SS18-04 (0.3)	SS18-04 (0.5)	SS18-08 (0.3)	SS18-08 (0.5)
	DATE SAMPLED		29-Mar-18	29-Mar-18	29-Mar-18	29-Mar-18	29-Mar-18
	LAB CERTIFICATE		B823570	B823570	B823570	B823570	B823570
	LAB SAMPLE ID		TE7255	TE7256	TE7257	TE7261	TE7262
	SAMPLE DEPTH (mbg)		0.05	0.03	0.05	0.03	0.05
	SOIL DESCRIPTION		Brown Sand	Brown Sand	Brown Sand	Brown Sand	Brown Sand
	Microbiology						
n/s	*E. coli*	MPN/100g	<20	<20	<20	<20	<20
n/s	Total Coliform	MPN/100g	<20	<20	<20	3,500	7,000
n/s	Human *Bacteriodes*	CEs/g	--	--	--	--	ND
n/s	Total *Bacteriodes*	CEs/g	--	--	--	--	ND

Notes:

MPN/100g	Most Probable Number per 100 grams
CEs/100g	Cell Equivalents per 100 grams
n/s	No standards
RPD	Relative Percent Difference
MS	Maximum Spread
ND	Non Detect
mbg	Metres below ground

APPENDIX C

SURFACE WATER ANALYTICAL RESULTS

SURFACE WATER ANALYTICAL RESULTS
Microbiology

1300 David Avenue, Port Moody, BC
Project #: 13953
April 2018

BCWQG (2017) Primary Contact Recreation	Health Canada (2012) Primary Contact Recreation	SAMPLE ID DATE SAMPLED LAB CERTIFICATE LAB SAMPLE ID TOP OF SCREEN (mbg) BOTTOM OF SCREEN (mbg)	Units	SW18-01 29-Mar-18 B823570 TE7265	SW18-A 29-Mar-18 B823570 TE8793 Duplicate of SW18-01	RPD or MS for SW18-01 and SW18-A	SW18-02 29-Mar-18 B823570 TE7266	SW18-05 29-Mar-18 B823570 TE7267	SW18-06 29-Mar-18 B823570 TE7268	SW18-07 29-Mar-18 B823570 TE7269	SW18-09 29-Mar-18 B823570 TE7270	SW18-10 29-Mar-18 B823570 TE7271
		Microbiology										
n/g	n/g	Fecal Coliforms	CFU/100mL	<1	0	--	7	1	1	<1	<1	6
200/100 mL	200/100 mL	E. coli	CFU/100mL	4	4	--	67	100	**940**	0	0	0
n/g	n/g	Total Coliform	CFU/100mL	11	10	--	79	780	980	0	0	0
n/s	n/s	Human *Bacteriodes*	CEs/100mL	--	--	--	--	ND	ND	--	--	--
n/s	n/s	Total *Bacteriodes*	CEs/100mL	--	--	--	--	27,526	ND	--	--	--

Notes:

BC WQG	BC Water Quality Guidelines
Health Canada	Health Canada Guidelines for Canadian Recreational Water Quality
CFU	Colony Forming Units
n/g	No guideline
RPD	Relative Percent Difference
MS	Maximum Spread

APPENDIX D

ANALYTICAL LABORATORY REPORTS

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 13953-103
Your C.O.C. #: K019946, K019947, K019948

Attention: CRAIG PATTERSON

KEYSTONE ENVIRONMENTAL LTD
SUITE 320
4400 DOMINION STREET
BURNABY, BC
CANADA V5G 4G3

Report Date: 2018/05/10
Report #: R2552492
Version: 4 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B823570
Received: 2018/03/29, 17:17

Sample Matrix: DRINKING WATER
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Fecal Coliform membrane filt - Potable W	7	N/A	2018/03/29	BBY4SOP-00001	SM 22 9222 m
Fecal Coliform membrane filt - Potable W	1	N/A	2018/04/02	BBY4SOP-00001	SM 22 9222 m
Tot Coliform/E.Coli by MF-Chromocult(PW)	7	N/A	2018/03/29	BBY4SOP-00143	SM 22 9222
Tot Coliform/E.Coli by MF-Chromocult(PW)	1	N/A	2018/04/02	BBY4SOP-00143	SM 22 9222
Human Bacteroides in Water Subcontract (1)	2	N/A	2018/05/08		
Total Bacteroides in Water Subcontract (1)	2	N/A	2018/05/08		

Sample Matrix: Sediment
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Coliforms (MTF) in Soil (2)	7	N/A	2018/03/29	COR1 SOP-00019	Health Can MFHPB-19
Total Coliforms (MTF) in Soil (2)	1	N/A	2018/04/02	COR1 SOP-00019	Health Can MFHPB-19
Escherichia Coli (MTF) in Soil (2)	7	N/A	2018/03/29	COR1 SOP-00019	Health Can MFHPB-19
Escherichia Coli (MTF) in Soil (2)	1	N/A	2018/04/02	COR1 SOP-00019	Health Can MFHPB-19
Moisture	7	2018/03/31	2018/04/02	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Moisture	1	2018/04/03	2018/04/04	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Human Bacteroides in Soil Subcontract (1)	4	N/A	2018/04/19		
Human Bacteroides in Soil Subcontract (1)	1	N/A	2018/05/08		
Total Bacteroides inSoil Subcontract (1)	4	N/A	2018/04/19		
Total Bacteroides inSoil Subcontract (1)	1	N/A	2018/05/08		

Sample Matrix: Soil
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Coliforms (MTF) in Soil (2)	6	N/A	2018/03/29	COR1 SOP-00019	Health Can MFHPB-19
Escherichia Coli (MTF) in Soil (2)	6	N/A	2018/03/29	COR1 SOP-00019	Health Can MFHPB-19
Moisture	6	2018/03/31	2018/04/02	BBY8SOP-00017	BCMOE BCLM Dec2000 m
Human Bacteroides in Soil Subcontract (1)	1	N/A	2018/04/19		

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Your Project #: 13953-103
Your C.O.C. #: K019946, K019947, K019948

Attention: CRAIG PATTERSON

KEYSTONE ENVIRONMENTAL LTD
SUITE 320
4400 DOMINION STREET
BURNABY, BC
CANADA V5G 4G3

Report Date: 2018/05/10
Report #: R2552492
Version: 4 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B823570
Received: 2018/03/29, 17:17

Sample Matrix: Soil
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Total Bacteroides inSoil Subcontract (1)	1	N/A	2018/04/19		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Sub Burnaby to EMSL (NJ)
(2) The matrix is non-food and is outside of the scope of the method. Sample(s) analyzed have not been subjected to Maxxam's standard validation process for the submitted matrix and is not an accredited method.

Your Project #: 13953-103
Your C.O.C. #: K019946, K019947, K019948

Attention: CRAIG PATTERSON

KEYSTONE ENVIRONMENTAL LTD
SUITE 320
4400 DOMINION STREET
BURNABY, BC
CANADA V5G 4G3

Report Date: 2018/05/10
Report #: R2552492
Version: 4 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B823570
Received: 2018/03/29, 17:17

Encryption Key

Nancy Niklis
Project Manager
10 May 2018 11:01:59

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Nancy Niklis, Project Manager
Email: NNiklis@maxxam.ca
Phone# (604) 734 7276

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

RESULTS OF CHEMICAL ANALYSES OF DRINKING WATER

Maxxam ID		TE7267	TE7268	
Sampling Date		2018/03/29 13:00	2018/03/29 13:30	
COC Number		K019948	K019948	
	UNITS	SW18-05	SW18-06	QC Batch
External Sublet Analysis				
Subcontract Parameter	N/A	ATTACHED	ATTACHED	8982520

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

MICROBIOLOGY (DRINKING WATER)

Maxxam ID		TE7265	TE7266	TE7267	TE7268	TE7269	TE7270	TE7271		
Sampling Date		2018/03/29 11:30	2018/03/29 12:00	2018/03/29 13:00	2018/03/29 13:30	2018/03/29 14:00	2018/03/29 15:15	2018/03/29 15:45		
COC Number		K019948	K019948	K019948	K019948	K019948	K019948	K019948		
	UNITS	SW18-01	SW18-02	SW18-05	SW18-06	SW18-07	SW18-09	SW18-10	RDL	QC Batch
Microbiological Param.										
Fecal Coliforms	CFU/100mL	<1	7	1	1	<1	<1	6	1	8948217
Total Coliforms	CFU/100mL	11	79	780	980	0	0	0	N/A	8948211
E. coli	CFU/100mL	4.0	67	100	940	0	0	0	N/A	8948211

RDL = Reportable Detection Limit
N/A = Not Applicable

Maxxam ID		TE8793	
Sampling Date		2018/03/29 11:30	
COC Number		K019948	
	UNITS	SW18-A	QC Batch
Microbiological Param.			
Fecal Coliforms	CFU/100mL	0	8949386
Total Coliforms	CFU/100mL	10	8949384
E. coli	CFU/100mL	4.0	8949384

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

RESULTS OF CHEMICAL ANALYSES OF SEDIMENT

Maxxam ID		TE7258	TE7259	TE7260	TE7263	TE7264	
Sampling Date		2018/03/29 13:00	2018/03/29 13:30	2018/03/29 14:00	2018/03/29 15:15	2018/03/29 15:45	
COC Number		K019946	K019946	K019946	K019947	K019947	
	UNITS	SED18-05	SED18-06	SED18-07	SED18-09	SED18-10	QC Batch
External Sublet Analysis							
Subcontract Parameter	N/A	ATTACHED	ATTACHED	ATTACHED	ATTACHED	ATTACHED	8964567

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

PHYSICAL TESTING (SEDIMENT)

Maxxam ID		TE7252	TE7252	TE7253	TE7258	TE7259	TE7260	TE7263		
Sampling Date		2018/03/29 11:30	2018/03/29 11:30	2018/03/29 12:00	2018/03/29 13:00	2018/03/29 13:30	2018/03/29 14:00	2018/03/29 15:15		
COC Number		K019946	K019946	K019946	K019946	K019946	K019946	K019947		
	UNITS	SED18-01	SED18-01 Lab-Dup	SED18-02	SED18-05	SED18-06	SED18-07	SED18-09	RDL	QC Batch
Physical Properties										
Moisture	%	74	72	26	74	39	55	28	0.30	8948334

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate

Maxxam ID		TE7264		TE8792		
Sampling Date		2018/03/29 15:45		2018/03/29 11:30		
COC Number		K019947		K019946		
	UNITS	SED18-10	QC Batch	SED18-A	RDL	QC Batch
Physical Properties						
Moisture	%	21	8948334	70	0.30	8950379

RDL = Reportable Detection Limit

Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

MICROBIOLOGY (SEDIMENT)

Maxxam ID		TE7252	TE7253	TE7258	TE7259	TE7260	TE7263	TE7264		
Sampling Date		2018/03/29 11:30	2018/03/29 12:00	2018/03/29 13:00	2018/03/29 13:30	2018/03/29 14:00	2018/03/29 15:15	2018/03/29 15:45		
COC Number		K019946	K019946	K019946	K019946	K019946	K019947	K019947		
	UNITS	SED18-01	SED18-02	SED18-05	SED18-06	SED18-07	SED18-09	SED18-10	RDL	QC Batch
Microbiological Param.										
E. coli	MPN/100g	<20	<20	<20	<20	<20	210	45	20	8948187
Total Coliforms	MPN/100g	<20	<20	240000	45	3300	210	140	20	8948185
RDL = Reportable Detection Limit										

Maxxam ID		TE8792		
Sampling Date		2018/03/29 11:30		
COC Number		K019946		
	UNITS	SED18-A	RDL	QC Batch
Microbiological Param.				
E. coli	MPN/100g	<20	20	8949393
Total Coliforms	MPN/100g	<20	20	8949389
RDL = Reportable Detection Limit				

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		TE7262	
Sampling Date		2018/03/29 14:45	
COC Number		K019947	
	UNITS	**SS18-08 (0.5)**	**QC Batch**
External Sublet Analysis			
Subcontract Parameter	N/A	ATTACHED	8964567

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

PHYSICAL TESTING (SOIL)

Maxxam ID		TE7254	TE7255	TE7256	TE7257	TE7261	TE7262		
Sampling Date		2018/03/29 12:30	2018/03/29 12:35	2018/03/29 12:45	2018/03/29 12:50	2018/03/29 14:30	2018/03/29 14:45		
COC Number		K019946	K019946	K019946	K019946	K019946	K019947		
	UNITS	SS18-03 (0.3)	SS18-03 (0.5)	SS18-04 (0.3)	SS18-04 (0.5)	SS18-08 (0.3)	SS18-08 (0.5)	RDL	QC Batch
Physical Properties									
Moisture	%	36	12	11	11	26	18	0.30	8948334
RDL = Reportable Detection Limit									

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

MICROBIOLOGY (SOIL)

Maxxam ID		TE7254	TE7255	TE7256	TE7257	TE7261	TE7262		
Sampling Date		2018/03/29 12:30	2018/03/29 12:35	2018/03/29 12:45	2018/03/29 12:50	2018/03/29 14:30	2018/03/29 14:45		
COC Number		K019946	K019946	K019946	K019946	K019946	K019947		
	UNITS	SS18-03 (0.3)	SS18-03 (0.5)	SS18-04 (0.3)	SS18-04 (0.5)	SS18-08 (0.3)	SS18-08 (0.5)	RDL	QC Batch
Microbiological Param.									
E. coli	MPN/100g	<20	<20	<20	<20	<20	<20	20	8948187
Total Coliforms	MPN/100g	<20	<20	<20	<20	3500	7000	20	8948185
RDL = Reportable Detection Limit									

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Maxxam Job #: B823570
Report Date: 2018/05/10

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	11.3°C

Change Request: Report to include results for total, fecal coliforms and E. coli on samples SED18-A and SW18-A, duplicates of samples SED18-01 and SW18-01 respectively, as per client request on 2018/04/02.

Sample(s) analyzed past hold time. Analysis performed with client's consent.

Version 2: Report reissued to include subcontracted results for bacteriodes and human bacteriodes on samples SED18-05, SED18-07, SS18-08 (0.5), SED18-09, and SED18-10 as per request on 2018/04/12

Sample TE8792 [SED18-A] : Sample was analyzed past recommended hold time for Total Coliforms (MTF) in Soil. Sample was analyzed past recommended hold time for Escherichia Coli (MTF) in Soil. Sample was analyzed past recommended hold time for Fecal Coliforms (MTF) in Soil - Wet.

Sample TE8793 [SW18-A] : Sample was analyzed past method specific hold time for Fecal Coliform membrane filt - Potable W. Sample was analyzed past method specific hold time for Tot Coliform/E.Coli by MF-Chromocult(PW).

Results relate only to the items tested.

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Maxxam Job #: B823570
Report Date: 2018/05/10

QUALITY ASSURANCE REPORT

KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

			Method Blank		RPD	
QC Batch	**Parameter**	**Date**	**Value**	**UNITS**	**Value (%)**	**QC Limits**
8948334	Moisture	2018/04/02	<0.30	%	2.5	20
8950379	Moisture	2018/04/04	<0.30	%	3.1	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

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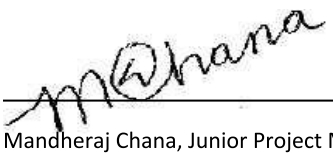
Maxxam Job #: B823570
Report Date: 2018/05/10

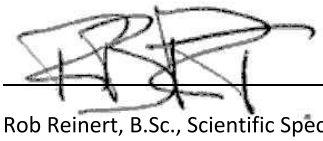
KEYSTONE ENVIRONMENTAL LTD
Client Project #: 13953-103
Sampler Initials: BTL

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Mandheraj Chana, Junior Project Manager



Rob Reinert, B.Sc., Scientific Specialist

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K 019946

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CHAIN OF CUSTODY RECORD

BBY FCD-00077/07

Page 1 of 3

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5. Toll Free (800) 665-8566

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: 3763 - Keystone Environmental Ltd.	Company Name: KEL	Quotation #:	☒ Regular TAT 5 days (Most analyses)
Contact Name: Craig Patterson	Contact Name: Sumaira	P.O. #/ AFE#: 13953-103	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: #320 - 4400 Dominion Street	Address: Same	Project #:	Rush TAT (Surcharges will be applied)
Burnaby, BC PC: V5G 4G3	PC:	Site Location:	☐ Same Day ☐ 2 Days
Phone: (604) 430-0671	Phone:	Site #:	☐ 1 Day ☐ 3 Days
Email: CSpatterson@keystoneenvironmental.ca		Sampled By: BTL + KM	Date Required:

Regulatory Criteria	Special Instructions
☐ BC CSR Soil ☐ BC CSR Water	☐ Return Cooler
☐ YK CSR Soil ☐ YK CSR Water	☐ Ship Sample Bottles (Please Specify)
☐ CCME (Specify) ☐ Other (Specify)	
☐ Drinking Water ☐ BC Water Quality	

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	Sample Identification	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	BTEX/VPH	BTEX/F1	PAH	EPH	Dissolved Metals	Dissolved Mercury	Total Metals	Total Mercury	Chloride	TSS	pH	Nitrite	E. coli	Total and fecal coliforms	total anaerobic bacteria	# OF CONTAINERS SUBMITTED	HOLD - DO NOT ANALYZE	COMMENTS
1	SED18-01	2018/03/29	11:30	sediment													X	X	X	3		(1) Re: Total and fecal coliforms & human bacteria - samples to be placed on hold.
2	SED18-02		12:00	sediment													X	X	X	3		
3	SS18-03 (0.3)		12:30	soil													X	X	X	3		
4	SS18-03 (0.5)		12:35	soil													X	X	X	3		
5	SS18-04 (0.3)		12:45	soil													X	X	X	3		
6	SS18-04 (0.5)		12:50	soil													X	X	X	3		
7	SED18-05		13:00	sediment													X	X	X	3		
8	SED18-06		13:30	sediment													X	X	X	3		
9	SED18-07		14:00	sediment													X	X	X	3		
10	SS18-08 (0.3)	↓	14:30	soil													X	X	X	3		

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
N/A		11, 10, 13
		JUST SAMPLED

COOLING MEDIA PRESENT Y / N

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Brett Lamb	2018/03/29	17:00	FEDEX TRACK	2018/03/29	17:17

B823570_COC

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CHAIN OF CUSTODY RECORD

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Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5. Toll Free (800) 665-8566

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required
Company Name:	3763 - Keystone Environmental Ltd.	Company Name:	SAME	Quotation #:		☒ Regular TAT 5 days (Most analyses)
Contact Name:	Craig Patterson	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	#320 - 4400 Dominion Street	Address:		Project #:	13953 -103	Rush TAT (Surcharges will be applied)
	Burnaby, BC PC: V5G 4G3		PC:	Site Location:		☐ Same Day ☐ 2 Days
Phone:	(604) 430-0671	Phone:		Site #:		☐ 1 Day ☐ 3 Days
Email:	cspatterson@keystoneenvironmental.ca	Email:		Sampled By:		Date Required:
						Rush Confirmation #:

Regulatory Criteria

☐ BC CSR Soil ☐ BC CSR Water
☐ YK CSR Soil ☐ YK CSR Water
☐ CCME (Specify) ☐ Other (Specify)
☐ Drinking Water ☐ BC Water Quality

Special Instructions

☐ Return Cooler
☐ Ship Sample Bottles (Please Specify)

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

#	Sample Identification	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	MTBE / VOC/BTEXS/VPH / BTEXS/VPH	VOC/BTEX/F1 / BTEX/F1	LEPH/HEPH/PAH / PAH	F2 - F4 / TEH / EPH	Preserved? / Filtered? / Dissolved Metals	Preserved? / Filtered? / Dissolved Mercury	Field Preserved? / Total Metals	Field Preserved? / Total Mercury	Sulphate / Fluoride / Chloride	COD / BOD / TDS / TSS	Alkalinity / Conductivity / pH	Ammonia / Nitrate / Nitrite	E.Coli	Total and fecal coliforms	Total and human bacteriods ①		# OF CONTAINERS SUBMITTED	HOLD - DO NOT ANALYZE
1	SS18-08 (0.5)	2018/03/29	14:45	soil													X	X	X		3	
2	SED18-09	↓	15:15	sediment													X	X	X		3	
3	SED18-10	↓	15:45	sediment													X	X	X		3	
4																						
5																						
6																						
7																						
8																						
9																						
10																						

LABORATORY USE ONLY

CUSTODY SEAL Y / N Present	Intact	COOLER TEMPERATURES
N/A		11, 10, 13

JUST SAMPLED

COOLING MEDIA PRESENT (Y) / N

COMMENTS: ① Total and human bacteride samples to be placed on hold

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Brett Law	2018/03/29	17:00	Pedro Tack	2018/03/29	17:17

COC-1027 Keystone

B823570_COC

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CHAIN OF CUSTODY RECORD

BBY FCD-00077/07
Page 3 of 3

Burnaby: 4606 Canada Way, Burnaby, BC V5G 1K5. Toll Free (800) 665-8566

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: 3763 - Keystone Environmental Ltd.	Company Name: SAME	Quotation #:	☒ Regular TAT 5 days (Most analyses)
Contact Name: Craig Patterson	Contact Name:	P.O. #/ AFE#:	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: #320 - 4400 Dominion Street	Address:	Project #: 13953-103	Rush TAT (Surcharges will be applied)
Burnaby, BC PC: V5G 4G3	PC:	Site Location:	☐ Same Day ☐ 2 Days
Phone: (604) 430-0671	Phone:	Site #:	☐ 1 Day ☐ 3 Days
Email: csputterson@keystoneenvironmental.ca	Email:	Sampled By: BTL + KM	Date Required:
			Rush Confirmation #:

Regulatory Criteria

- ☐ BC CSR Soil
- ☐ BC CSR Water
- ☐ YK CSR Soil
- ☐ YK CSR Water
- ☐ CCME (Specify)
- ☐ Other (Specify)
- ☒ Drinking Water
- ☒ BC Water Quality

Special Instructions

- ☐ Return Cooler
- ☐ Ship Sample Bottles (Please Specify)

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

	Sample Identification	Date Sampled (YYYY/MM/DD)	Time Sampled (HH:MM)	Matrix	BTEX/VPH	BTEX/F1	PAH	EPH	Dissolved Metals	Dissolved Mercury	Total Metals	Total Mercury	Chloride	TSS	pH	Nitrite	E. coli	Total and Fecal Coliforms	Total and Thermotolerant	# OF CONTAINERS SUBMITTED
1	SW18-01	2018/03/29	11:30	water													X	X	X	3
2	SW18-02		12:00	water													X	X	X	3
3	SW18-05		13:00	water													X	X	X	3
4	SW18-06		13:30	water													X	X	X	3
5	SW18-07		14:00	water													X	X	X	3
6	SW18-09		15:15	water													X	X	X	3
7	SW18-10		15:45	water													X	X	X	3
8																				
9																				
10																				

HOLD - DO NOT ANALYZE	LABORATORY USE ONLY		
	CUSTODY SEAL Y / N		COOLER TEMPERATURES
	Present	Intact	
	N/A		11,10,13
			JUST SAMPLED
	COOLING MEDIA PRESENT (Y) / N		

COMMENTS

1) Total and thermotolerant samples to be placed on hold

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Brett Lucas	2018/03/29	17:00	Pedro Tack	2018/03/29	17:17

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Maxxam's standard Terms and Conditions. Signing of this Chain of Custody document is acknowledgment and acceptance of our terms which are available for viewing at

B823570_COC

COC-1027 Keystone

EMSL Analytical, Inc.
200 Route 130 North, Cinnaminson, NJ 08077
Phone/Fax: (800) 220-3675/ 786-0262
http://www.emsl.com E-mail: Dnalab2@EMSL.com

Client:	Maxxam Analytics	EMSL Order ID:	611800666
	4606 Canada Way	Date Received:	4/16/2018
	Burnaby, BC V5G 1K5	Date Analyzed:	4/19/2018
Attn:	Nancy Niklis	Date Reported:	4/19/2018
Project:	B823570	Date Amended:	

Rapid Detection of Total *Bacteroides* by Quantitative PCR

EMSL Test: M095

Lab Sample Number	Client Sample ID	Description	Soil Received	Soil Sampled (g)	CEs */g Soil
0666-1	TE7258-SED18-05	N/A	Bulk	1.2313	902,216
0666-2	TE7260-SED18-07	N/A	Bulk	1.2613	5,749
0666-3	TE7262-SS18-08 (0.5)	N/A	Bulk	1.1335	None Detected
0666-4	TE7263-SED18-09	N/A	Bulk	1.214	None Detected
0666-5	TE7264-SED18-10	N/A	Bulk	1.2066	None Detected

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

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PCR Laboratory Director

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Client:	Maxxam Analytics	EMSL Order ID:	611800666
	4606 Canada Way	Date Received:	4/16/2018
	Burnaby, BC V5G 1K5	Date Analyzed:	4/19/2018
Attn:	Nancy Niklis	Date Reported:	4/19/2018
Project:	B823570	Date Amended:	

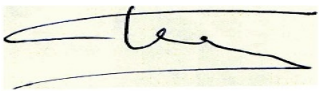
Rapid Detection of Human *Bacteroides* by Quantitative PCR

EMSL Test: M199

Lab Sample Number	Client Sample ID	Description	Bulk Received	Bulk Sampled (g)	CEs* /g Soil
0666-1	TE7258-SED18-05	N/A	Bulk	1.2313	None Detected
0666-2	TE7260-SED18-07	N/A	Bulk	1.2613	None Detected
0666-3	TE7262-SS18-08 (0.5)	N/A	Bulk	1.1335	None Detected
0666-4	TE7263-SED18-09	N/A	Bulk	1.214	None Detected
0666-5	TE7264-SED18-10	N/A	Bulk	1.2066	None Detected

Note: The qPCR assay for human *Bacteroides* is based on HF183 marker which was evaluated by EPA scientists (SAM, 33, 2010). The qPCR detects human specific *Bacteroides* predominantly.

CEs: Cells Equivalent, measured by PCR using genomic DNA standards.



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http://www.emsl.com E-mail: Dnalab2@EMSL.com

Client:	**Maxxam Analytics**	EMSL Order ID:	**611800780**
	4606 Canada Way	Date Received:	**5/3/2018**
	Burnaby, BC V5G 1KS	Date Analyzed:	**5/4/2018**
Attn:	**Nancy Niklis**	Date Reported:	**5/8/2018**
Project:	**B823570**	Date Amended:	**5/10/2018**

Rapid Detection of Total *Bacteroides* by Quantitative PCR

EMSL Test: M095

Lab Sample Number	Client Sample ID	Description	Soil Received	Soil Sampled (g)	CEs */g Soil
0780-1	TE7259-SED18-06	N/A	Bulk	1.368	25,780

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

Retort amendment date 05/10/2018 following customer's request
0780-1 TE7259-SED18-06 Sample name is corrected

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Client:	**Maxxam Analytics**	EMSL Order ID:	**611800780**
	4606 Canada Way	Date Received:	**5/3/2018**
	Burnaby, BC V5G 1KS	Date Analyzed:	**5/4/2018**
Attn:	**Nancy Niklis**	Date Reported:	**5/8/2018**
Project:	**B823570**	Date Amended:	**5/10/2018**

Rapid Detection of Human *Bacteroides* by Quantitative PCR

EMSL Test: M199

Lab Sample Number	Client Sample ID	Description	Bulk Received	Bulk Sampled (g)	CEs* /g Soil
0780-1	TE7259-SED18-06	N/A	Bulk	1.368	None Detected

Note: The qPCR assay for human *Bacteroides* is based on HF183 marker which was evaluated by EPA scientists (SAM, 33, 2010). The qPCR detects human specific *Bacteroides* predominantly.

CEs: Cells Equivalent, measured by PCR using genomic DNA standards.

Retort is amended 05/10/2018 following customer's request

0780-1 TE7259-SED18-06 Sample name is corrected

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Client:	**Maxxam Analytics**	EMSL Order ID:	**611800780**
	4606 Canada Way	Date Received:	**5/3/2018**
	Burnaby, BC V5G 1KS	Date Analyzed:	**5/4/2018**
Attn.	**Nancy Niklis**	Date Reported:	**5/8/2018**
Project:	**B823570**	Date Amended:	**5/9/2018**

Rapid Detection of Total *Bacteroides* by Quantitative PCR

EMSL Test: M095

Lab Sample Number	Client Sample ID	Description	Water Received (mL)	Water Sampled (mL)	CEs*/100 mL
0780-2	TE7267-SW18-05	N/A	200	200	27,526
0780-3	TE7268-SW18-06	N/A	200	200	None Detected

CEs: Cell Equivalent, measured by PCR using genomic DNA standards.

Retort amendment date 05/09/2018 following customer's request

0780-3	TE7268-SW18-06	Sample name corrected

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Client:	**Maxxam Analytics**	EMSL Order ID:	**611800780**
	4606 Canada Way	Date Received:	**5/3/2018**
	Burnaby, BC V5G 1KS	Date Analyzed:	**5/4/2018**
Attn.	**Nancy Niklis**	Date Reported:	**5/8/2018**
Project:	**B823570**	Date Amended:	**5/10/2018**

Rapid Detection of Human *Bacteroides* by Quantitative PCR

EMSL Test Code: M199

Lab Sample Number	Client Sample ID	Description	Water Received (mL)	Water Sampled (mL)	CEs /100 mL
0780-2	TE7267-SW18-05	N/A	200	200	None Detected
0780-3	TE7268-SW18-06	N/A	200	200	None Detected

Note: The qPCR assay for human *Bacteroides* is based on HF183 marker which was evaluated by EPA scientists (SAM, 33, 2010). The qPCR detects human specific *Bacteroides* predominantly.

CEs: Cells Equivalent, measured by PCR using genomic DNA standards.

EMSL maintains liability limited to the cost of analysis. Interpretation of the data contained in this report is the responsibility of the client. This report relates only to the samples reported above and may not be reproduced, except in full, without written approval by EMSL. The above test report relates only to the items tested. EMSL bears no responsibility for sample collection activities or analytical method limitations

Retort amendment date 05/10/2018 following customer's request
0780-3 TE7268-SW18-06 Sample name corrected

Sergey Balashov, Ph.D.
PCR Laboratory Director