Project Title	Addendum No.:
Septic System Upgrades	3
Project Location:	**Project Number:**
Banff National Park, Alberta	R.077777.001
	Date:
.	November 26, 2015

The following changes on the bid documents are effective immediately.
This addendum will form part of the contract documents.

Bid Form

No changes.

Drawings

No changes.

Specifications

1. **Appendices:** Add attached appendices to Specifications.

Attachments:

- Specification Appendices

END OF ADDENDUM 3

APPENDIX A

Two Jack Main Campground and Cascade Day Use Area Geotechnical Investigation

ALBERTA
MATERIALS TESTING & ENGINEERING
CALGARY • EDMONTON • RED DEER

July 13, 2015

Project No.: AMC-15-128

Submitted To: Mr. Steven Pickle, MSc PEng

AECOM
300 – 48 Quarry Park Blvd SE,
Calgary, AB T2C 5P2

GEOTECHNICAL ASSESSMENT

Banff Wastewater Upgrades AECOM Project #60429272

Banff, AB

Submitted By:
Alberta Materials Testing Ltd.
#112, 2850 – 107th Avenue SE
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Contents

1.0 INTRODUCTION

Alberta Materials Testing Ltd. (AMT) presents our geotechnical findings for the proposed Banff wastewater upgrades at Two Jack Main (Jack) and the Cascades Day Use (Cascades) area. This report provides our geotechnical findings, but does not include any design or recommendations. The report has been written to conform to Alberta Private Sewage Systems Standard of Practice – 2009 Hand Book (APSSSP) Part 7. Attachments to this report include: a site location plan, borehole location plan, borehole logs, and laboratory test results.

2.0 SCOPE OF WORK

The scope of work for this assessment was outlined in the proposal submitted by AMT on May 26th, 2015 (via email) to AECOM. AMT's scope of work, as described in the proposal, included the following:

- A geotechnical test pitting investigation to assess the subsurface soil and groundwater conditions;
- Laboratory testing to determine the natural moisture content, atterberg limits, and grain-size distribution on selected samples, and,
- Preparation of a geotechnical engineering report summarizing the findings of the test pitting investigation and laboratory testing.

Testing of soil or groundwater with respect to environmental considerations is beyond the scope of this project; however, such services can be provided upon request.

3.0 PROJECT DESCRIPTION

The proposed project is located to the northeast of the Banff community in Alberta. The project is split into two separate locations Jack and Cascades. Both locations are off Lake Minnewanka Scenic Dr. approximately 6km apart from each other. The project will consist of the development of new wastewater facilities. Both facilities were treated as one site instead of treating each wastewater facility as its own site.

4.0 METHODOLOGY

A geotechnical test pitting investigation was conducted on June 26th, 2015. The investigation included the excavating to a minimum depth of 2.7m and sampling of one borehole using a tracked excavator owned and operated by AJB from Canmore, AB. Underground utility locates were provided through the National Parks. A total of five test pits were completed, three at Jack and two at Cascades

Sampling and logging procedures for the investigation were as follows:

- Topsoil and frost penetration depths, as applicable, were logged for the borehole;
- Samples of the disturbed soil were obtained at various depths dependent on soil horizons for natural moisture content and grain size distribution analysis; and
- A site walk around at each location was performed to determine geotechnical characteristics of the site.

The soils encountered during the investigation were sampled and logged by a representative of AMT. Representative samples obtained during the investigation were tested at our Calgary laboratory.

5.0 SITE CONDITIONS

5.1 Site Description

Two Jack Main

The site is located approximately 7km NE of the Banff community, just west Lake Minnewanka Scenic Drive. The site is large in size with multiple wastewater treatment facilities planned. Overall the site has elevation gains and losses. The test pits range from 1467m to 1486m in elevation. The closest body of water is Two Jack Lake, approximately 300m east of the closest test pit. In general, the site is densely covered in coniferous trees, small shrubs and grass. There are no developments near the site, the closest being the community of Banff. Most test areas were nominally flat, although TP3 was close to a sever slope directly to the west. Access to the site is from Lake Minnewanka Scenic Drive.

Cascades Day Use

The site is located approximately 4km NE of Banff, and just east of Lake Minnewanka Scenic Drive. The overall site is large in size, but a small area was investigated for a single wastewater treatment facility. The area for investigation was nominally flat and sloped down gently toward the Cascades pond. The test pits were at an elevation of 1401m. The closest body of water is Cascades pond, approximately 90m east of closest test pit. In general the development area is densely covered in coniferous trees, small shrubs and grass. There are no developments near the site, the closest being the community of Banff . Access to the site is from Lake Minnewanka Scenic Drive.

5.2 Soil Conditions

5.2.1 Soil Stratigraphy

Two Jack Main

Complete borehole logs are attached in Appendix B. Table 1 summarizes the conditions observed in the borehole and/or the stratigraphy in order of increasing depth:

Table 1: General Borehole Logs

Test Pit No.	Horizon (m)	Texture	%Clay	% Silt	%Sand	%Gravel
1	0.3 to2.6	Gravel	0	0.5	28.5	71
1	2.6 to 2.8	Gravel	0	0	19	81
2	0.4 to 1.2	Gravel	0	0.8	21.2	78
2	1.2 to 1.9	Sand	0	0.3	71.7	28
2	1.9 to 2.8	Sand	0	8	92	0
3	0.3 to 0.5	Sand and Silt	15	39	46	0
3	0.5 to 2.0	Sand and Silt	18	35	47	0
3	2.0 to 2.8	Sand and Silt	20	37	43	0

The soil conditions described above and encountered in the specific boreholes are representative of the general soil conditions in the immediate vicinity of each respective bore hole. Interpretation of soil conditions between boreholes is based on an assumed continuity of subsurface conditions. The

soil conditions described below are generalized and are based on the available borehole information. Variation in stratigraphy can occur between borehole locations, and in the areas not investigated.

Groundwater was not encountered during the drilling investigation. No wells were installed for water level monitoring. No mottling or gleying was discovered, although ground water levels can vary seasonally with climatic conditions.

Cascades Day Use

Complete borehole logs are attached in Appendix B. Table 2 summarizes the conditions observed in the borehole and/or the stratigraphy in order of increasing depth:

Table 2: General Borehole Logs

Test Pit No.	Depth (m)	Texture	%Clay	% Silt	%Sand	%Gravel
4	0.2 to 0.7	Silt	22	63	14	0
4	0.7 to 2.8	Gravel	0	1.5	17.5	81
5	0.2 to 0.7	Silt	22	63	14	0
5	0.7 to 2.8	Gravel	0	1.5	17.5	81

The soil conditions described above and encountered in the specific boreholes are representative of the general soil conditions in the immediate vicinity of each respective bore hole. Interpretation of soil conditions between boreholes is based on an assumed continuity of subsurface conditions. The soil conditions described below are generalized and are based on the available borehole information. Variation in stratigraphy can occur between borehole locations, and in the areas not investigated.

Groundwater was not encountered during the drilling investigation. No wells were installed for water level monitoring. No mottling or gleying was discovered, although ground water levels can vary seasonally with climatic conditions.

5.3.2 Restrictive Layer Conditions

Table 3: Soil Conditions

Test Pit No.	Depth To Restrictive Layer (m)	Depth to High Permeable Layer (m)
1	N/A	0.3
2	N/A	0.4
3	0.5	N/A
4	N/A	0.7
5	N/A	0.7

All soils encountered in all test pits was granular, grade 0 structure except of test pit three. This soil was blocky, grade 3 structure and was encountered at a depth of 0.5m.

6.0 FIELD REVIEW

It is recommended that geotechnical field reviews are carried out to assess the actual soil conditions encountered. Should the conditions differ significantly from those assumed for design, AMT should be provided with the opportunity to review the assessment and modify the report, as appropriate.

7.0 CLOSURE

Recommendations presented herein are based on the geotechnical evaluation of the findings of the testpits completed on June 26th, 2015. The material in this report reflects AMT's best judgment based on the information available to AMT at the time of preparation of this report. If conditions other than those are noted during subsequent phases of development, AMT should be notified and given the opportunity to review and revise the recommendations included in this report, as necessary.

This report has been prepared for the exclusive use of the client, their consultants and representatives for the specific application of the development described within this report. Any use of this report by third parties, or any reliance on or decisions based on it are the responsibility of such third parties. AMT accepts no responsibility, if any, suffered by any third party as a result of decisions made or actions based on this report.

We appreciate the opportunity to be of service to you. If you have any questions regarding the contents of this report, or if we can be of further assistance to you on this project, please contact our office.

Sincerely,
Alberta Materials Testing Ltd.
A subsidiary of the CCMET Group of Companies

Scott Robbins, PEng
Geotechnical Engineer

Christopher Holt, PhD, PEng
Senior Geotechnical Engineer

APEGA Permit to Practice No. P12584

Alberta Materials Testing Ltd.
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APPENDIX A

FIGURES

	Site Location	
	Project: Banff Wastewater Upgrades Location: Two Jack Main and Cascades Day Use	AMC15-128

	Bore Hole Locations	
	Project: Two Jack Main Location: Banff, Alberta	AMC-15-128

	Bore Hole Locations	
	Project: Cascades Day Use Location: Banff, Alberta	AMC-15-128

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APPENDIX B

BOREHOLE LOGS

SOIL LOG

TP15-01

CLIENT AECOM **PROJECT No** AMC-15-128

PROJECT Banff Test Pit Investigation **DATUM** Ground Surface **NORTHING** 51.230068

LOCATION Two Jack Campground and Cascade Day Use Area **ELEVATION** 1467 m **EASTING** -115.513684

DATE TESTED June 26, 2015 **METHOD** Tracked Excavator

DEPTH (m)	CLASSIFICATION	SOIL SYMBOL	MATERIAL DESCRIPTION	SAMPLE TYPE	ELEVATION	SPT (N)	MOISTURE CONTENT & ATTERBERG LIMITS (WP, W, WL; 20 40 60 80)	POCKET ▲ PENTROMETER (kPa) 100 175 250 325; □ SPT N VALUE 20 40 60 80	DEPTH (ft)
0.0	OL		TOPSOIL, trace roots and organics, black, dry, loose						0
	ML		Sandy SILT, trace cobbles, trace roots and organics, brown, dry, loose						
0.5	GW		Sandy GRAVEL, some cobbles, trace fines, grey, damp, loose-compact	GB	1466.6		○		
1.0				GB	1465.8		○		
1.5									5
2.0				GB	1465.2		○		
2.5	GW		GRAVEL, some sand, trace cobbles, trace fines, grey, damp, loose to compact	GB	1464.4		○		
			End of hole at 2.8 m.						
3.0									

Sample Type: GS- Grab Sample SPT- Standard Penetration Test
ST- Shelby Tube PT- Piston Tube VT- Shear Vane Test

LOGGED BY: SR

SOIL LOG AMC-15-128 BANFF GINT.GPJ METRO TESTING LAB.GDT 7/13/15

SOIL LOG

TP15-02

CLIENT AECOM **PROJECT No** AMC-15-128

PROJECT Banff Test Pit Investigation **DATUM** Ground Surface **NORTHING** 51.233743

LOCATION Two Jack Campground and Cascade Day Use Area **ELEVATION** 1486 m **EASTING** -115.50512

DATE TESTED June 26, 2015 **METHOD** Tracked Excavator

DEPTH (m)	CLASSIFICATION	SOIL SYMBOL	MATERIAL DESCRIPTION	SAMPLE TYPE	ELEVATION	SPT (N)	MOISTURE CONTENT & ATTERBERG LIMITS (WP, W, WL; 20 40 60 80)	POCKET ▲ PENTROMETER (kPa) 100 175 250 325; □ SPT N VALUE 20 40 60 80	DEPTH (ft)
0.0	OL		TOPSOIL, trace roots and organics, black, dry, loose						0
	ML		Sandy SILT, fine, trace roots and organics, brown, dry, loose	GB	1485.7		○		
0.5	GW		Sandy GRAVEL, some cobbles, trace roots and organics, trace fines, brown, damp, loose	GB	1485.3		○		
1.0	SP		Gravely SAND, clean, coarse, grey, moist, loose	GB	1484.8		○		
1.5									5
2.0	SP-SM		SAND, trace gravel, trace fines, fine, grey, moist, loose @2.8m hit a boulder, digging stopped	GB	1483.8		○		
2.5									
3.0			End of hole at 2.8 m.						

Sample Type: GS- Grab Sample SPT- Standard Penetration Test
ST- Shelby Tube PT- Piston Tube VT- Shear Vane Test

LOGGED BY: SR

SOIL LOG AMC-15-128 BANFF GINT.GPJ METRO TESTING LAB.GDT 7/13/15

SOIL LOG

TP15-03

CLIENT AECOM **PROJECT No** AMC-15-128

PROJECT Banff Test Pit Investigation **DATUM** Ground Surface **NORTHING** 51.230236

LOCATION Two Jack Campground and Cascade Day Use Area **ELEVATION** 1481 m **EASTING** -115.52807

DATE TESTED June 26, 2015 **METHOD** Tracked Excavator

DEPTH (m)	CLASSIFICATION	SOIL SYMBOL	MATERIAL DESCRIPTION	SAMPLE TYPE	ELEVATION	SPT (N)	MOISTURE CONTENT & ATTERBERG LIMITS (WP, W, WL; 20 40 60 80)	POCKET ▲ PENTROMETER (kPa) 100 175 250 325; □ SPT N VALUE 20 40 60 80	DEPTH (ft)
0.0	OL		TOPSOIL, trace roots and organics, black, dry, loose						0
	ML		Sandy SILT, fine, trace roots and organics, brown, dry, loose	GB	1480.8		○		
	SP-SM		SAND and SILT, some clay, trace gravel, trace organics and roots grey and brown, dry, compact	GB	1480.6		○ I		
0.5			SAND and SILT, some clay, trace cobbles, grey, moist, very stiff	GB	1480.3		○ H		
1.0				GB	1479.9		○		
1.5	SP-SM								5
2.0				GB	1479		○H		
2.5				GB	1478.5		○		
3.0			End of hole at 2.8 m.						

Sample Type: GS- Grab Sample SPT- Standard Penetration Test
ST- Shelby Tube PT- Piston Tube VT- Shear Vane Test

LOGGED BY: SR

SOIL LOG AMC-15-128 BANFF GINT.GPJ METRO TESTING LAB.GDT 7/13/15

SOIL LOG

TP15-04

CLIENT AECOM **PROJECT No** AMC-15-128

PROJECT Banff Test Pit Investigation **DATUM** Ground Surface **NORTHING** 51.213075

LOCATION Two Jack Campground and Cascade Day Use Area **ELEVATION** 1401 m **EASTING** -115.533815

DATE TESTED June 26, 2015 **METHOD** Tracked Excavator

DEPTH (m)	CLASSIFICATION	MATERIAL DESCRIPTION	SAMPLE TYPE	ELEVATION	SPT (N)
0.0	OL	TOPSOIL, trace roots and organics, black, dry, loose			
	ML	Clayey SILT, some sand, grey and brown, dry, loose Trace roots and organics to 0.3m	GB	1400.5	
1.0	GP	GRAVEL, some sand, trace cobbles, grey, dry, dense	GB	1399.5	
1.5			GB	1399.2	
2.0	GP	Sandy GRAVEL, trace cobbles, grey, moist, dense	GB	1398.8	
2.5		End of hole at 2.8 m.			
3.0					

MOISTURE CONTENT & ATTERBERG LIMITS: WP W WL; 20 40 60 80

POCKET ▲ PENTROMETER (kPa): 100 175 250 325

□ SPT N VALUE: 20 40 60 80

DEPTH (ft): 0, 5

Sample Type: GS- Grab Sample SPT- Standard Penetration Test
ST- Shelby Tube PT- Piston Tube VT- Shear Vane Test

LOGGED BY: SR

SOIL LOG AMC-15-128 BANFF GINT.GPJ METRO TESTING LAB.GDT 7/13/15

SOIL LOG

TP15-05

CLIENT AECOM **PROJECT No** AMC-15-128

PROJECT Banff Test Pit Investigation **DATUM** Ground Surface **NORTHING** 51.212863

LOCATION Two Jack Campground and Cascade Day Use Area **ELEVATION** 1401 m **EASTING** -115.53043

DATE TESTED June 26, 2015 **METHOD** Tracked Excavator

DEPTH (m)	CLASSIFICATION	MATERIAL DESCRIPTION	SAMPLE TYPE	ELEVATION	SPT (N)	MOISTURE CONTENT & ATTERBERG LIMITS (WP, W, WL; 20 40 60 80)	POCKET ▲ PENTROMETER (kPa) 100 175 250 325; □ SPT N VALUE 20 40 60 80	DEPTH (ft)
0.0	OL	TOPSOIL, trace roots and organics, black, dry, loose						0
	ML	Clayey SILT, some sand, grey and brown, dry, loose Trace roots and organics to 0.3m						
0.5			GB	1400.5				
	GP	GRAVEL, some sand, trace cobbles, grey, dry, dense @2.0m increase in cobbles	GB	1400.2				
1.0								
1.5								5
2.0								
2.5			GB	1398.5				
		End of hole at 2.8 m.						
3.0								

Sample Type: GS- Grab Sample SPT- Standard Penetration Test
ST- Shelby Tube PT- Piston Tube VT- Shear Vane Test

LOGGED BY: SR

SOIL LOG AMC-15-128 BANFF GINT.GPJ METRO TESTING LAB.GDT 7/13/15

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APPENDIX C

LABORATORY TESTING

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

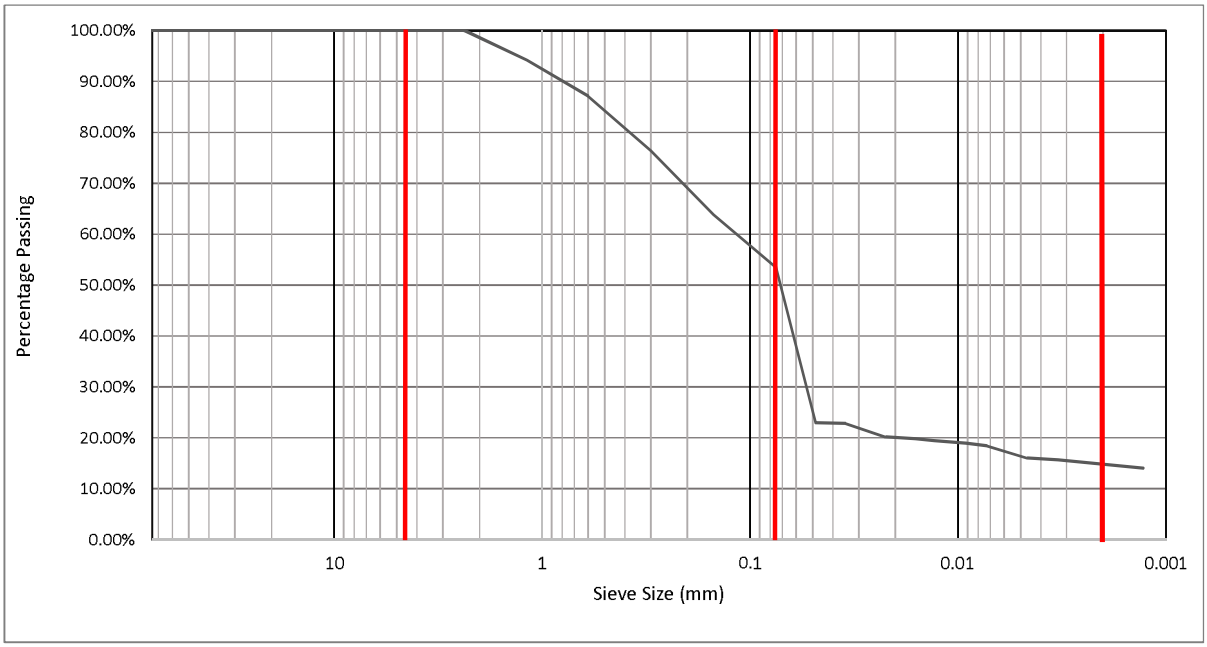
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 8-Jul-15

Sampled by Scott Robbins
Source BH 15-03 (0.4m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
40	100.00%
25	100.00%
19	100.00%
12.5	100.00%
9.5	100.00%
4.75	100.00%
2.36	100.00%
1.18	94.14%
0.6	87.07%
0.3	76.36%
0.15	63.84%

Particle Size (mm)	Percent Passing
0.075	53.54%
0.048	22.93%
0.035	22.75%
0.022	20.15%
0.016	19.80%
0.013	19.45%
0.009	18.93%
0.007	18.41%
0.005	15.98%
0.003	15.63%
0.001	14.07%

Gravel	**N.A.**
Sand	**46.0%**
Silt	**39.0%**
Clay	**15.0%**

Comments: Hydro + Wet Sieve analysis

Tested by Filip Matyasek

Date 10-Jul-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

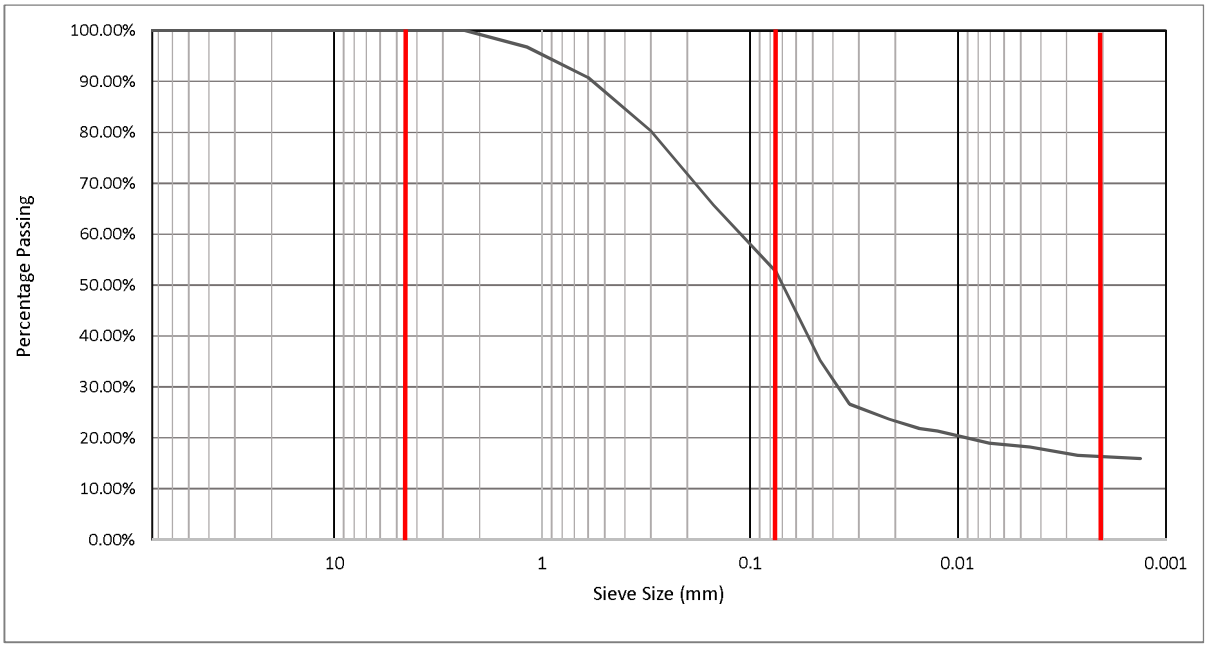
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 10-Jul-15

Sampled by Scott Robbins
Source BH 15-03 (0.7m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
40	100.00%
25	100.00%
19	100.00%
12.5	100.00%
9.5	100.00%
4.75	100.00%
2.36	100.00%
1.18	96.75%
0.6	90.78%
0.3	80.29%
0.15	65.64%

Particle Size (mm)	Percent Passing
0.075	52.62%
0.046	35.15%
0.033	26.59%
0.021	23.69%
0.015	21.85%
0.013	21.24%
0.009	19.87%
0.007	18.95%
0.005	18.19%
0.003	16.51%
0.001	15.89%

Gravel	**N.A.**
Sand	**47.0%**
Silt	**35.0%**
Clay	**18.0%**

Comments: Hydro + Wet Sieve analysis

Tested by Filip Matyasek

Date 10-Jul-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
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ASTM D422

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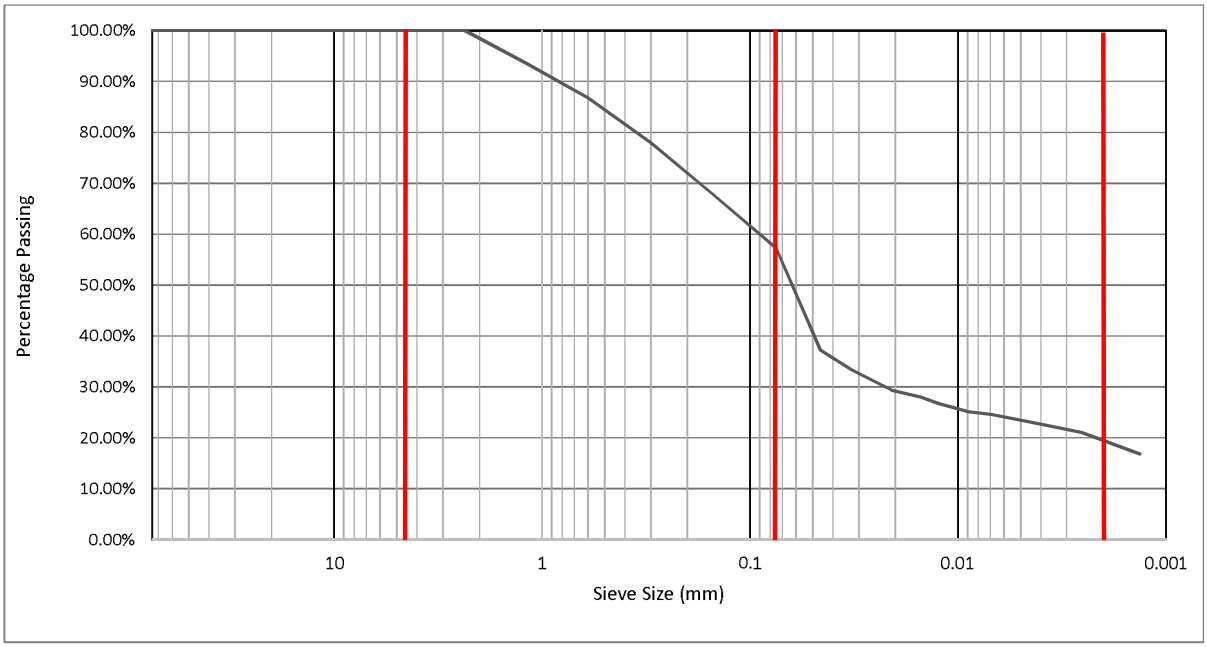
Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 10-Jul-15

Sampled by Scott Robbins
Source BH 15-03 (2.0m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
40	100.00%
25	100.00%
19	100.00%
12.5	100.00%
9.5	100.00%
4.75	100.00%
2.36	100.00%
1.18	93.46%
0.6	86.73%
0.3	77.88%
0.15	67.69%

Particle Size (mm)	Percent Passing
0.075	57.31%
0.046	37.17%
0.032	33.28%
0.021	29.38%
0.015	27.97%
0.012	26.73%
0.009	25.13%
0.007	24.60%
0.004	23.01%
0.003	21.06%
0.001	16.81%

Gravel	**N.A.**
Sand	**43.0%**
Silt	**37.0%**
Clay	**20.0%**

Comments: Hydro + Wet Sieve analysis

Tested by Filip Matyasek

Date 30-Jun-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

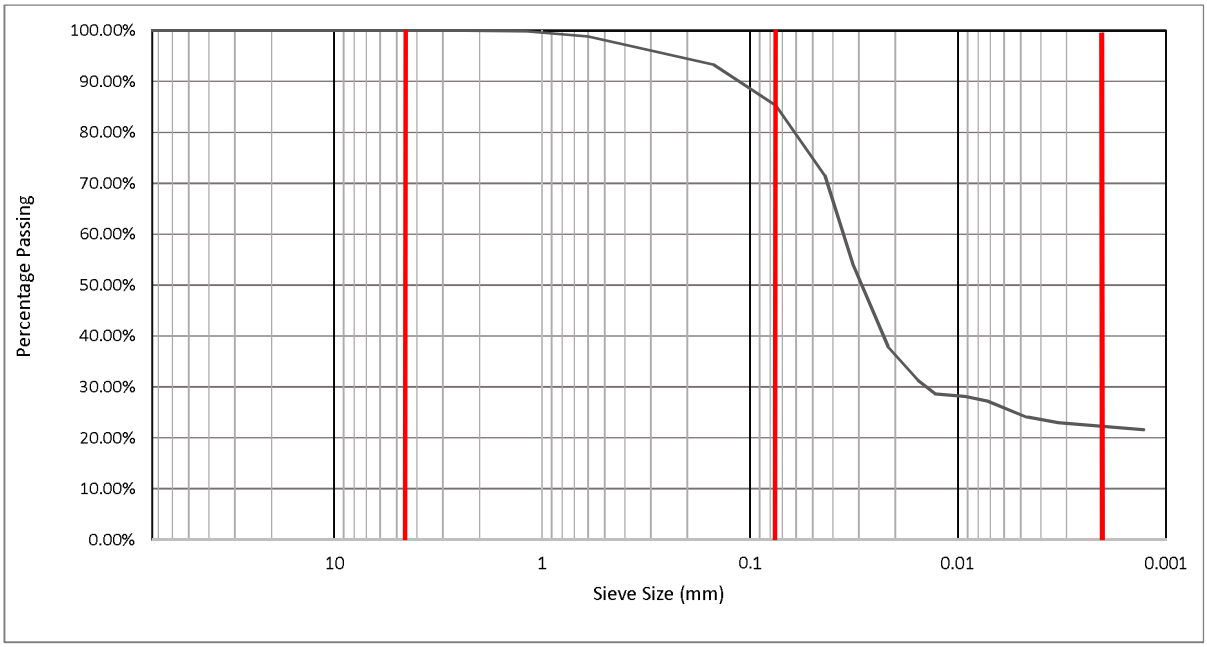
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 8-Jul-15

Sampled by Scott Robbins
Source BH 15-04 (0.5m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
40	100.00%
25	100.00%
19	100.00%
12.5	100.00%
9.5	100.00%
4.75	100.00%
2.36	100.00%
1.18	99.80%
0.6	98.82%
0.3	96.06%
0.15	93.29%

Particle Size (mm)	Percent Passing
0.075	85.21%
0.044	71.53%
0.032	53.98%
0.022	37.79%
0.016	31.31%
0.013	28.61%
0.009	28.07%
0.007	27.26%
0.005	24.02%
0.003	22.94%
0.001	21.59%

Gravel	**N.A.**
Sand	**14.0%**
Silt	**63.0%**
Clay	**22.0%**

Comments: Hydro + Wet Sieve analysis

Tested by Filip Matyasek

Date 10-Jul-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

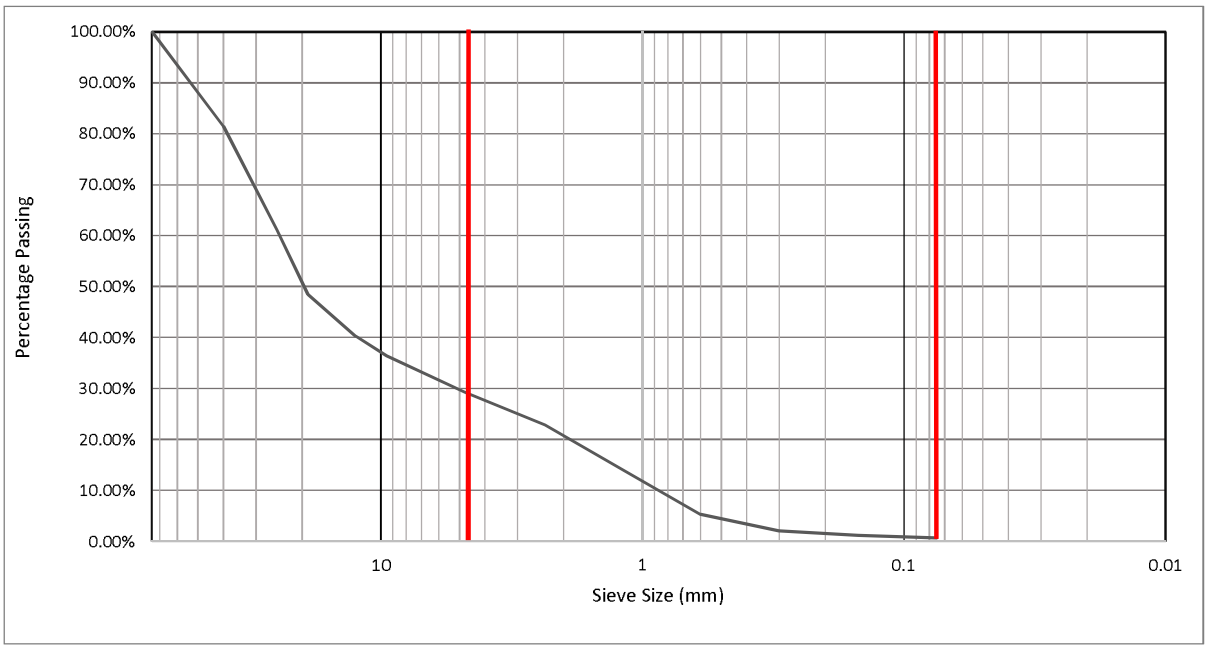
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 30-Jun-15

Sampled by Scott Robbins
Source BH 15-01 (1.2m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
40	81.40%
25	61.05%
19	48.44%
12.5	40.20%
9.5	36.33%
4.75	29.22%
2.36	22.80%
1.18	13.89%
0.6	5.25%
0.3	2.03%
0.15	1.14%

Particle Size (mm)	Percent Passing
0.075	0.59%
0.038	
0.027	
0.018	
0.013	
0.011	
0.008	
0.006	
0.004	
0.003	
0.001	

Gravel	**71.0%**
Sand	**29.0%**
Silt	**0.0%**
Clay	

Comments

Tested by Filip Matyasek

Date 30-Jun-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

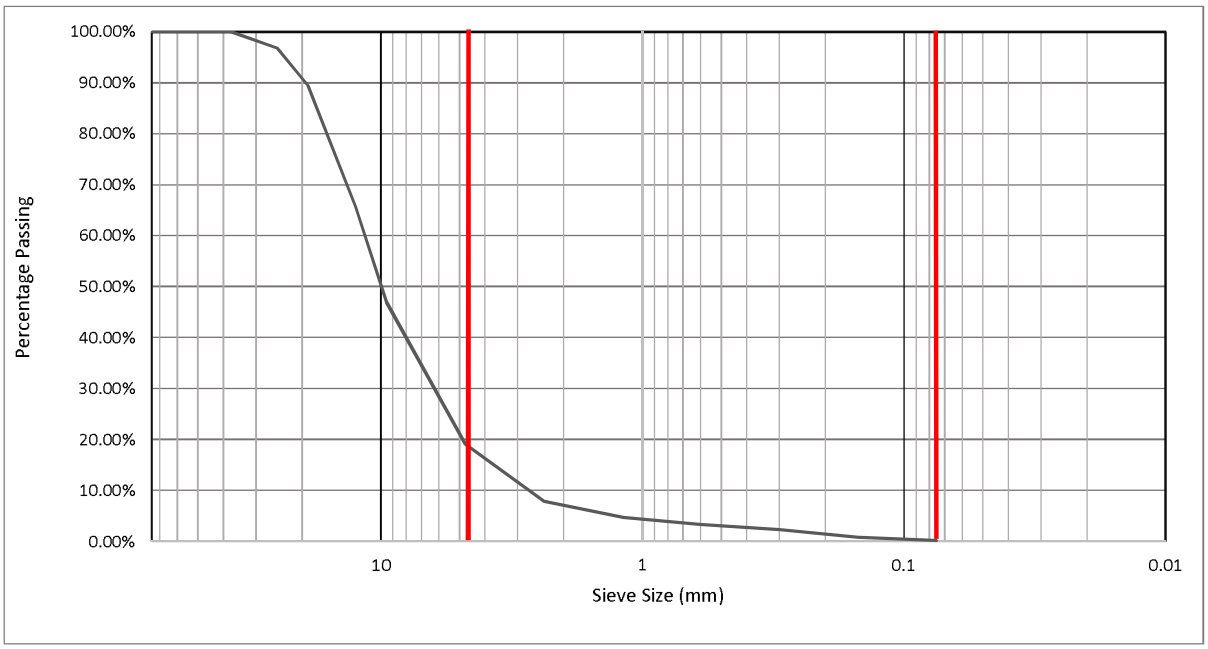
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 30-Jun-15

Sampled by Scott Robbins
Source BH 15-01 (2.6m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
37.5	100.00%
25	96.83%
19	89.45%
12.5	65.67%
9.5	46.89%
4.75	19.06%
2.36	7.76%
1.18	4.66%
0.6	3.29%
0.3	2.30%
0.15	0.76%

Particle Size (mm)	Percent Passing
0.075	0.08%
0.038	
0.027	
0.018	
0.013	
0.011	
0.008	
0.006	
0.004	
0.003	
0.001	

Gravel	**81.0%**
Sand	**19.0%**
Silt	**0.0%**
Clay	

Comments

Tested by Filip Matyasek

Date 30-Jun-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

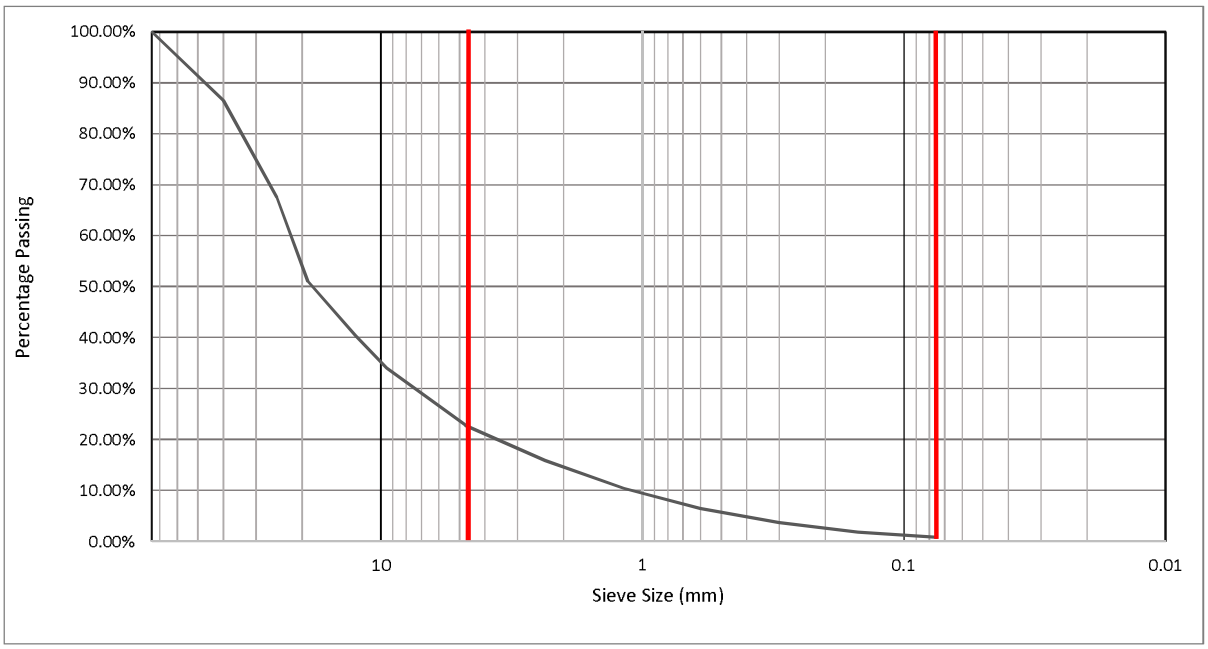
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 30-Jun-15

Sampled by Scott Robbins
Source BH 15-02 (0.7m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
40	86.50%
25	67.50%
19	50.99%
12.5	40.32%
9.5	34.00%
4.75	22.76%
2.36	15.85%
1.18	10.37%
0.6	6.40%
0.3	3.67%
0.15	1.75%

Particle Size (mm)	Percent Passing
0.075	0.78%
0.038	
0.027	
0.018	
0.013	
0.011	
0.008	
0.006	
0.004	
0.003	
0.001	

Gravel	**78.0%**
Sand	**22.0%**
Silt	**0.0%**
Clay	

Comments

Tested by Filip Matyasek

Date 30-Jun-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

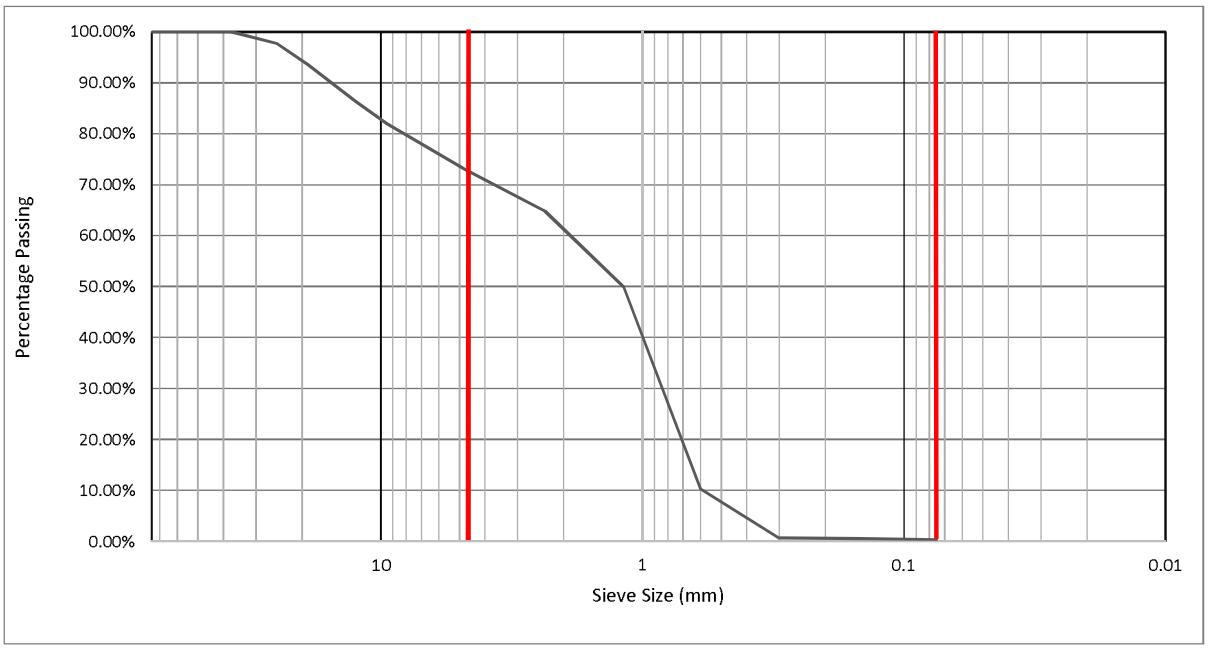
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 30-Jun-15

Sampled by Scott Robbins
Source BH 15-02 (1.2m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
37.5	100.00%
25	97.69%
19	93.44%
12.5	86.32%
9.5	81.96%
4.75	72.94%
2.36	64.76%
1.18	49.87%
0.6	10.27%
0.3	0.62%
0.15	0.44%

Particle Size (mm)	Percent Passing
0.075	0.32%
0.038	
0.027	
0.018	
0.013	
0.011	
0.008	
0.006	
0.004	
0.003	
0.001	

Gravel	**28.0%**
Sand	**72.0%**
Silt	**0.0%**
Clay	**0.0%**

Comments

Tested by Filip Matyasek

Date 30-Jun-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

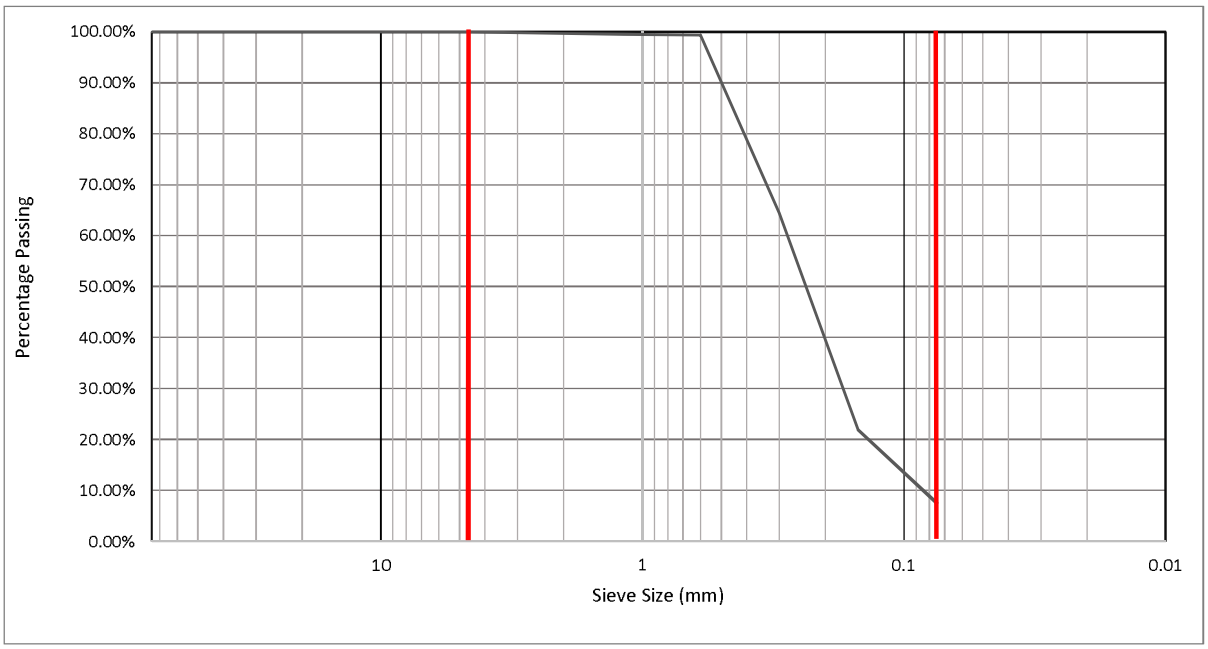
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 30-Jun-15

Sampled by Scott Robbins
Source BH 15-02 (2.2m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
37.5	100.00%
25	100.00%
19	100.00%
12.5	100.00%
9.5	100.00%
4.75	100.00%
2.36	99.66%
1.18	99.52%
0.6	99.29%
0.3	64.37%
0.15	21.91%

Particle Size (mm)	Percent Passing
0.075	7.50%
0.038	
0.027	
0.018	
0.013	
0.011	
0.008	
0.006	
0.004	
0.003	
0.001	

Gravel	**0.0%**
Sand	**92.0%**
Silt	**8.0%**
Clay	

Comments

Tested by Filip Matyasek

Date 30-Jun-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

HYDROMETER ANALYSIS REPORT
ASTM D422

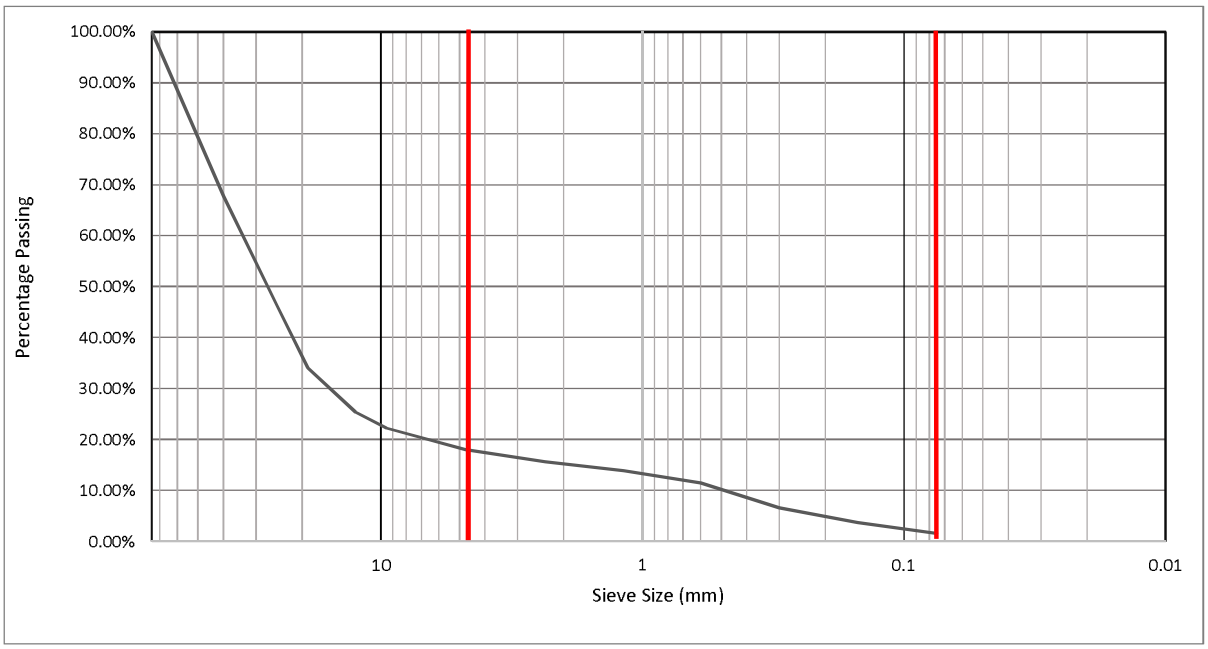
To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29-Jun-15
Date Received 29-Jun-15
Date Tested 30-Jun-15

Sampled by Scott Robbins
Source BH 15-04 (1.5m)
Material Type Native Material



Particle Size (mm)	Percent Passing
75	100.00%
40	67.73%
25	46.32%
19	33.97%
12.5	25.34%
9.5	22.22%
4.75	18.01%
2.36	15.54%
1.18	13.83%
0.6	11.47%
0.3	6.55%
0.15	3.66%

Particle Size (mm)	Percent Passing
0.075	1.47%
0.038	
0.027	
0.018	
0.013	
0.011	
0.008	
0.006	
0.004	
0.003	
0.001	

Gravel	**81.0%**
Sand	**17.5%**
Silt	**1.5%**
Clay	

Comments

Tested by Filip Matyasek

Date 30-Jun-15

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

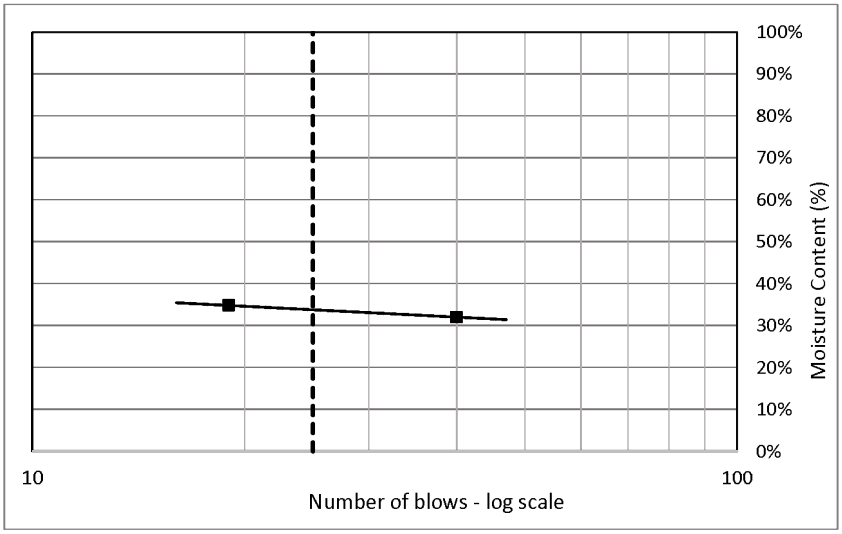
ATTERBERG LIMITS REPORT
ASTM D4318

To AECOM

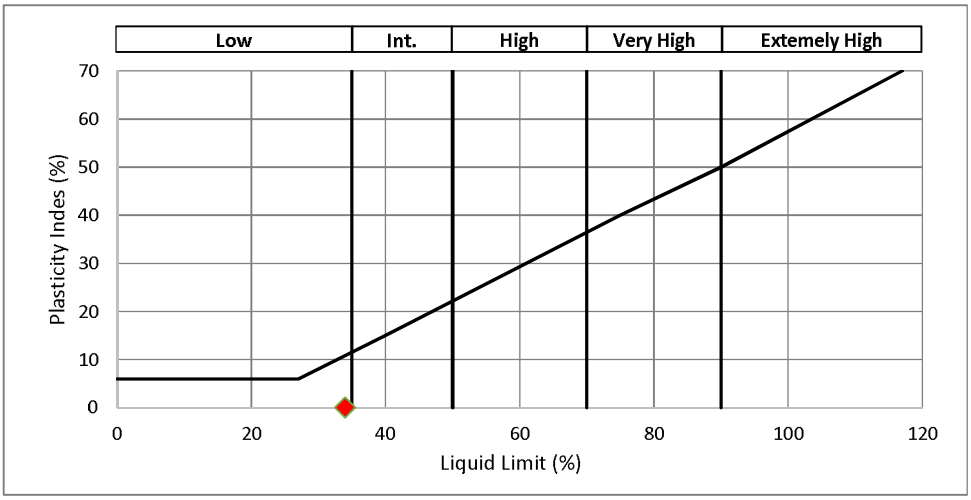
Attn

Project AMC 15-128
Septic in Banff

Date Sampled	29/Jun/15
Date Received	29/Jun/15
Date Tested	3/Jul/15
Sampled by	Filip Matyasek
Source	BH 03 (0.4m)
Material Type	Native Material



Liquid Limit	**34%**
Plastic Limit	**NO**
Plasticity Index	**N.A.**
Soil Classification	**OL**



Comments
Non plastic material

Tested by Filip Matyasek

Reviewed by Scott Robbins

Date July 8 2015

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

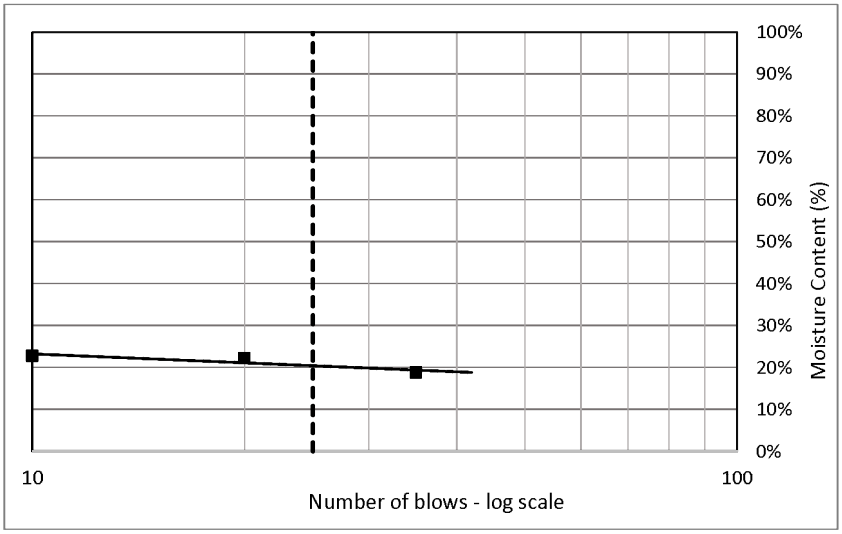
ATTERBERG LIMITS REPORT
ASTM D4318

To AECOM

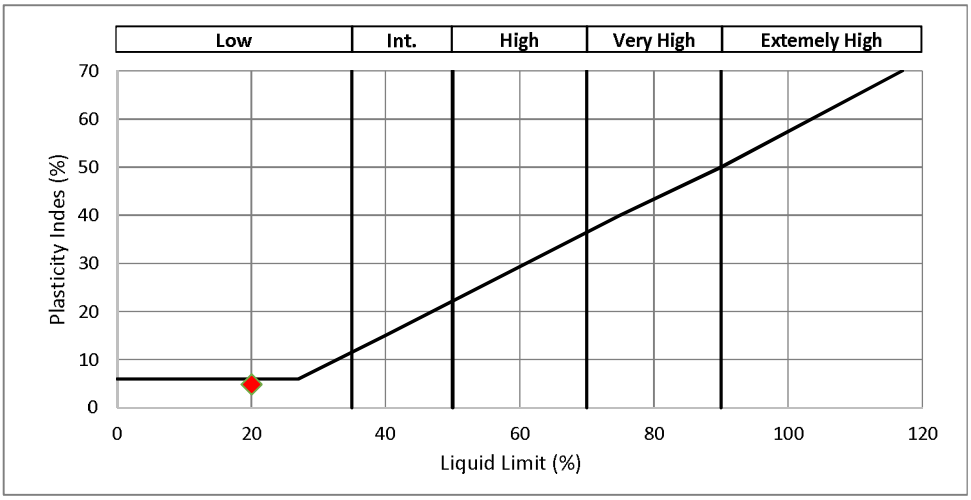
Attn

Project AMC 15-128
Septic in Banff

Date Sampled	29/Jun/15
Date Received	29/Jun/15
Date Tested	3/Jul/15
Sampled by	Filip Matyasek
Source	BH 03 (0.7m)
Material Type	Native Material



Liquid Limit	**20%**
Plastic Limit	**15.1%**
Plasticity Index	**4.9%**
Soil Classification	**CL - ML**



Comments

Tested by	Filip Matyasek
Reviewed by	Scott Robbins
Date	July 8 2015

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

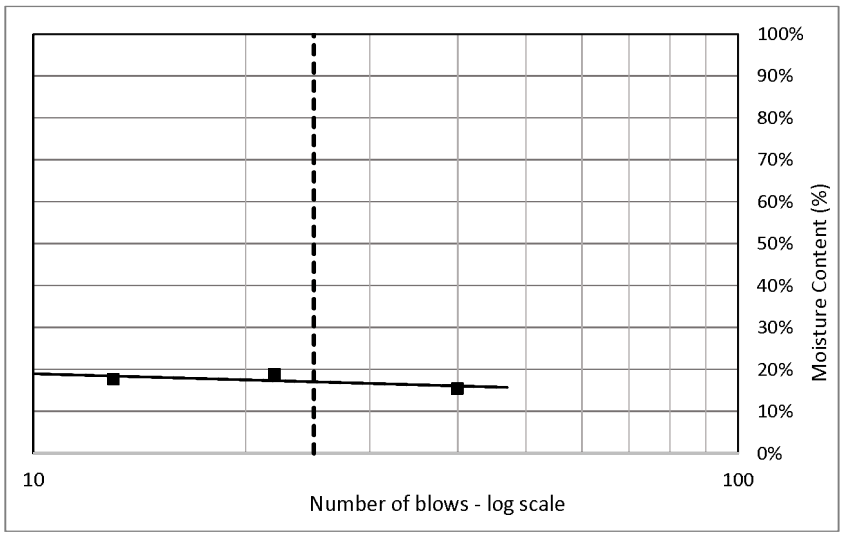
ATTERBERG LIMITS REPORT
ASTM D4318

To AECOM

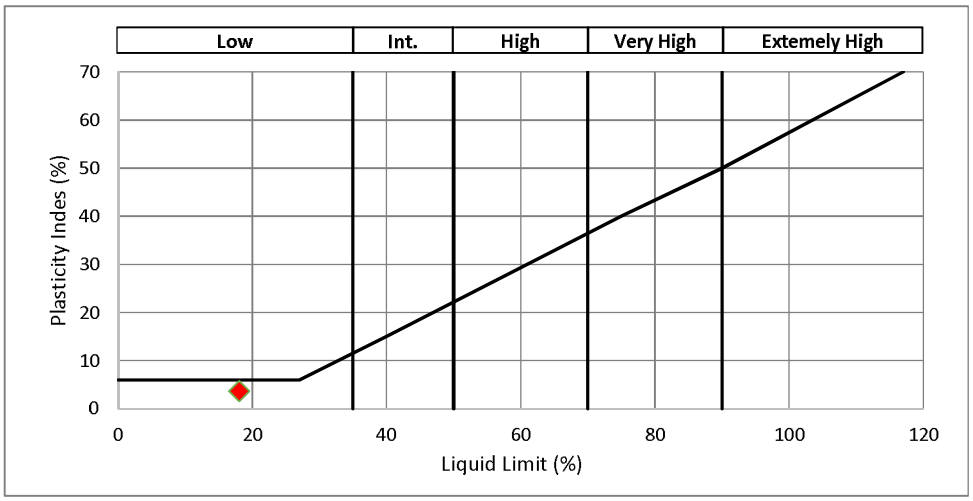
Attn

Project AMC 15-128
Septic in Banff

Date Sampled	29/Jun/15
Date Received	29/Jun/15
Date Tested	3/Jul/15
Sampled by	Filip Matyasek
Source	BH 03 (2.0m)
Material Type	Native Material



Liquid Limit	**18%**
Plastic Limit	**14.3%**
Plasticity Index	**3.7%**
Soil Classification	**ML**



Comments

Tested by	Filip Matyasek
Reviewed by	Scott Robbins
Date	July 8 2015

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

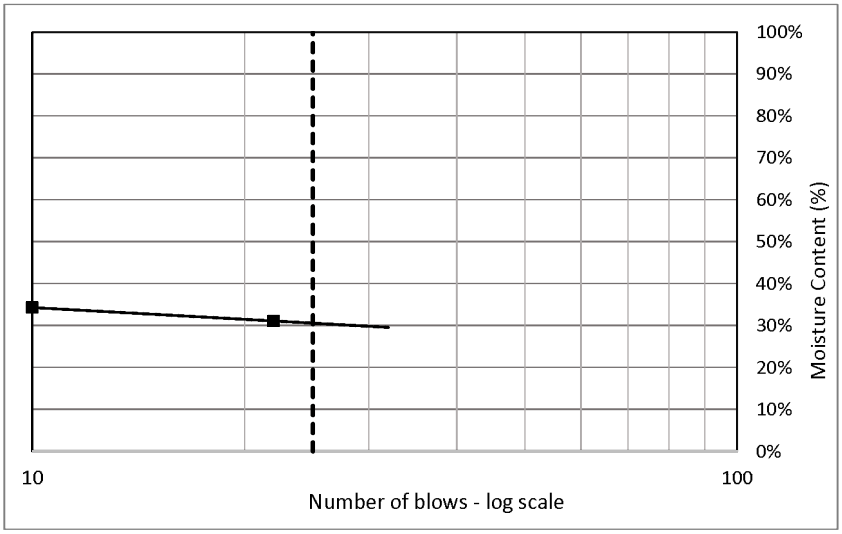
ATTERBERG LIMITS REPORT
ASTM D4318

To AECOM

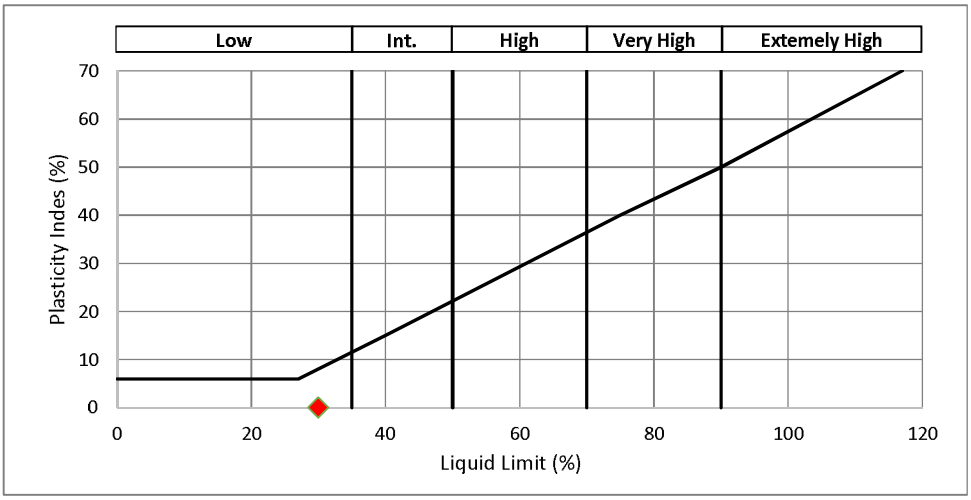
Attn

Project AMC 15-128
Septic in Banff

Date Sampled	29/Jun/15
Date Received	29/Jun/15
Date Tested	3/Jul/15
Sampled by	Filip Matyasek
Source	BH 04 (0.5m)
Material Type	Native Material



Liquid Limit	**30%**
Plastic Limit	**NO**
Plasticity Index	**N.A.**
Soil Classification	**OL**



Comments
Non plastic material

Tested by	Filip Matyasek
Reviewed by	Scott Robbins
Date	July 10 2015

Alberta Materials Testing
#112 - 2850 107th Avenue SE
Calgary, AB, T2Z 3R7

MOISTURE CONTENT REPORT
ASTM D2216

To AECOM

Attn.

Project AMC 15-128
Septic in Banff

Date Sampled 29/Jun/15
Date Received 29/Jun/15
Date Tested 29/Jun/15

Sampled by Filip Matyasek
Source BH 01,02,03,04,05
Material Type Native Material

Location	Depth (m)	Wt. Tin (g)	Wt. Tin + Wet Soil (g)	Wt. Tin + Dry Soil (g)	Wt. Water (g)	Wt. Dry Soil (g)	Moisture Content (%)
BH-01	0.4	28.1	96.3	92.6	3.7	64.5	**5.7%**
BH-01	1.2	28.2	103.0	100.1	2.9	71.9	**4.0%**
BH-01	1.8	28.3	116.5	114.5	2.0	86.2	**2.3%**
BH-01	2.6	28.4	104.3	101.7	2.6	73.3	**3.5%**
BH-02	0.3	28.2	90.7	86.5	4.2	58.3	**7.2%**
BH-02	0.7	28.2	99.5	96.0	3.5	67.8	**5.2%**
BH-02	1.2	28.4	115.9	114.2	1.7	85.8	**1.98%**
BH-02	2.2	28.3	83.5	78.9	4.6	50.6	**9.1%**
BH-03	0.2	28.6	67.4	65.2	2.2	36.6	**6.0%**
BH-03	0.4	28.3	81.5	77.6	3.9	49.3	**7.9%**
BH-03	0.7	28.3	108.4	102.2	6.2	73.9	**8.4%**
BH-03	1.1	28.3	96.9	91.4	5.5	63.1	**8.7%**
BH-03	2	28.4	99.5	93.9	5.6	65.5	**8.55%**
BH-03	2.5	28.3	96.1	91.8	4.3	63.5	**6.8%**
BH-04	0.5	28.4	68.0	59.2	8.8	30.8	**28.6%**
BH-04	1.5	28.3	80.0	76.6	3.4	48.3	**7.0%**
BH-04	1.8	28.4	87.1	84.7	2.4	56.3	**4.3%**
BH-04	2.2	28.4	115.5	111.3	4.2	82.9	**5.1%**
BH-05	0.5	28.3	72.7	64.0	8.7	35.7	**24.4%**
BH-05	0.8	28.3	84.4	82.1	2.3	53.8	**4.3%**
BH-05	2.5	28.5	90.2	87.9	2.3	59.4	**3.9%**

Comments

Tested by Filip Matyasek

Reviewed by Scott Robbins

Date July 8 2015

Alberta Private Sewage Treatment System Soil Profile Log Form

Owner Name or Job ID. AMC15-128 Two Jack Main

Legal Land Location								Test Pit GPS Coordinates	
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing
								51.230068	-115.513684

Vegetation notes: -Dense Coniferous Trees -Small shrubs / grass coverage

Overall site slope % Variable

Slope position of test pit: 1%

~~To the South~~ Ranges Through site To the South

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
~~PSTP~~ TP15-01	Sand	Gravel	Excellent	0.5	2.6

Hori-zon	Depth ~~(cm) (in)~~ m	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
1	0 to 0.1	fine	HT	black	No	No	Sg	0	Loose	Dry	0
2	0.1 to 0.3	fine	HT	brown	No	No	Sg	0	Loose	Dry	10%
3	0.3 to 2.6	C-VC [illegible]	Lab	grey	No	No	Gr	0	Loose-compact	damp	98%
4	2.6 to 2.8	C-VC	Lab	grey	No	No	Gr	0	Loose-compact	damp	98%

Depth to Groundwater	N/A	Restricting Soil Layer Characteristic	N/A
Depth to Seasonally Saturated Soil	N/A	Depth to restrictive Soil Layer	N/A
Site Topography	1467.6m	Depth to Highly Permeable Layer Limiting Design	0.3m
Key Soil Characteristics applied to system design effluent loading	Very Granular, high flow expected.		

Weather Condition notes: Dry Spell

Comments: such as root depth and abundance or other pertinent observations:

Root Depth 0.3m

Alberta Private Sewage Treatment System Soil Profile Log Form

Owner Name or Job ID. AMC 15-128 Two Jack Main

Legal Land Location								Test Pit GPS Coordinates	
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing
								51.233743	-115.505120

Vegetation notes: - Dense Coniferous Trees - Small shrubs / grass coverage

Overall site slope %: Variable throughout site

Slope position of test pit: 1% To South

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
TP 15-02	Gravel	Sand	Excellent	0.3m	1.2m

Hori-zon	Depth ~~(cm)~~ ~~(in)~~ m	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
1	0 to 0.1	Fine	HT	black	No	No	Sg	0	Loose	Dry	0
2	0.1 to 0.4	Fine	Lab	brown	No	No	Sg	0	Loose	Dry	15%
3	0.4 to 1.2	Very ~~Medium~~ Coarse	Lab	brown	No	No	Gr	0	Loose	damp	95%
4	1.2 to 1.9	Coarse	Lab	grey	No	No	Gr	0	Loose	moist	100%
5	1.9 to 2.8	medium	Lab	grey	No	No	Gr	0	Loose	moist	92 ~~100~~%

Depth to Groundwater	N/A	Restricting Soil Layer Characteristic	N/A
Depth to Seasonally Saturated Soil	N/A	Depth to restrictive Soil Layer	N/A
Site Topography	1486.5m	Depth to Highly Permeable Layer Limiting Design	0.4m
Key Soil Characteristics applied to system design effluent loading	Granular Material, high flow expected.		

Weather Condition notes: Dry Spell

Comments: such as root depth and abundance or other pertinent observations:

Root Depth @ 1.2m

Alberta Private Sewage Treatment System Soil Profile Log Form

Owner Name or Job ID. AMC15-128 Two Jack Main

Legal Land Location								Test Pit GPS Coordinates	
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing
								51.230236	-115.502807

Vegetation notes: - dense coniferous trees - small shrubs & grass

Overall site slope %: Variable Throughout Site

Slope position of test pit: 1:1 to west

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
TP15-03	Silt	Sand	Poor	0.4m	1.1m

Hori-zon	Depth ~~(cm)~~ ~~(in)~~ m	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
1	0 to 0.1m	Fine	HT	Black	No	No	Sg	0	Loose	Dry	0
2	0.1 to 0.3	fine	HT	brown	No	No	Sg	0	loose	Dry	0
3	0.3 to 0.5	~~Fine~~	Lab	grey/ brown	No	No	Sg	1	Compact	dry	150
4	0.5 to 2.8	fine	Lab	grey	No	No	bk	3	Very Stiff	moist	50

Depth to Groundwater	N/A	Restricting Soil Layer Characteristic	0.3-0.5m
Depth to Seasonally Saturated Soil	N/A	Depth to restrictive Soil Layer	0.3-0.5m
Site Topography	1481.6m	Depth to Highly Permeable Layer Limiting Design	N/A
Key Soil Characteristics applied to system design effluent loading	0.3-0.5 soil becomes very stiff, appears impermeable		

Weather Condition notes: Very Dry

Comments: such as root depth and abundance or other pertinent observations:

roots to 0.3m

Alberta Private Sewage Treatment System Soil Profile Log Form

Owner Name or Job ID. AMC15-128 Cascades Day Use

Legal Land Location								Test Pit GPS Coordinates	
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing
								51.213075	-115.533815

Vegetation notes:	- Dense coniferous Trees - small shrubs & grass	Overall site slope %	gently down to Lake (east)
		Slope position of test pit:	0

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
TP15-04	Gravel	Sand	Excellent	0.5m	1.5m

Horizon	Depth ~~(cm) (in)~~ m	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
1	0 to 0.2	fine	HT	black	No	No	Sg	0	Loose	Dry	0
2	0.2 to 0.7	fine	Lab	grey/brown	No	No	Sg	0	Loose	Dry	14
3	0.7 to 1.8	Very Coarse	Lab	grey	No	No	~~Sg~~ gr	0	dense	Dry	98
4	1.8 to 2.8	Very Coarse	HT	grey	No	No	~~Sg~~ gr	0	dense	~~D~~ moist	98

Depth to Groundwater	N/A	Restricting Soil Layer Characteristic	N/A
Depth to Seasonally Saturated Soil	N/A	Depth to restrictive Soil Layer	N/A
Site Topography	1401	Depth to Highly Permeable Layer Limiting Design	0.7 m
Key Soil Characteristics applied to system design effluent loading	Excellent Drainage at 0.7 m		

Weather Condition notes: Very Dry

Comments: such as root depth and abundance or other pertinent observations:

0.3m to roots

Alberta Private Sewage Treatment System Soil Profile Log Form

Owner Name or Job ID. AMC15-128 Cascades Day Use

Legal Land Location								Test Pit GPS Coordinates	
LSD-1/4	Sec	Twp	Rg	Mer	Lot	Block	Plan	Easting	Northing
								51.212863	-115.534043

Vegetation notes: - Dense coniferous trees
- Small shrubs + grass

Overall site slope %: gently down to lake (east)

Slope position of test pit: O

Test hole No.	Soil Subgroup	Parent Material	Drainage	Depth of Lab sample #1	Depth of Lab sample #2
TP15-05	Gravel	Sand	Excellent	0.5m	1.5m

Hori-zon	Depth (cm) ~~(in)~~ m	Texture	Lab or HT	Colour	Gleying	Mottling	Structure	Grade	Consistence	Moisture	% Coarse Fragments
1	0 to 0.2m	Fine	HT	black	No	No	Sg	O	Loose	dry	O
2	0.2 to 0.7m	Fine	Lab	grey/ brown	No	No	Sg	O	Loose	dry	14
3	0.7m to 2.8m	Very Course	Lab	grey	No	No	gr	O	dense	dry	98
4											

Depth to Groundwater	N/A	Restricting Soil Layer Characteristic	N/A
Depth to Seasonally Saturated Soil	N/A	Depth to restrictive Soil Layer	N/A
Site Topography	1401	Depth to Highly Permeable Layer Limiting Design	0.7m
Key Soil Characteristics applied to system design effluent loading	Excellent drainage @ 0.7m		

Weather Condition notes: Very Dry

Comments: such as root depth and abundance or other pertinent observations:

0.3m to roots

APPENDIX B

East Gate Geotechnical Evaluation

ASSESSMENT OF SITE SUITABILITY FOR PSDS
EAST GATE
BANFF NATIONAL PARK, ALBERTA

Submitted to:

PARKS CANADA
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Banff, Alberta
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Prepared by:

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Date: March 2011
File: 910-0465-067

ASSESSMENT OF SITE SUITABILITY FOR PSDS
EAST GATE
BANFF NATIONAL PARK, ALBERTA

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1.0 INTRODUCTION

The following report presents results of An Assessment of Site Suitability for installation of a private sewage treatment system. The area under consideration was East Gate Housing and East site location in Banff National Park, Alberta.

Written authorization to proceed with the assessment of the site was received on October 12, 2010, from Rose Marino on behalf of Parks Canada. Field work was carried out on December 2, 2010.

2.0 BACKGROUND

The area of interest was the East Gate Housing and Gate Houses. The development is located at the East Gate of Banff National Park, Alberta.

The area was developed at the time of investigation and consisted of a single residence, four (4) gate houses and two (2) out buildings. The area is located in a mountain valley, with the area of interest covered with trees and shrubs.

3.0 METHODS OF INVESTIGATION

Two (2) test pits were excavated to determine the subsurface soil profile. The test pits were excavated in an area where a septic field will be installed. This area was decided upon based on location of property lines, residential building, and slopes on the lot.

The test pits were excavated to a maximum depth of 3.05 metres (10.0 feet). Samples of the soils encountered in the test pits were bagged and returned to Curtis Engineering laboratory for soil texture determination. Field identifications, using the Canadian System of Soil Classification, was used to determine and describe the soil profile found in each test pit.

4.0 LOT DESCRIPTIONS AND RECOMMENDATIONS

The following describes the area of interest and makes recommendations for the area based on individual site conditions and soil texture observed in the field and soil texture analysis performed at our laboratory.

4.1 AREA OF INTEREST AT EAST GATE

The area of interest for the septic field is located north of the existing field and east of the existing residence. The field will be located north of the Transcanada Highway and the four gate houses located there. At the time of the investigation, the site was covered with trees and shrubs.

The soil profile found in the test pits excavated consists of loam over silt loam and loamy sand in Test Pit 1 (TP-1) and silt loam over loam, silty clay loam and sandy loam in Test Pit 2 (TP-2). The soil structure was strongly blocky. The soil profiles show the area of interest is suitable for standard septic tank and field systems.

Lot 1 Test Pit Details

Test Pit No.	Depth (cm)	Texture	% Clay	%Silt	% Sand
1	45	Silty Loam	10	59	31
1	100	Loamy Sand	5	10	85
2	30	Silt Loam	5	66	29
2	50	Loam	20	48	32
2	120	Silty Clay Loam	35	53	12
2	150	Sandy Loam	10	25	65

5.0 RECOMMENDATIONS

5.1 GENERAL

The design of the field is based upon the residence house having four (4) bedrooms without a soaker tub or garburator, plus four (4) gate houses. It these details change, Curtis Engineering should be notified to adjust the sizing of the treatment mound.

5.2 TREATMENT FIELD

A standard treatment field is recommended for the lot. The maximum depth of the field laterals is 900 mm. The typical sewage volume and size of the proposed system is tabulated below. The typical sewage volume was calculated assuming six (6) people in the residence and an average of three (3) people in the gate houses per day leading to nine (9) persons.

SYSTEM INFORMATION FOR LOTS 1 AND 2 WITH FIELDS EAST GATE BANFF NATIONAL PARK, ALBERTA			
Lot	**Typical Daily Sewage Volume**	**Soil Texture and Loading Rate**	**Area Occupied by System**
1&2	3060 L/day (675 Gal/day)	Silty clay Loam (13.2 L/day/m^2)	231.8 SQ metres

The required setback distances for treatment field are as follows:

- 3m to property lines, septic tanks or buildings without basement, cellar or crawl space.
- 15m from a water course/source.
- 9m from a basement, cellar or crawl space.

6.0 GENERAL RECOMMENDATIONS

Standard treatment fields are the recommended solution for the site to deal with the septic effluent. The fields should be built long and narrow, as this allows for the water to move along from the field infiltration area quickly, decreasing the possibility of groundwater mounding, increasing the life of the system and permitting the system to blend into the landscape better.

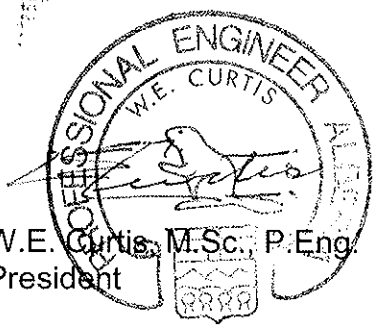
The area noted on the drawing of the lot showing the proposed septic field should be staked out and protected from traffic and development to preserve soils structure.

7.0 CONCLUSIONS

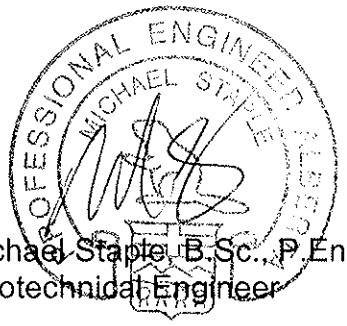
The overall suitability of the lot for standard septic tank and treatment fields is good. For this lot, standard treatment fields are recommended for on-site treatment of effluent.

Respectfully Submitted,

CURTIS ENGINEERING ASSOCIATES LTD.



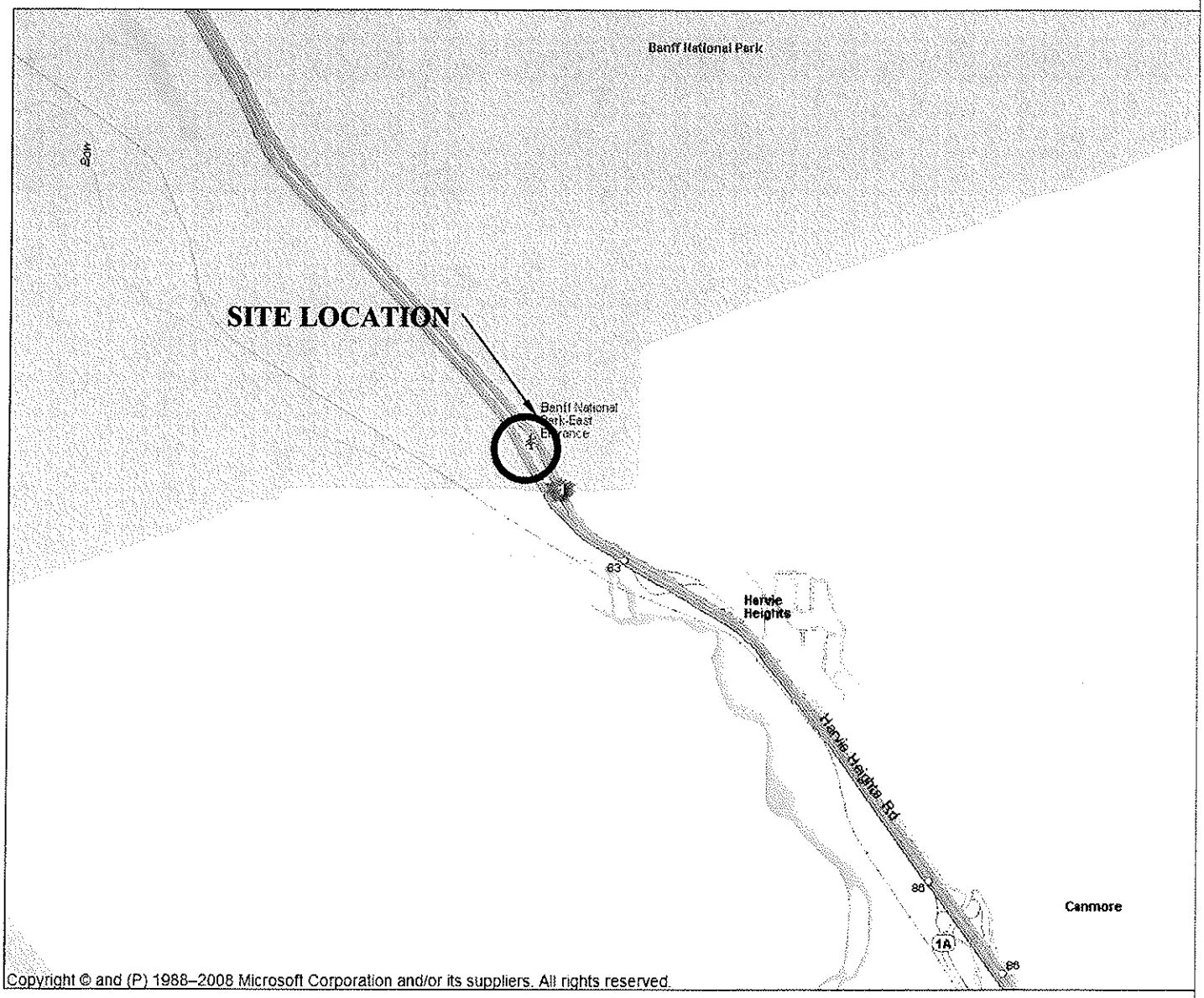
W.E. Curtis, M.Sc., P.Eng.
President



Michael Staple, B.Sc., P.Eng.
Geotechnical Engineer

MJS/cpd

PERMIT TO PRACTICE
CURTIS ENGINEERING ASSOCIATES (96) LTD.
Signature
Date April 4/2011
PERMIT NUMBER: P 6284
The Association of Professional Engineers, Geologists and Geophysicists of Alberta



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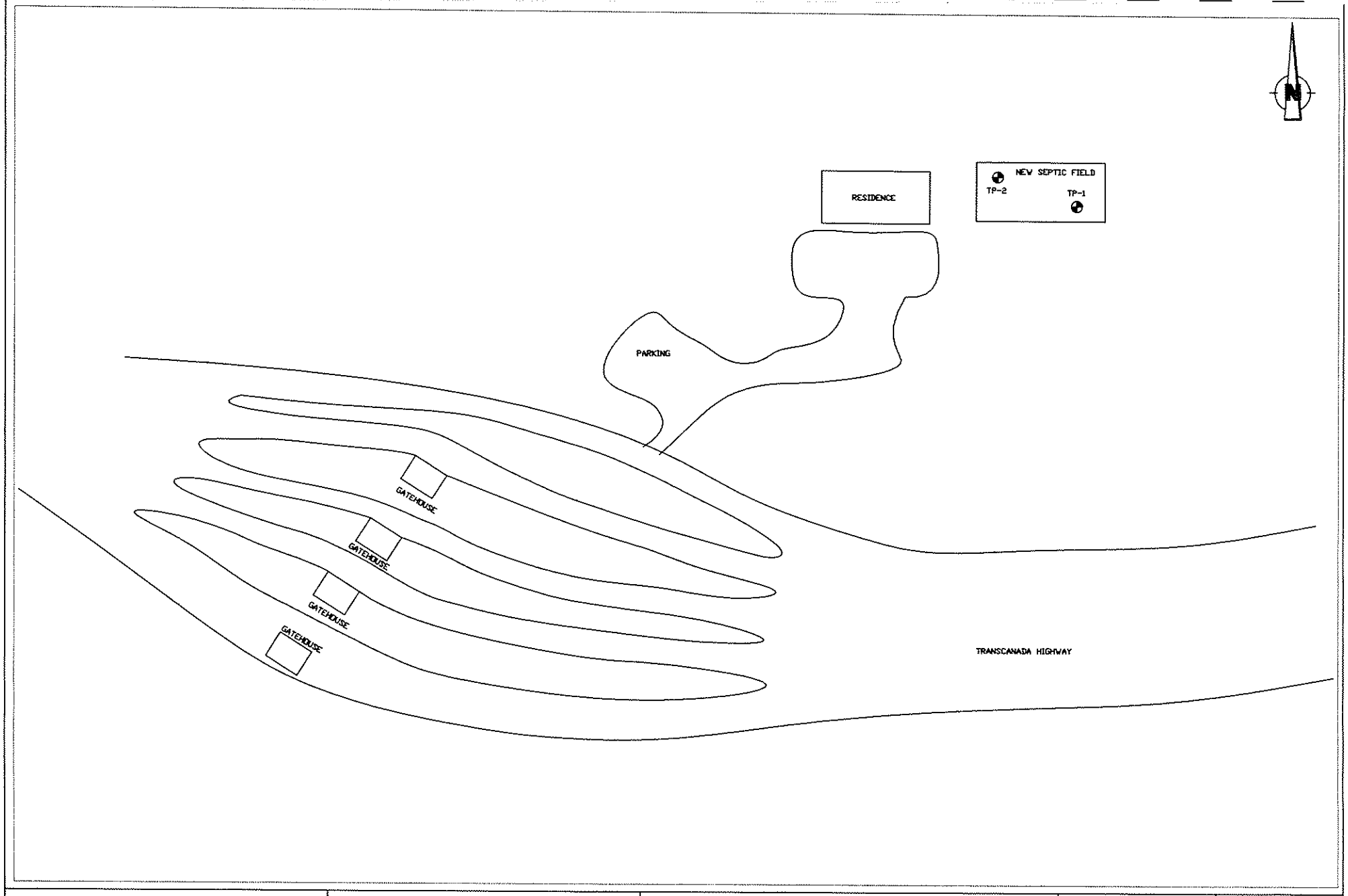
SITE LOCATION PLAN
PROPOSED SEPTIC FIELD
EAST GATE
BANFF NATIONAL PARK, ALBERTA

DRAWN BY: MJS	DATE: MAR 27,11
CHK'D BY: WEC	DRAWING NO.: I-1
SCALE: NTS	
FILE NO.: 910-465-067	



LEGEND

TEST PIT

CURTIS ENGINEERING ASSOCIATES LTD.

SITE PLAN
PROPOSED SEPTIC FIELD
EAST GATE
BANFF NATIONAL PARK, ALBERTA

DRAWN BY MJS	DATE MAR 27,11
CHK'D BY WEC	DRAWING NO. I-2
SCALE NTS	
FILE NO. 910-465-067	

Owner Name or Job ID:	Parks Canada Agency (File No. 910-0465-067)								
Legal Land Location					Plan	Block	Lot	GPS Coordinates	
LSD - 1/4	SEC	TWP	RG	MER				EASTING	NORTHING

Aerial Photos:	No	Topography:	Flat
General Vegetation:	Trees and Shrubs	Overall Site Slope %	3%
		Slope Position of System:	MID

Test Hole No.	Soil Subgroup	Parent Material	Drainage Class	Depth of Sample #1	Depth of Sample #2
TP-1		Sand	Good	45	100

Horizon	Depth (cm)	Texture	Colour	Greyed	Mottled	Structure	Consistence	Moisture	%CF
Am	0-17	Laom	Black	No	No	Single		15-20	<10%
CK	17-48	Silt Loam	Brown	No	No	Mild Blocks		15-20	<10%
IICk	48-305	Loamy Sand	Brown	No	No	Single		15-20	<10%

Depth to Groundwater		Limiting Soil Layer Characteristic, Describe	
Depth to Seasonally Saturated Soil		Depth to Limiting Soil Layer	

Key Limiting System Design Characteristic	

Comments:

Owner Name or Job ID:	Parks Canada Agency (File No. 910-0465-067)

Legal Land Location					Plan	Block	Lot	GPS Coordinates	
LSD - 1/4	SEC	TWP	RG	MER				EASTING	NORTHING

Aerial Photos:	No
General Vegetation:	Trees and Shrubs

Topography:	Flat
Overall Site Slope %	2%
Slope Position of System:	MID

Test Hole No.	Soil Subgroup	Parent Material	Drainage Class	Depth of Sample #1	Depth of Sample #2
TP-2		Sand	Good	40	120

Horizon	Depth (cm)	Texture	Colour	Greyed	Mottled	Structure	Consistence	Moisture	%CF
An	0-15	Loam	Black	No	No	Single		15-20%	<10%
Ak	15-45	Silt Loam	Brown	No	No	Blocks		15-20%	<10%
Bk	45-105	Loam	Brown	No	No	Blocks		15-20%	<10%
Ck	105-145	Silty Clay Loam	Brown	No	No	Blocks		15-20%	<10%
IICk	145-305	Sandy Loam	Brown	No	No	Single		15-20%	<10%

Depth to Groundwater	N/A
Depth to Seasonally Saturated Soil	N/A

Limiting Soil Layer Characteristic, Describe	N/A
Depth to Limiting Soil Layer	N/A

Key Limiting System Design Characteristic	

Comments:

APPENDIX C

Soil Classification Guide (Alberta Sewage Systems Standard of Practice 2009)

Maintenance of Wastewater Treatment Plants

A packaged sewage treatment plant requires maintenance. As a certification requirement of the NSF 40 Standard, a 2-year initial service policy shall be furnished to the owner by the manufacturer or the authorized representative and the cost of the initial service policy shall be included in the original purchase price. The initial policy shall contain provisions for four inspection/service visits (scheduled once every 6 months over the 2-year period) during which electrical, mechanical, and other applicable components are inspected, adjusted, and serviced. The plant needs to be maintained at intervals of not more than 6 months following the initial two year period as well.

Soils Evaluation

Critical Design Information

The evaluation of the soils used for an onsite sewage treatment system to determine the soil characteristics that impact design is the most important design criteria along with determining wastewater flow volume and strength. Without this information the design of a successful system cannot be completed.

The following information is not intended to provide the reader with sufficient knowledge to undertake a soils investigation for the design of an onsite sewage treatment system. It points out the main soil characteristics related to onsite sewage system design. There are many other characteristics a trained person needs to be aware of and able to identify when looking at a soil profile in the field. Most of the characteristics needed for design must be determined in the field by observation of the soil profile. These characteristics cannot be determined by sending a sample of the soil to a laboratory. The investigation of the soil profile needs to be done by a trained individual to obtain accurate results.

This Standard requires the use of the Canadian System of Soil Classification be applied in the assessment of soil suitability and the design basis of private sewage systems. Using the Canadian System of Soil Classification is superior to a geotechnical evaluation based on the Unified Soil Classification System for determining the suitability of soil for an onsite sewage system and for the successful design of an onsite sewage system. An evaluation based on geotechnical procedures and terminology is not acceptable for design.

Percolation tests are not accepted as design criteria. Such testing of the ability of the soil to accept and move water characterizes only a small amount of soil in the immediate area of the test. It will not identify other characteristics that are outside its small area of influence that may very well cause a system failure. Also, sources of error in the field permeability test are well documented in literature. Erroneously high values can be caused by the existence of macropores or small scale soil characteristics that allow water movement.

Two soil test pits must be excavated in the area proposed for the septic system to describe the soil profile that affects the design choices for the system. The depth of the soil investigation must be adequate to show the required vertical separation for a particular type of system is available. It also must be to a sufficient depth to show that liner loading limitations are not a concern. For systems over 5.7 cubic metes per day the investigation must go tot depth needed to provide the information needed to model ground water mounding potential. A proper characterization of the soil profile in each test pit, including a determination of the texture, structure, consistence, and the presence of redoximorphic features for each horizon is essential for determining the suitability of the site and design criteria applied to the system. See Section 7.1 which sets out site evaluation requirements.

Key characteristics of the soil that affect the long term success of systems include soil texture and structure which significantly affects water movement in the soil; saturated or seasonally saturated soil conditions indicated by redoximorphic conditions, and depth to any restricting layers of soil that will severely limit the downward movement of water.

Soil texture is determined by the mix of sand silt and clay in the soil (particle size distribution). Soils with a high percentage of clay restrict the movement of effluent through the soil. Sandy soil allows the effluent to move through the soil quickly. Characterization of the soil texture must include characterization of the particle size of sand when the general soil texture is sandy loam, loamy sand or sand. Fine or very fine sands in these soil textures will result in significantly lower long term effluent loading rates compared to medium or coarse sands or sandy loams. The medium and coarse sands, loamy sands and sandy loams have reduced treatment capacity as these textures allow the effluent to rapidly travel through the soil profile.

Soil Structure is the formation of soil into consolidated peds ("clumps") and cracks form between the structured peds. These cracks provide a route for the applied effluent to move into and through the soil. Generally a lack of structure (no structure or weak structure) will impede water movement through the soil; however some types of structure will impede the movement of water through the soil (platey structure which is characterized as having a long horizontal width that blocks downward movement of effluent.

Saturated soil are identified by redoximorphic features in the soil. These characteristics are recognized in agricultural soil sciences and are very valuable in predicting seasonal high water tables. This is much more effective than a single point in time measurement of the water table often applied in a geotechnical evaluation. A single groundwater depth measure does not reflect seasonal variation in water tables and is not acceptable as an effective indicator of the near surface water table. However, redoximorphic features are sometimes difficult to detect in sandy soils. In these situations wells to determine the near surface water table can provide additional valuable information if readings are taken at different times of the year and at times of expected high groundwater.

Restrictive layers are either saturated soils or soils that have significant clay content and little structure. If the soil characteristics do not allow a loading rate for secondary treated effluent as set out in Table 8.1.1.10, they should be considered a restricting layer. The depth from the infiltration surface to the limiting layer is a critical design consideration.

Soil Texture

Soil texture affects the movement of water in the soil and wastewater treatment capacity of the soil.

The soil texture classification is one of the factors used in determining the allowed effluent loading rate in litres per square metre (gallons per square foot) on the in situ soil. The soil texture is a classification determined by the relative amounts of sand, silt and clay in a soil (the mineral portions of the soil). How coarse (sandy) or fine (clayey) the soil is, affects the ability of the soil to transmit air and water as well as treating the effluent.

The mineral portion of the soil is divided into three size fractions: Sand (S) with particle sizes between 2.00 and 0.05 mm, Silt (Si) with particle sizes between 0.05 and 0.002 mm, and Clay (C) with particle sizes less than 0.002 mm. Mineral fragments (gravel) with a mean diameter larger than 2 mm are excluded from the texture classification. These large particles are classed as coarse fragments. A large percentage of course fragments in sandy soil require a reduction in the effluent loading rate. See Article 8.1.2.4.

Soil texture refers to the relative percentage of sand, silt, and clay in a soil, i.e., particle size distribution. The texture of a soil is expressed as a class name formed by combining the terms of sand, silt, clay and loam. For example, if the clay fraction dominates the properties of the soil, the soil class name would simply be "clay." However, if this soil contains enough sand to appreciably modify the properties imparted by the clay, then the class name would be "sandy clay." When the percentage of sand and clay are known, the class name can be determined from the textural triangle shown following Table 8.1.1.10. Methods use in the Laboratory can provide an accurate classification of the soil texture as well as determine the percentages of Sand sizes in the soil sample when needed. Article 7.1.1.2.(3)(c) requires a sample of the most limiting layer (the layer the soil evaluator thinks is most important to the design) be submitted to an accredited lab for analysis. The lab uses both hydrometer methods and sieve particle sizing where required to determine the sand fraction sizes. The test procedures the lab uses must follow the Canadian System of Soil Sciences recognized practices.

Particle or Grain Size Analysis Test

A Particle or Grain Size analysis test is a laboratory procedure performed on a soil sample to establish the amounts of sand, silt and clay in the sample. The procedures may include sieving, pipette sampling or hydrometer methods. Once the amounts of sand, silt and clay have been established, a soil texture can be determined.

Hand Texturing of Soil

Hand texturing is used in the field to make estimates of soil texture and is based on the "feel" of a moist soil sample.

To **hand texture**, use the steps below or those in the following graphic illustration.

1. Place about a teaspoon of soil in the palm of your hand and moisten the soil by slowly adding water. Knead the soil and add water until it has the consistency of moist putty (not soup).
2. To estimate the textural class, use the following guidelines:
    (a) pure clay will feel very slippery and very sticky
    (b) pure silt will feel smooth and slippery but not sticky
    (c) pure sand will feel very gritty.

    The soil is most often made up of various amounts of each soil particle size so the combined feel of the above is considered to estimate the soil texture as described in the soil texture triangle.

3. Press and rub the moistened soil between your thumb and forefinger to estimate the gritty and slippery feel, then pull the two fingers apart to estimate stickiness.

This is an example procedure for hand texturing of a soil sample. Be advised that this is presented as an additional example of a qualitative field technique and that accuracy improves with experience (often many years are required). By obtaining a number of known soil texture samples you can practice with these to help you calibrate your fingers to do the manual texturing of soils.

Figure: Hand Texturing of Soil

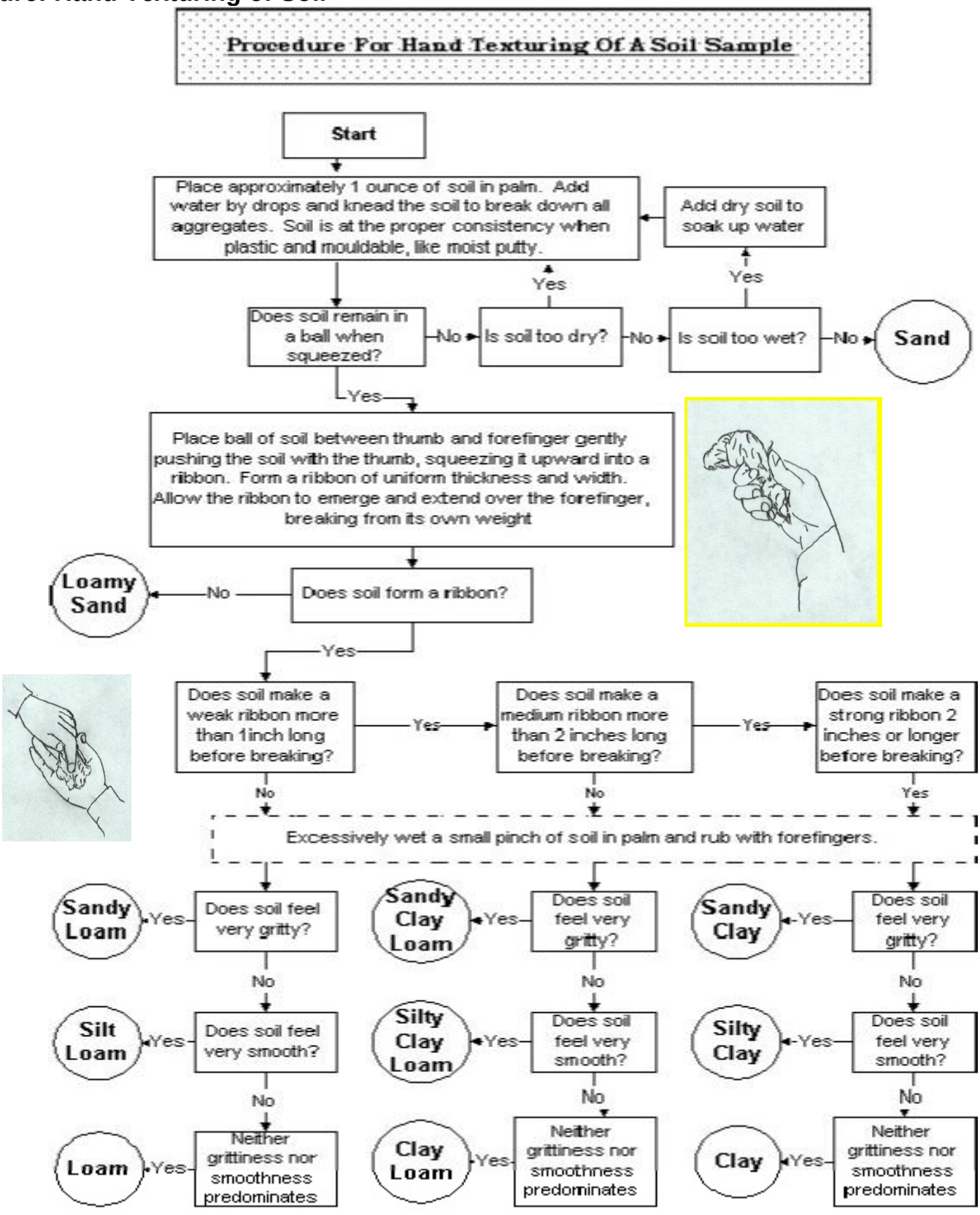
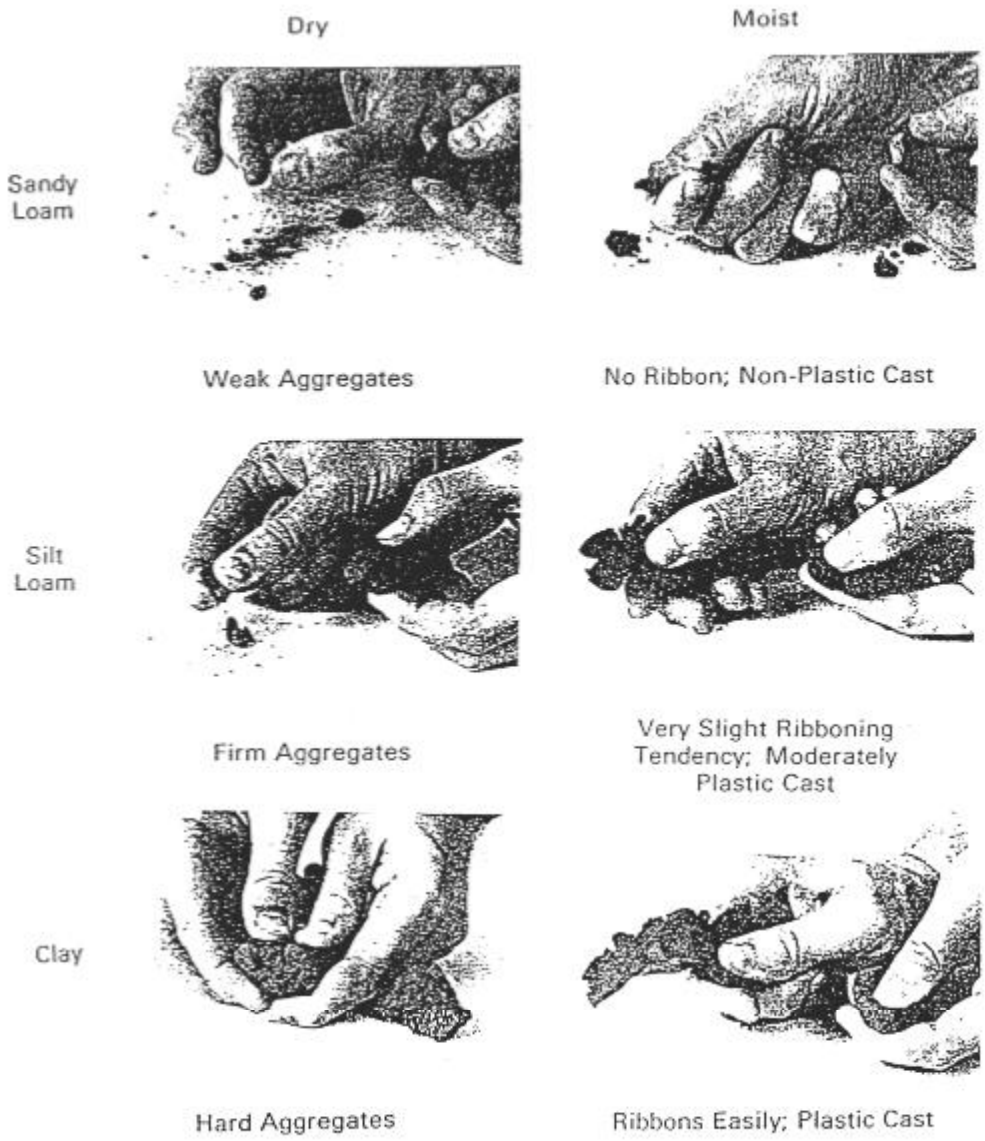


Table: Textural Properties of Dry and Wet Mineral Soils

Soil Class	Feeling and Appearance	
	Dry Soil	Moist Soil
Sand	Loose, single grains which feel gritty. Squeezed in the hand, the soil mass falls apart when the pressure is released.	Squeezed in the hand, it forms a cast which crumbles when touched. Does not form a ribbon between thumb and forefinger.
Sandy Loam	Aggregates easily crushed; very faint velvety feeling initially but with continued rubbing the gritty feeling of sand soon dominates.	Forms a cast which bears careful handling without breaking. Does not form a ribbon between thumb and forefinger.
Loam	Aggregates are crushed under moderate pressure; clods can be quite firm. When pulverized, loam has velvety feel that becomes gritty with continued rubbing. Casts bear careful handling	Cast can be handled quite freely without breaking. Very slight tendency to ribbon between thumb and forefinger. Rubbed surface is rough.
Silt Loam	Aggregates are firm but may be crushed under moderate pressure. Clods are firm to hard. Smooth, flour-like feel dominates when soil is pulverized.	Cast can be freely handled without breaking. Slight tendency to ribbon between thumb and forefinger. Rubbed surface has a broken or rippled appearance.
Clay Loam	Very firm aggregates and hard clods that strongly resist crushing by hand. When pulverized, the soil takes on a somewhat gritty feeling due to the harshness of the very small aggregates which persist.	Cast can bear much handling without breaking. Pinched between the thumb and forefinger, it forms a ribbon whose surface tends to feel slightly gritty when dampened and rubbed. Soil is plastic, sticky and puddles easily.
Clay	Aggregates are hard; clods are extremely hard and strongly resist crushing by hand. When pulverized, it has a grit-like texture due to the harshness of numerous very small aggregates which persist.	Casts can bear considerable handling without breaking. Forms a flexible ribbon between thumb and forefinger and retains its plasticity when elongated. Rubbed surface has a very smooth, satin feeling. Sticky when wet and easily puddled.

Figure : Dry and Wet Feel of Various Soil Textures



Soil structure is observed in the field as the face of a soil test pit is examined. Soil Structure cannot be determined in a sample sent to a laboratory. As defined in the CanSIS glossary, soil structure is:

"The combination or arrangement of primary soil particles into secondary particles, units, or peds. These peds may be, but usually are not, arranged in the profile in such a manner as to give a distinctive characteristic pattern. The peds are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades."

Soil Structure

The grade of the structure is defined in the CanSIS glossary as:
"A grouping or classification of soil structure on the basis of inter- and intra- aggregate adhesion, cohesion, or stability within the profile. Three grades of structure designated from 1 to 3 are:

1. *weak poorly formed, indistinct peds barely evident in place.*
2. *moderate well-formed distinct peds, moderately durable and evident, but not distinct, in undisturbed soil.*
3. *strong durable peds that are quite evident in undisturbed soil, adhere weakly to one another, withstand displacement, and become separated when the soil is disturbed."*

Source: http://sis2.agr.gc.ca/cansis/glossary/s/index.html Accessed Jan 10, 2011.

The shape of the structure and grade of the structure are key characteristics, along with the soil texture, applied in determining appropriate effluent loading rates on the soil. The shape and grade of the soil structure are identified in the second and third column of table 8.1.1.10 and table A.1.E.1 which is used to determine the appropriate effluent loading rates. Without the information gained by a soil characterization that includes the soil structure, an effluent loading rate cannot be selected from the table or reasonably justified.

The photo on the following page provides a clear look at soil structure. In the center of the picture the soil structure is columnar. This columnar structure is very well defined and easy to see. It also can be pulled from the soil column and holds together well in that shape when removed. Those two characteristics indicate it is a "Grade 3" (strong) columnar structure. At the top of the photo the structure is blocky. This structure is not so easily seen but is still well defined when pulled form the soil profile. It would be a "Grade 2" (moderate) blocky structure.

The columnar structure is indicative of a solenetz soil that is impacted by sodium. It is not well suited to soil based treatment systems as the top of the columnar structure creates a restrictive layer that will stop the downward movement of effluent. This is due to the columnar structure swelling as it is wetted and closing all macros pores between the shapes of the structure.

The graphic on the following page shows the various soil structure shapes found in soil and assists in correct identification of soil structure. The graphics on this page showing a circle with dots within the circles and titles "Percent Areas" assists with estimating the amount of coarse fragment (gravel) in the soil.

Figure: Soil Structure Photo

Columnar soils structure at center of photo, blocky structure at top of photo. This soil is a solenetz soil that is not well suited to onsite sewage systems. A restrictive layer is created at the top of the columnar structure due to swelling of the soil once it is wetted. Ground surface is approximately 100 mm (4 inches) above the top of this photo. The top of the columnar structure is approximately 450 mm (18 inches) below ground surface.

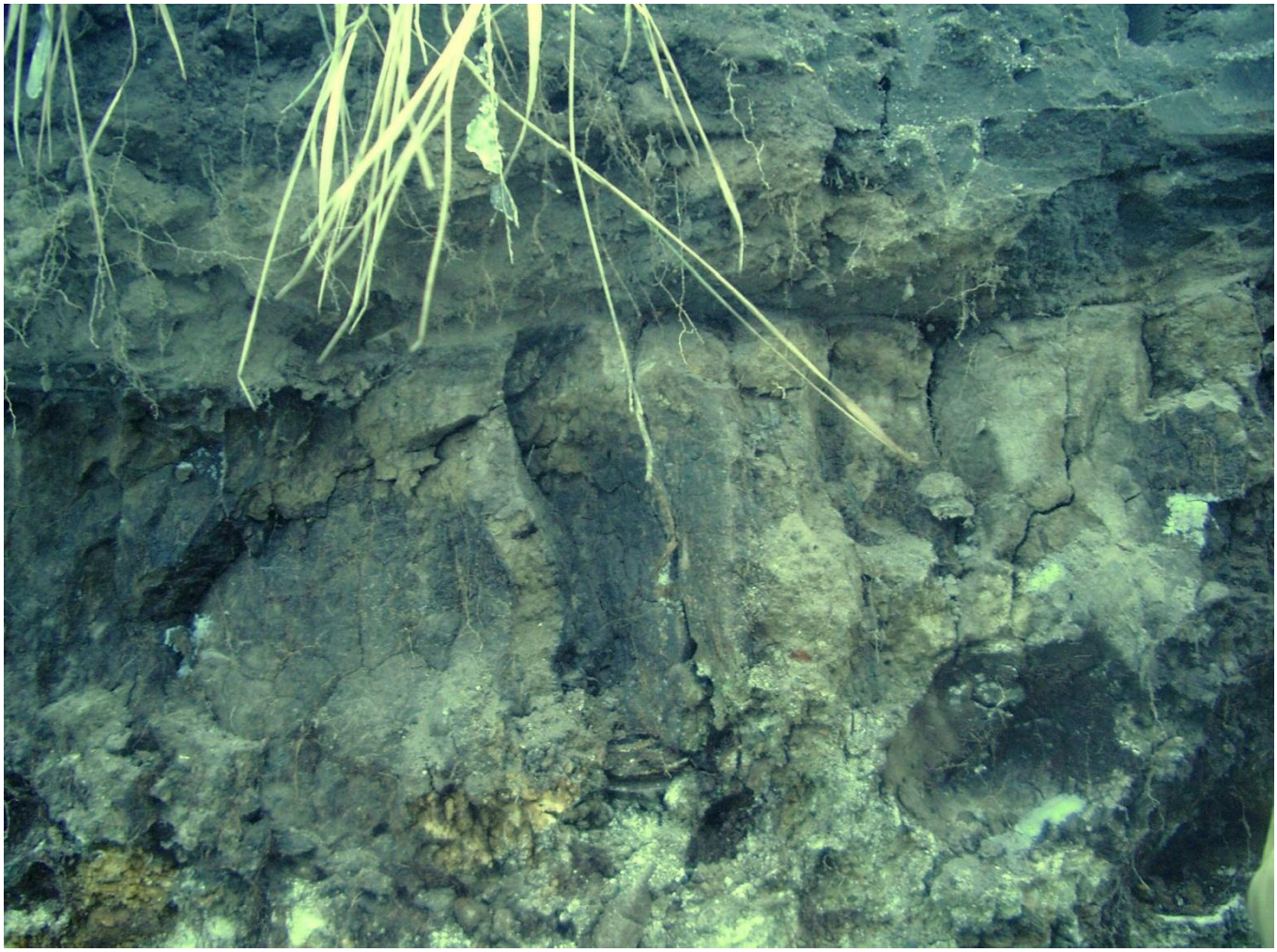
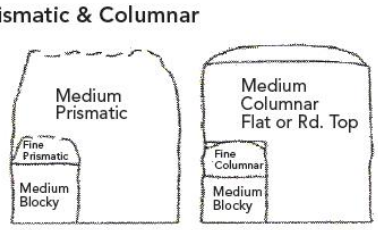
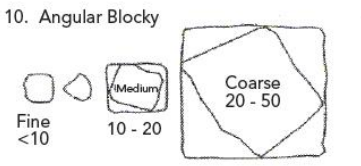


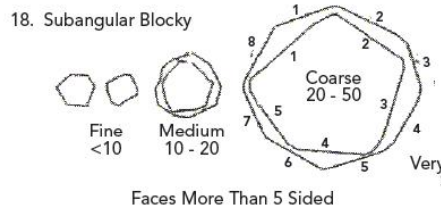
Figure : Soil Structure Shapes and Estimating Coarse Fragment Percentage

Structure

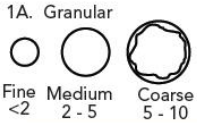
Grade	Class	Kind
w Week	vf Very fine	sg Single grained
wm Weak to moderate	f Fine	ma Massive
m Moderate	m Medium	bk Angular blocky
ms Moderate to strong	c Coarse	sbk Subangular block
s Strong	vc Very coarse	gr Granular
		pr Prismatic
		col Columnar





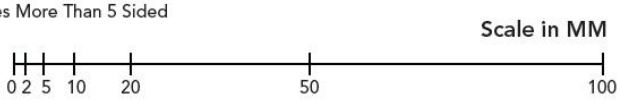


Fine < 20
Medium 20 - 50
Coarse 50 - 100
Very Coarse >100



Faces More Than 5 Sided

Fine <2
Medium 2 - 5
Coarse >5



Slope Classes of Local Landings

Class	Slope	Aprx°	Description
1	0 - 0.5	0	level
2	0.5 - 2.5	0.3 - 1.5	nearly level
3	2 - 5	1 - 3	very gentle slopes
4	6 - 9	3.5 - 5	gentle slopes
5	10 - 15	6 - 8.5	moderate slopes
6	16 - 30	9 - 17	strong slopes
7	31 - 45	17 - 24	very strong slopes
8	46 - 70	25 - 35	extreme slopes
9	71 - 100	35 - 45	steep slopes
10	>100	>45	very steep slopes

Surface Stones

	Surface Area	Distance Apart (cm)
S0 non-stony	<0.01%	>30
S1 slightly stony	0.01-0.1%	10 - 30
S2 moderately stony	0.1- 3 %	2 - 10
S3 very stony	3 - 15%	1 - 2
S4 exceedingly stony	15 - 50%	0.1 - 5
S5 excessively stony	50%	0.1

Slope Position

c	cret
u	upper slope
m	mid-slope
l	lower slope
t	toe
d	depression
l	level

Drainage

VR	Very Rapidly
R	Rapidly
W	Well
M	Moderately Well
I	Imperfectly
P	Poory
VP	Very Poorly

Percent Areas