TSF Containment Dam

TSF Containment Dam Completely Encapsulated

PAG Placement and NAG Cover

NAG Cover

South Dyke

EL. 315m

C FIG 16

C FIG 16

N

N 7267500

N 7267000

N 7266500

E 434500

E 435000

E 435500

E 436000

295

300

305

310

315

320

330

3125

LEGEND

- Containment Dam
- PAG with NAG Cover
- NAG Cover

0m 50 100 150 200 250 300

1 : 7500

C:\MD\SNIC\CLIENTS\SRK\2014\BACK RIVER TAILINGS\DRAWINGS\FIGURES SEPT 2015\BR TMSD FIGURE 14_15.dwg

srk consulting

SRK JOB NO.: 1CS020.008

FILE NAME: BR-TMSD FIGURE 14_15.dwg

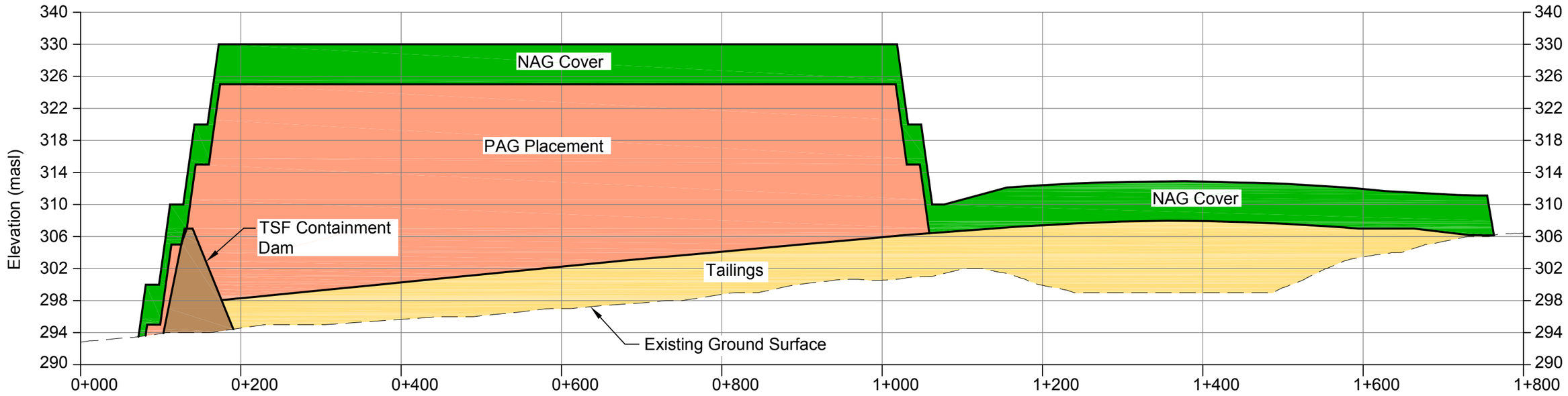
Sabina GOLD & SILVER CORP.

BACK RIVER PROJECT

Tailings Management System Design

TSF Conceptual Closure Plan

DATE:	APPROVED:	FIGURE:
SEPT. 2015	IM	14



CC
FIG 15

TMF CLOSURE SECTION

10x Exaggeration

LEGEND

- Containment Dam
- PAG Placement
- Tailings Surface
- NAG Cover

0m 50 100 150 200

1 : 5000 (Horizontal Scale)

srk consulting

SRK JOB NO.: 1CS020.008

FILE NAME: BR–TMSD FIGURE 14_15.dwg

Sabina GOLD & SILVER CORP.

BACK RIVER PROJECT

Tailings Management System Design

TSF Conceptual Closure Section C-C

DATE:	APPROVED:	FIGURE:
SEPT. 2015	IM	15

C:\MD\SINC\CLIENTS\SINK\2014\BACK RIVER TAILINGS\DRAWINGS\FIGURES SEPT 2015\BR-TMSD FIGURE 14_15.dwg

Appendices

Appendix A - 2010 National Building Code Seismic Hazard Calculation

2010 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Requested by: , SRK Consulting

October 14, 2014

Site Coordinates: 65.5284 North 106.3966 West

User File Reference: Back River - Goose TSF

National Building Code ground motions:
2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA (g)
0.095	0.057	0.026	0.008	0.036

Notes. Spectral and peak hazard values are determined for firm ground (NBCC 2010 soil class C - average shear wave velocity 360-750 m/s). Median (50th percentile) values are given in units of g. 5% damped spectral acceleration (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are tabulated. Only 2 significant figures are to be used. ***These values have been interpolated from a 10 km spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.2)	0.011	0.035	0.055
Sa(0.5)	0.007	0.022	0.034
Sa(1.0)	0.003	0.011	0.016
Sa(2.0)	0.001	0.003	0.005
PGA	0.003	0.011	0.019

References

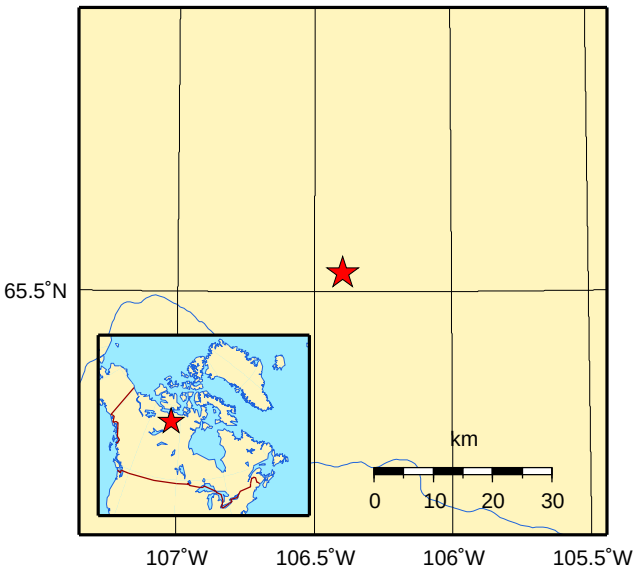
National Building Code of Canada 2010 NRCC no. 53301; sections 4.1.8, 9.20.1.2, 9.23.10.2, 9.31.6.2, and 6.2.1.3
Appendix C: Climatic Information for Building Design in Canada - table in Appendix C starting on page C-11 of Division B, volume 2

User's Guide - NBC 2010, Structural Commentaries NRCC no. 53543 (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File xxxx
Fourth generation seismic hazard maps of Canada: Maps and grid values to be used with the 2010 National Building Code of Canada (in preparation)

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



Appendix B - Back River Project - Tailings Physical Characteristics

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Memo

To:	Project File	**Client:**	Sabina Gold & Silver Corp.
From:	Sam Amiralaei, EIT Iozsef Miskolczi, PEng	**Project No:**	1CS020.008
Reviewed By:	Maritz Rykaart, PhD, PEng	**Date:**	September 27, 2015
Subject:	Back River Project - Tailings Physical Characteristics		

1 Introduction

As part of the larger Final Environmental Impact Study (FEIS) for the Back River Project (the Project) in Nunavut, SRK Consulting (Canada) Inc. was retained by Sabina Gold & Silver Corp. to complete the preliminary design of the Tailings Management System (TMS) for the Project.

Previous physical characterization testing was carried out as part of the prefeasibility study (PFS) (Knight Piésold 2013). This included index testing, slurry settling tests, air drying tests, and consolidation and permeability tests. The testing was carried out on two 100 micron (i.e. P_{80} passing 100 micron sieve) master composite tailings samples, which was considered representative of the PFS tailings process design. These two samples were representative of the overall blend of ore over the expected life of mine including ore from all of the George Property deposits, Umwelt open pit and underground, Llama open pit and Goose Main open pit.

Additional metallurgical testing completed as part of the feasibility study (FS) confirmed that the tailings will be ground to a smaller size, with P_{80} passing the 50 micron sieve (Sabina 2014). As a result, additional tailings physical characterization testing was carried out on two composite 50 micron samples. These samples however contained only Goose Main deposit ore. The results of both the 100 and 50 micron physical characterization testing is presented in this memo, and forms the design basis for tailings properties assumptions adopted in the TMS design.

2 Laboratory Test Program

2.1 100 Micron Samples

Knight Piésold (2013) presents the details of physical characterization testing carried out on two composite 100 micron tailings samples. Each of these samples weighed about 10 kg and was prepared by G&T Metallurgical in Kamloops, January 2013. The testing was carried out at the Knight Piésold laboratory in Denver, Colorado. Table 1 summarize the tests completed on these samples.

Table 1: Summary of Tests Completed on two Composite 100 Micron Tailings Samples (Knight Piésold 2013)

Test	Standard
Specific Gravity	ASTM D854
Atterberg Limits	ASTM D4318
Particle Size Distribution (Sieve and Hydrometer)	ASTM D422
Undrained Settling Test	KP internal standard
Drained Settling Test	KP internal standard
Air Drying Test	KP internal standard
Consolidation Test	KP internal standard
Falling Head Permeability Test	ASTM D 5856-02

2.2 50 Micron Samples

Two composite samples of the 50 micron Goose Main tailings were submitted to Golder Associates' geotechnical testing laboratory in Burnaby, Canada. The samples were about 40 kg in size and was prepared by ALS. Table 2 summarizes the testing completed on each sample, and the complete test results are included as Attachment A.

Table 2: Summary of Tests Completed on two 50 Micron Tailings Samples

Test	Standard
Specific Gravity	ASTM D854-14
Atterberg Limits	ASTM 4318-10
Particle Size Distribution (Sieve and Hydrometer)	ASTM 422
Undrained Settling Test	Golder internal standard

3 Tailings Test Results

3.1 Index Testing

The results of the index testing (specific gravity, Atterberg limits, and particle size distribution) are summarized in Table 1. Figure 1 presents the complete particle size distribution curves of these four samples. These results confirm that according to the Unified Soil Classification System (USCS) both the 100 and 50 micron tailings are considered silty sand (SM). The difference in the specific gravity is ascribed to the fact that the 100 micron composite samples contain a composite of the majority of project ore types, while the 50 micron samples contain only Goose Main ore.

Table 3: Summary of Tailings Index Geotechnical Properties

	Sample ID	Atterberg Limits	Specific Gravity	Particle Size Distribution		
				Sand (%)	Silt (%)	Clay (%)
100 Micron Grind	Test 1	Non-Plastic	3.15	28	66	6
	Test 2	Non-Plastic	3.17	38	57	5
50 Micron Grind	Tailings Composite 1	Non-Plastic	2.87	8	85	7
	Tailings Composite 2	Non-Plastic	2.88	8	86	7

Source: J:\01_SITES\Back River\1CS020.006_FS_Study\!080_Deliverables\TSF Design Report\030_Appendices\Tailings Properties\Memo\Table\BackRiver_TailingsProperties_Tables_SA

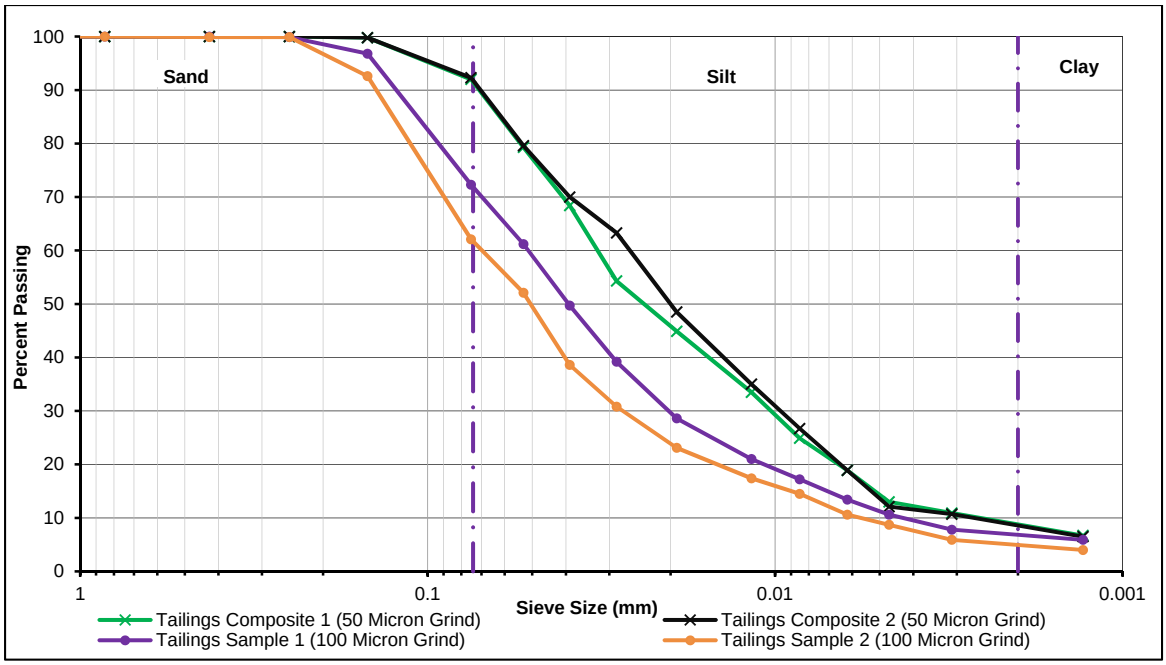

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Figure 1: Particle Size Distribution of the Tailings Samples

3.2 Settling and Consolidation Testing

The results of the undrained settling, drained settling, and air drying tests completed on the tailings samples are summarized in Table 4. The complete data sheets for the 100 micron samples can be found in Knight Piésold (2013), while the 50 micron undrained settling test data is provided in Attachment A.

The settling tests provided an estimate of the density to which the tailings slurry will settle in a sub-aqueous environment, while the air drying tests provides an indication of the ultimate dry density of the tailings under subaerial deposition strategies.

The results show that the 50 micron tailings has a slightly lower density at similar water contents of about 50% solids, which is understandable considering the lower specific gravity compared to the 100 micron tailings. It is however reasonable to assume that a realistic lower range for dry-density under sub-aqueous conditions would be about 1.2 tonnes per cubic metre (T/m³). Further drying under subaerial deposition, densities could approach about 1.8 T/m^3 assuming a solids content of about 50% which is the Project's target.

Table 4: Summary of Slurry Settling and of Air Drying Test Results

	Sample ID	Laboratory Test Type	Actual Percent Solid (%)	Void Ratio		Dry Density (tonnes/m^3)		Total Water Recovery (%)
				Initial	Final	Initial	Final	
100 Micron Grind	Test 1	Undrained Settling Test	35	5.90	1.33	0.46	1.35	77
			48	3.48	1.25	0.70	1.4	64
	Test 2		33	6.59	1.30	0.42	1.38	81
			46	3.79	1.26	0.66	1.40	67
	Test 1	Drained Settling Test	33	6.34	1.19	0.43	1.44	82
			48	3.50	1.16	0.70	1.46	67
	Test 2		33	6.39	1.22	0.43	1.43	81
			45	3.88	1.2	0.65	1.44	69
	Test 1	Air Drying Test	33	6.19	0.62	0.44	1.94	-
			48	3.40	0.61	0.72	1.96	-
	Test 2		33	6.45	0.71	0.43	1.85	-
			46	3.72	0.7	0.67	1.86	-
50 Micron Grind	Tailings Composite 1	Undrained Settling Test	50	-	-	0.74	1.27	-
	Tailings Composite 2		50	-	-	0.74	1.27	-

Source: J:\01_SITES\Back River\1CS020.006_FS_Study\!080_Deliverables\TSF Design Report\030_Appendices\Tailings Properties\Memo\Table\BackRiver_TailingsProperties_Tables_SA

NOTES:

1. Total water recovery is defined as the percentage of water recovered from the slurry during settling.

Slurry consolidometer and low stress slurry consolidation tests were also carried out on the 100 micron samples (Knight Piésold 2013). Tables 5 and 6 summarize these results.

Table 5: Summary of Slurry Consolidometer Test Results

	Sample ID	Load Increment (kPa)	Average Effective Stress (kPa)	Void Ratio (e)	Dry Density (tonnes /m^3)	C_v (m^2/year)	m_v (m^2/year)	k_v (cm/sec)
100 Micron Grind	Test 1	14	-	0.97	1.60	-	-	-
		-	24	-	-	2,700	$5x10^{-4}$	-
		34	-	0.95	1.62	-	-	$3x10^{-5}$
		-	52	-	-	3,000	$3x10^{-4}$	-
		69	-	0.93	1.63	-	-	$3x10^{-5}$
		-	103	-	-	5,700	$2x10^{-4}$	-
		138	-	0.9	1.66	-	-	$3x10^{-5}$
		-	207	-	-	8,200	$1x10^{-4}$	-
		276	-	0.87	1.68	-	-	$3x10^{-5}$
		-	414	-	-	10,700	$8x10^{-4}$	-
		552	-	0.83	1.72	-	-	$3x10^{-5}$
		-	690	-	-	14,800	$4x10^{-4}$	-
		827	-	0.81	1.74	-	-	$2x10^{-5}$
	Test 2	14	-	1.27	1.40	-	-	-
		-	24	-	-	900	$5x10^{-3}$	-
		34	-	1.03	1.56	-	-	$4x10^{-5}$
		-	52	-	-	3,900	$2x10^{-4}$	-
		69	-	1.02	1.57	-	-	$4x10^{-5}$
		-	103	-	-	5,000	$2x10^{-4}$	-
		138	-	0.99	1.59	-	-	$3x10^{-5}$
		-	207	-	-	8,500	$1x10^{-4}$	-
		276	-	0.96	1.62	-	-	$3x10^{-5}$
		-	414	-	-	10,900	$8x10^{-5}$	-
		552	-	0.92	1.65	-	-	$3x10^{-5}$
		-	690	-	-	15,100	$5x10^{-5}$	-
		827	-	0.89	1.67	-	-	$3x10^{-5}$

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Table 6: Summary of Low Stress Consolidation Test Results

	Sample ID	Self-Weight Loading (kPa)	Average Effective Stress (kPa)	Void Ratio (e)	Dry Density (tonnes /m^3)	C_v (m^2/year)	m_v (m^2/year)	k_v (cm/sec)
100 Micron Grind	Test 1	0.90	-	1.32	1.36	-	-	-
		-	1.80	-	-	90	$3x10^{-2}$	$8x10^{-5}$
		2.60	-	1.20	1.43	-	-	-
	Test 2	0.80	-	1.41	1.32	-	-	-
		-	1.70	-	-	160	$3x10^{-2}$	$1x10^{-4}$
		2.60	-	1.27	1.40	-	-	-

Source: J:\01_SITES\Back River\1CS020.006_FS_Study\!080_Deliverables\TSF Design Report\030_Appendices\Tailings Properties\Memo\Table\BackRiver_TailingsProperties_Tables_SA

3.3 Permeability Testing

Falling head permeability tests were performed on the 100 micron settled tailings samples, after completion of each of the drained settling tests (Knight Piésold 2013). This test provides an indication of the vertical permeability of the tailings material at very low effective stresses (approximately 1 kPa) and corresponding low density. These average permeability values are listed in Table 7.

Table 7: Tailings Permeability Test Results

	Sample ID	Void Ratio		Falling Head Permeability (cm/s)
		Initial	Final	
100 Micron Grind	Test 1	6.34	1.19	$4x10^{-5}$
		3.50	1.16	$6x10^{-5}$
	Test 2	6.39	1.22	$7x10^{-5}$
		3.88	1.2	$2x10^{-5}$

4 References

Knight Piésold Consulting. (2013). Back River Project Report on Laboratory Geotechnical Testing of Tailings Materials, for Sabina Gold & Silver Corporation, October.

Sabina Gold and Silver Corp. 2014. Technical Decision Memorandum. FSTDM-001 Rev. A. August 26, 2014.

Golder Associates Ltd. - Burnaby Lab
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Specific Gravity of Soil Solids By Water Pycnometer

Reference: ASTM D854 -14

Project No.:	1416474	**Borehole:**	**KM 4030-147**
Project:	Mine Tailings - PO #1CS020.006	**Sample Number:**	Tailings Composite (Test 2)
Location:	Back River	**Depth (m):**	N/A
Client:	SRK	**Lab ID No:**	393

Visual Description:	**% Passing 4.75µm**	100.00
Tailings	**Excluded Material Description**	No excluded material

Specific Gravity of Fine Fraction Method B - Oven Dried Samples

		Trial 1	Trial 2
Flask Number		A	7
Air Removal Method	M_p	Vacuum	Vacuum
Mass of Flask (g)		173.66	171.23
Mass of Flask + Dry Soil (g)		253.87	248.26
Mass of Flask + Soil + Water (g)	$M_{\rho ws,t}$	724.4	719.72
Test Temperature (°C)	T_t	20.2	20.2
Mass of Flask + Water (g)	$M_{\rho w,t}$	672.03	669.29
Tare Number		35	203
Mass of Tare + Dry Soil (g)		431.05	255.85
Mass of Tare (g)		350.78	178.77
Mass of Oven Dry Soil (g)	M_S	80.27	77.08
Temperature Coefficient	K	1.00	1.00
Specific Gravity at Test Temperature	G_t	2.88	2.89
Specific Gravity at 20ºC	$G_{20°C}$	2.88	2.89

AVERAGE SPECIFIC GRAVITY OF TRIALS	2.88

MM	November 24, 2014	LP	NOVEMBER 26,2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd. - Burnaby Lab
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Specific Gravity of Soil Solids By Water Pycnometer

Reference: ASTM D854 -14

Project No.:	1416474	**Borehole:**	**KM 4030-147**
Project:	Mine Tailings - PO #1CS020.006	**Sample Number:**	Tailings Composite (Test 1)
Location:	Back River	**Depth (m):**	N/A
Client:	SRK	**Lab ID No:**	393

Visual Description:	**% Passing 4.75µm**	100.00
Tailings	**Excluded Material Description**	No excluded material

Specific Gravity of Fine Fraction Method B - Oven Dried Samples

		Trial 1	Trial 2
Flask Number		D	E
Air Removal Method	M_p	Vacuum	Vacuum
Mass of Flask (g)		168.77	173.26
Mass of Flask + Dry Soil (g)		248.56	251.46
Mass of Flask + Soil + Water (g)	$M_{\rho ws,t}$	719.08	722.41
Test Temperature (°C)	T_t	20.2	20.2
Mass of Flask + Water (g)	$M_{\rho w,t}$	667.42	671.34
Tare Number		m-8	I-18
Mass of Tare + Dry Soil (g)		291	427.37
Mass of Tare (g)		211.51	349.07
Mass of Oven Dry Soil (g)	M_S	79.49	78.3
Temperature Coefficient	K	1.00	1.00
Specific Gravity at Test Temperature	G_t	2.86	2.88
Specific Gravity at 20ºC	$G_{20°C}$	2.86	2.88

AVERAGE SPECIFIC GRAVITY OF TRIALS	2.87

MM	November 24, 2014	LP	NOVEMBER 26,2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd. - Burnaby Lab
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Column Settling Test

Reference: Golder SOP

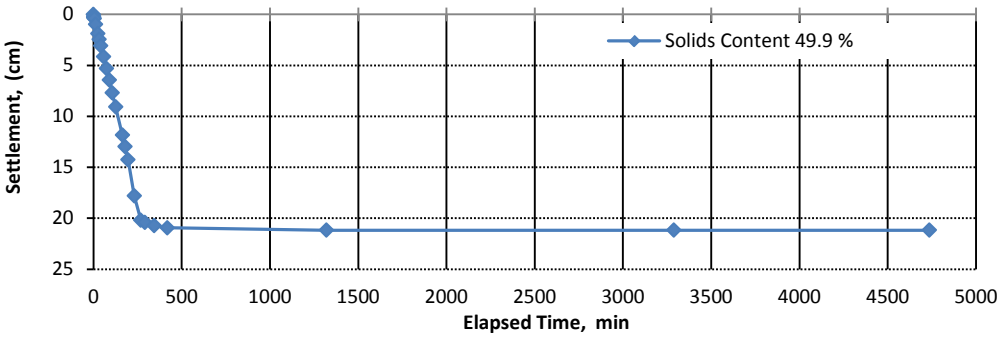
Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 2)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

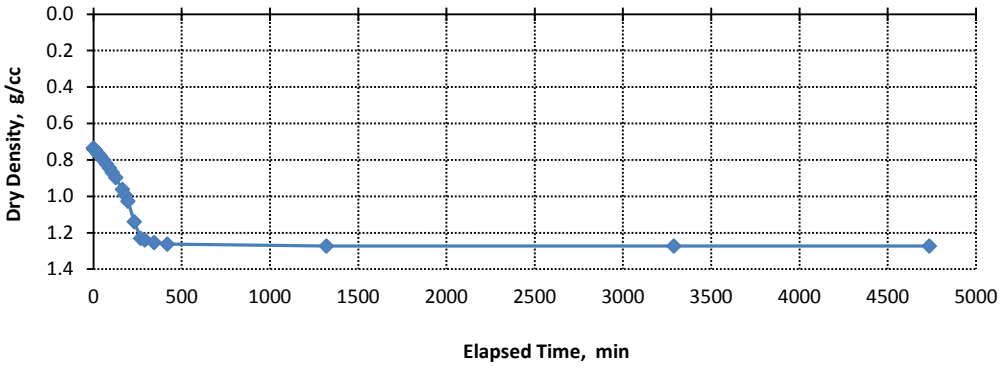
General Remarks

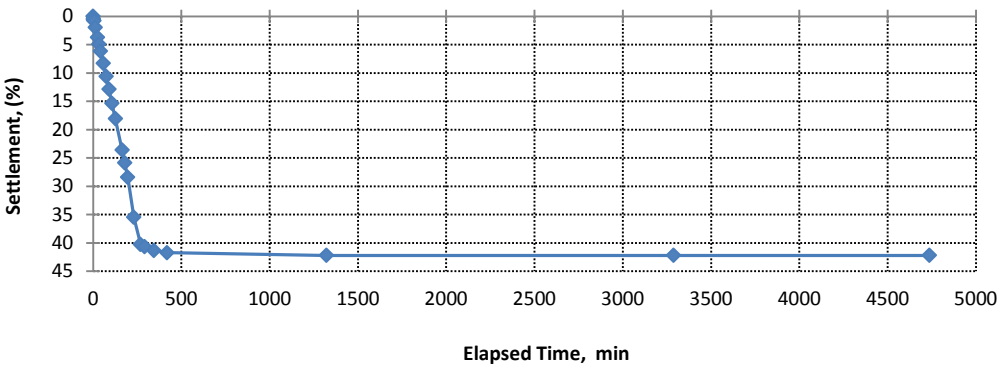
Description:	SILT (tailings)
Drainage:	Undrained
Specific Gravity:	2.88

Test Results

ΔT (min)	Δh_{soil} (cm)	ρ_{dry} (g/cm^3)
0	0.00	0.74
1	0.20	0.74
2	0.32	0.74
5	0.40	0.74
12	0.99	0.75
25	1.88	0.76
33	2.45	0.77
42	3.09	0.78
58	4.16	0.80
74	5.32	0.82
90	6.45	0.84
106	7.70	0.87
126	9.08	0.90
164	11.84	0.96
179	12.98	0.99
196	14.27	1.03
231	17.80	1.14
269	20.20	1.23
291	20.42	1.24
344	20.74	1.25
419	20.94	1.26
1321	21.18	1.27
3288	21.18	1.27
4737	21.18	1.27







TM/MM	November 21, 2014	LL	November 25, 2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd. - Burnaby Lab
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Column Settling Test

Reference
Golder SOP

Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 2)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

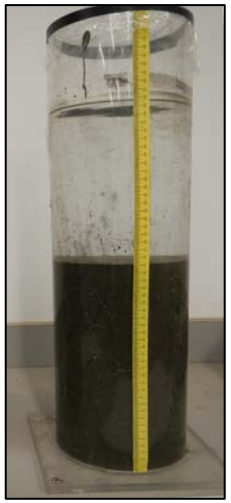
Test Setup Summary

Drainage	Undrained
Chamber	3
D_0 (cm)	14.05
A_0 (cm^2)	155.06
H_0 (cm)	50.20
V_0 (cm^3)	7784.09

Filter Cloth	N/A
Wet + Tare (g)	14137
Tare (g)	2676
Wet Wt (g)	11461
Dry Wt (g)	5728

Water Content (%)	100.21
Solids Content (%)	49.95
Wet Density (g/cm^3)	1.47
Dry Density (g/cm^3)	0.74





Remarks:

TM/MM	November 21, 2014	LL	November 25, 2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd. - Burnaby Lab
#300 - 3811 North Fraser Way
Burnaby, B.C. Canada V5J 5J2

Column Settling Test

Reference: Golder SOP

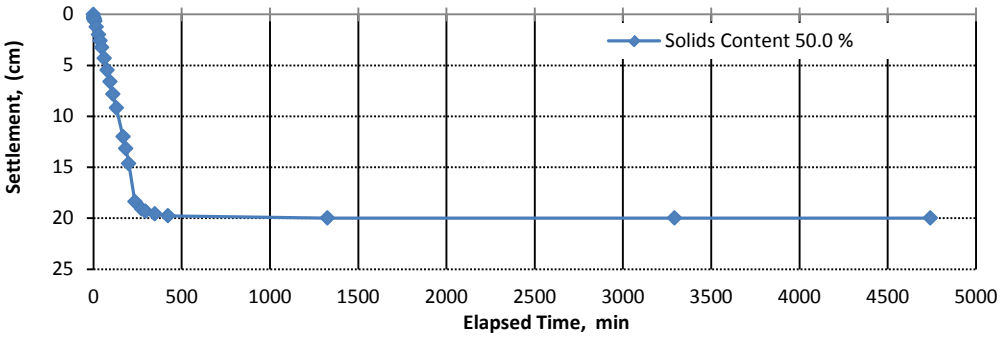
Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 1)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

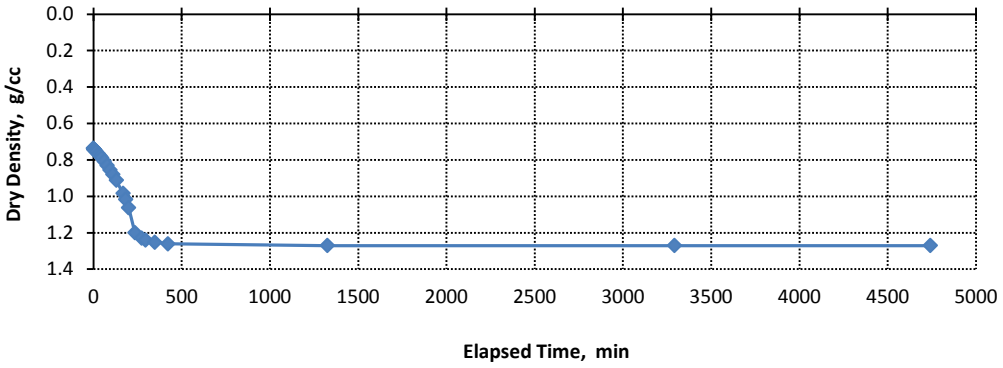
General Remarks

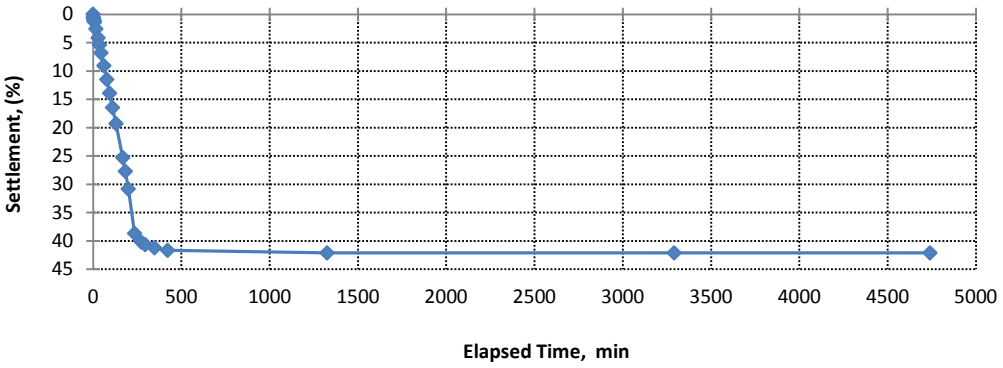
Description:	SILT (tailings)
Drainage:	Undrained
Specific Gravity:	2.87

Test Results

ΔT (min)	Δh_{soil} (cm)	ρ_{dry} (g/cm^3)
0	0.00	0.74
1	0.25	0.74
2	0.35	0.74
3	0.43	0.74
5	0.45	0.74
6	0.55	0.74
9	0.67	0.75
16	1.22	0.75
29	1.97	0.77
37	2.58	0.78
46	3.23	0.79
62	4.30	0.81
78	5.46	0.83
94	6.61	0.85
110	7.82	0.88
130	9.17	0.91
168	12.00	0.98
183	13.15	1.02
200	14.62	1.06
235	18.36	1.20
273	19.08	1.23
295	19.30	1.24
348	19.57	1.25
423	19.76	1.26
1325	19.98	1.27
3292	19.98	1.27
4741	19.98	1.27







TM/MM	November 21, 2014	LL	November 25, 2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd. - Burnaby Lab
#300 - 3811 North Fraser Way
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Column Settling Test

Reference
Golder SOP

Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 1)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

Test Setup Summary

Drainage	Undrained
Chamber	2
D_0 (cm)	14.05
A_0 (cm^2)	155.06
H_0 (cm)	47.45
V_0 (cm^3)	7357.67

Filter Cloth	N/A
Wet + Tare (g)	13502
Tare (g)	2673
Wet Wt (g)	10829
Dry Wt (g)	5412

Water Content (%)	100.10
Solids Content (%)	49.98
Wet Density (g/cm^3)	1.47
Dry Density (g/cm^3)	0.74



Remarks:

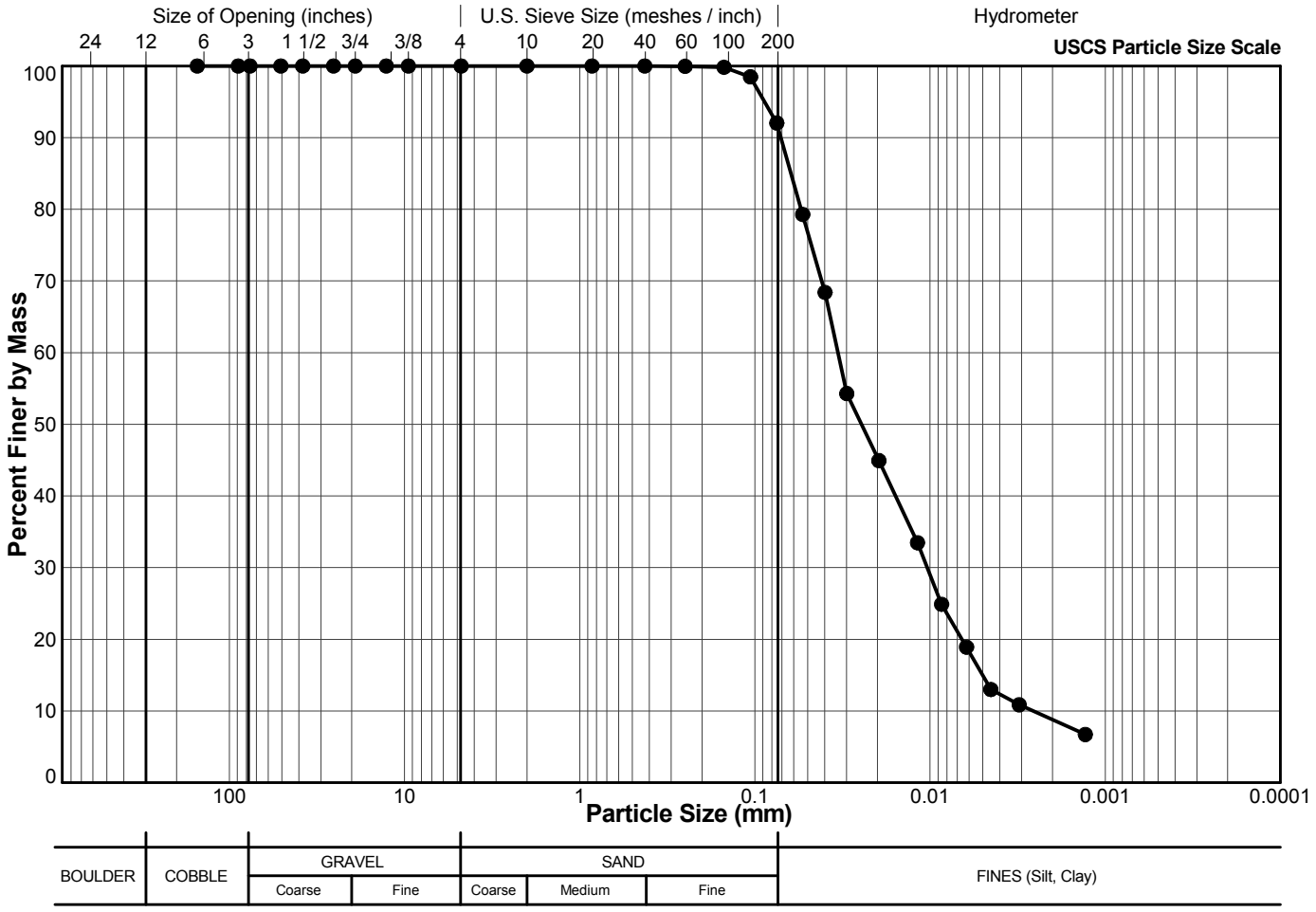
TM/MM	November 21, 2014	LL	November 25, 2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates

SUMMARY OF PARTICLE SIZE DISTRIBUTION

Reference(s)
ASTM D 422

Client:	SRK	**Sample Location:**	KM 4030-147
Project:	Mine Tailings - PO# 1CS020.006	**Sample No.:**	Tailings Composite 1
Location:	Back River	**Depth (m):**	N/A
Project No.:	1416474	**Lab Schedule No.:**	393



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		100.0
#40 US MESH	0.425		100.0
#60 US MESH	0.25		100.0
#100 US MESH	0.15		99.8
#140 US MESH	0.106		98.5
#200 US MESH	0.075		92.0
		0.0534	79.3
		0.0398	68.4
		0.0299	54.3
		0.0196	44.9
		0.0118	33.5
		0.0086	24.9
		0.0062	18.9
		0.0045	13.0
		0.0031	10.9
		0.0013	6.7

MM/OA	11/24/2014	LP	11/26/2014
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:597 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) MMiller 11/26/14

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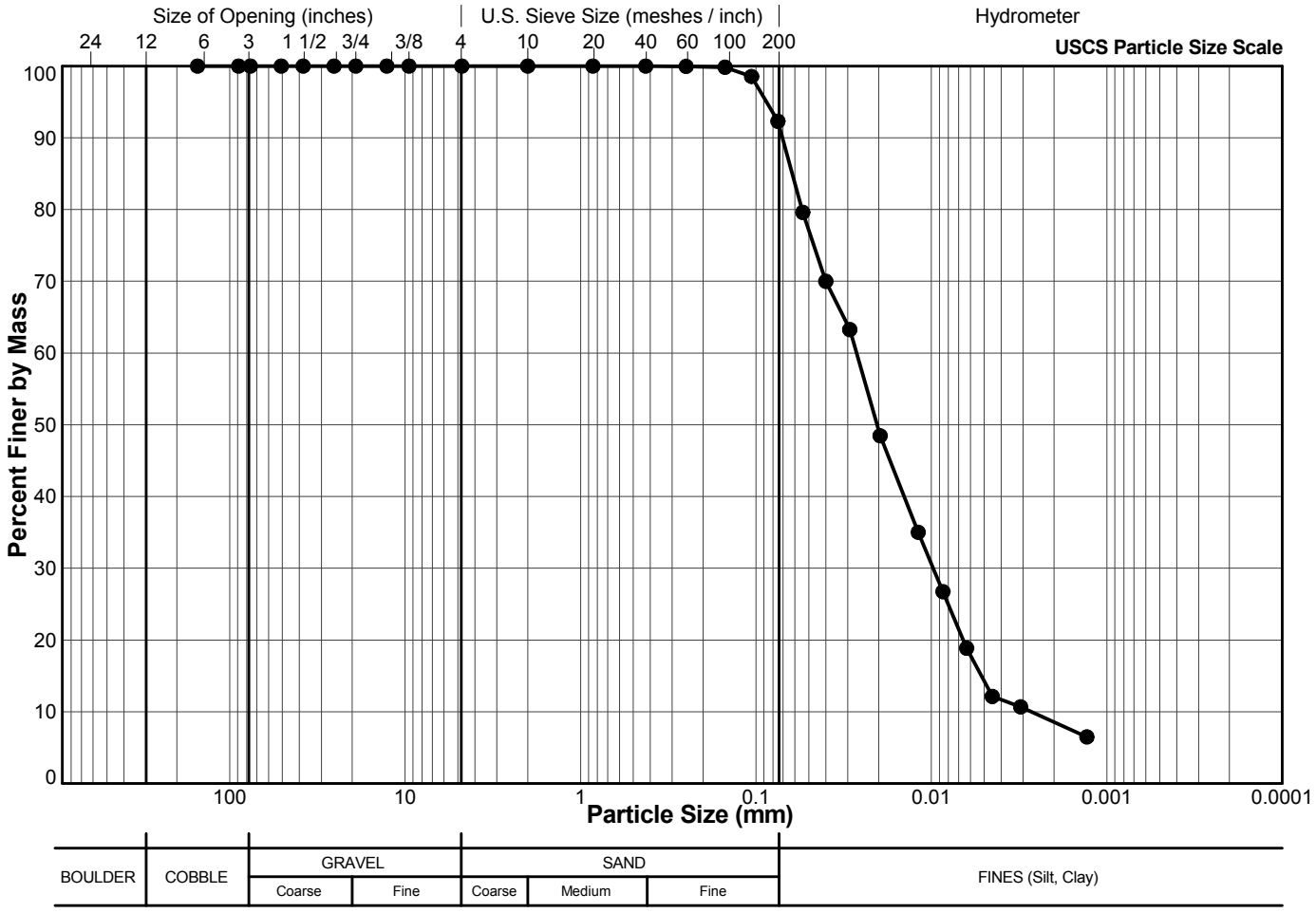
SUMMARY OF PARTICLE SIZE DISTRIBUTION

Reference(s)
ASTM D 422

Client:	SRK	**Sample Location:**	KM 4030-147
Project:	Mine Tailings - PO# 1CS020.006	**Sample No.:**	Tailings Composite 2
Location:	Back River	**Depth (m):**	N/A
Project No.:	1416474	**Lab Schedule No.:**	393



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
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1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		100.0
#40 US MESH	0.425		100.0
#60 US MESH	0.25		100.0
#100 US MESH	0.15		99.8
#140 US MESH	0.106		98.6
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		0.0400	70.0
		0.0292	63.3
		0.0196	48.5
		0.0119	35.0
		0.0086	26.7
		0.0063	18.9
		0.0045	12.1
		0.0031	10.7
		0.0013	6.5

	MM/OA	**11/24/2014**	**LP**	**11/26/2014**
	Tech	Date	Checked	Date

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

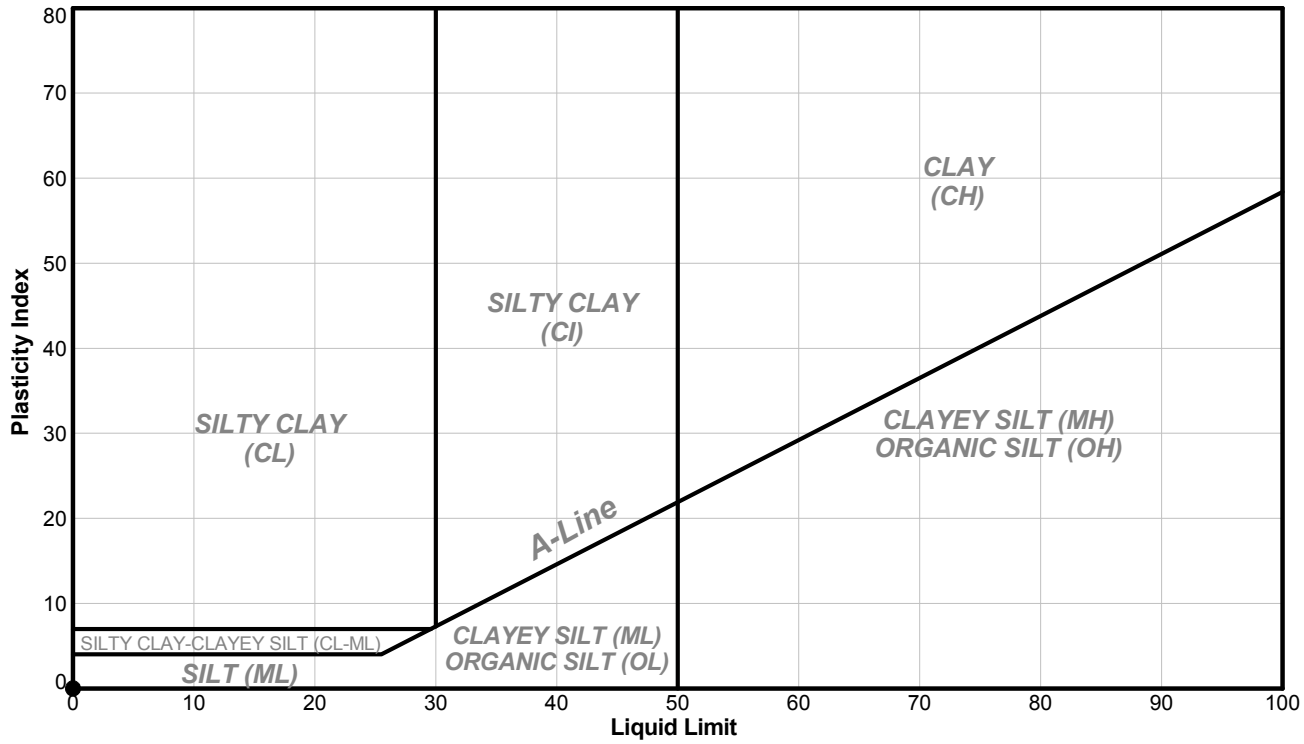
Reference(s)
ASTM D 4318-10

Client:	SRK	**ID:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Sample No.:**	**Tailings Composite**
Location:	Back River	**Depth (m):**	N/A
Project No.:	1416474	**Lab Schedule No.:**	393

Other Remarks: **N/A**

Test Method: **A-Multi Point** | **Preparation Method:** **Air Dried**

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	KM 4030-147	Tailings Composite	0.00	0.00	ND	NP	NP	NP		NP

NP - NON-PLASTIC RESULT ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

TM	11/25/2014	LP	11/26/2014
Tech	Date	Checked	Date

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Specific Gravity of Soil Solids By Water Pycnometer

Reference: ASTM D854 -14

Project No.:	1416474	**Borehole:**	**KM 4030-147**
Project:	Mine Tailings - PO #1CS020.006	**Sample Number:**	Tailings Composite (Test 2)
Location:	Back River	**Depth (m):**	N/A
Client:	SRK	**Lab ID No:**	393

Visual Description:	**% Passing 4.75µm**	100.00
Tailings	**Excluded Material Description**	No excluded material

Specific Gravity of Fine Fraction Method B - Oven Dried Samples

		Trial 1	Trial 2
Flask Number		A	7
Air Removal Method	M_p	Vacuum	Vacuum
Mass of Flask (g)		173.66	171.23
Mass of Flask + Dry Soil (g)		253.87	248.26
Mass of Flask + Soil + Water (g)	$M_{\rho ws,t}$	724.4	719.72
Test Temperature (°C)	T_t	20.2	20.2
Mass of Flask + Water (g)	$M_{\rho w,t}$	672.03	669.29
Tare Number		35	203
Mass of Tare + Dry Soil (g)		431.05	255.85
Mass of Tare (g)		350.78	178.77
Mass of Oven Dry Soil (g)	M_S	80.27	77.08
Temperature Coefficient	K	1.00	1.00
Specific Gravity at Test Temperature	G_t	2.88	2.89
Specific Gravity at 20ºC	$G_{20°C}$	2.88	2.89

AVERAGE SPECIFIC GRAVITY OF TRIALS	2.88

MM	November 24, 2014	LP	NOVEMBER 26,2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd. - Burnaby Lab
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Specific Gravity of Soil Solids By Water Pycnometer

Reference: ASTM D854 -14

Project No.:	1416474	**Borehole:**	**KM 4030-147**
Project:	Mine Tailings - PO #1CS020.006	**Sample Number:**	Tailings Composite (Test 1)
Location:	Back River	**Depth (m):**	N/A
Client:	SRK	**Lab ID No:**	393

Visual Description:	**% Passing 4.75µm**	100.00
Tailings	**Excluded Material Description**	No excluded material

Specific Gravity of Fine Fraction Method B - Oven Dried Samples

		Trial 1	Trial 2
Flask Number		D	E
Air Removal Method	M_p	Vacuum	Vacuum
Mass of Flask (g)		168.77	173.26
Mass of Flask + Dry Soil (g)		248.56	251.46
Mass of Flask + Soil + Water (g)	$M_{\rho ws,t}$	719.08	722.41
Test Temperature (°C)	T_t	20.2	20.2
Mass of Flask + Water (g)	$M_{\rho w,t}$	667.42	671.34
Tare Number		m-8	I-18
Mass of Tare + Dry Soil (g)		291	427.37
Mass of Tare (g)		211.51	349.07
Mass of Oven Dry Soil (g)	M_S	79.49	78.3
Temperature Coefficient	K	1.00	1.00
Specific Gravity at Test Temperature	G_t	2.86	2.88
Specific Gravity at 20ºC	$G_{20°C}$	2.86	2.88

AVERAGE SPECIFIC GRAVITY OF TRIALS	2.87

MM	November 24, 2014	LP	NOVEMBER 26,2014
TESTED BY	DATE	CHECKED BY	DATE

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Column Settling Test

Reference: Golder SOP

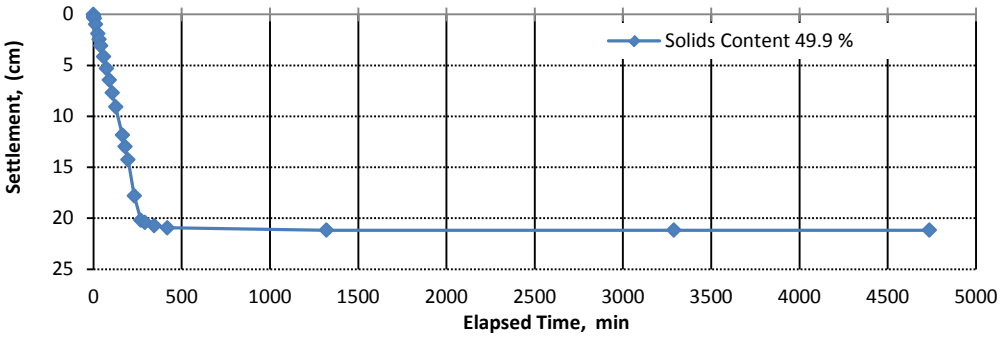
Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 2)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

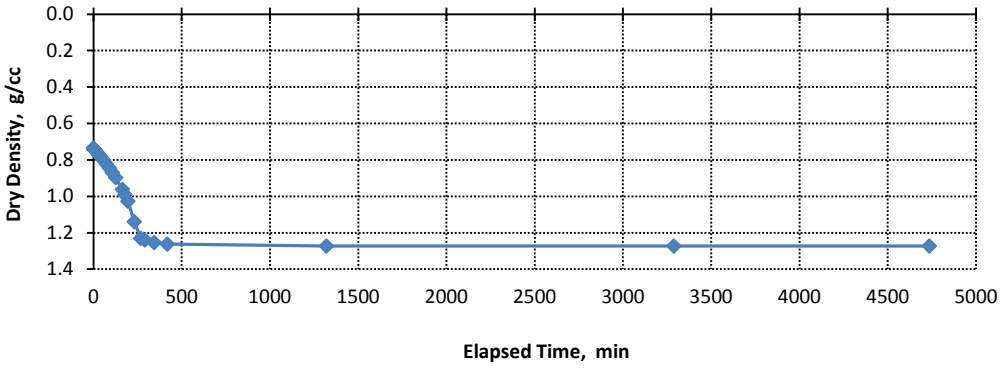
General Remarks

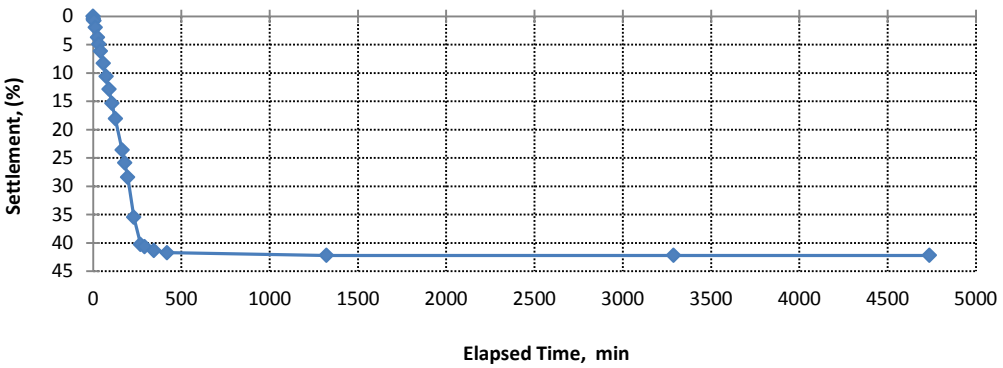
Description:	SILT (tailings)
Drainage:	Undrained
Specific Gravity:	2.88

Test Results

ΔT (min)	Δh_{soil} (cm)	ρ_{dry} (g/cm^3)
0	0.00	0.74
1	0.20	0.74
2	0.32	0.74
5	0.40	0.74
12	0.99	0.75
25	1.88	0.76
33	2.45	0.77
42	3.09	0.78
58	4.16	0.80
74	5.32	0.82
90	6.45	0.84
106	7.70	0.87
126	9.08	0.90
164	11.84	0.96
179	12.98	0.99
196	14.27	1.03
231	17.80	1.14
269	20.20	1.23
291	20.42	1.24
344	20.74	1.25
419	20.94	1.26
1321	21.18	1.27
3288	21.18	1.27
4737	21.18	1.27







TM/MM	November 21, 2014	LL	November 25, 2014
TESTED BY	DATE	CHECKED BY	DATE

Golder Associates Ltd. - Burnaby Lab
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Column Settling Test

Reference
Golder SOP

Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 2)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

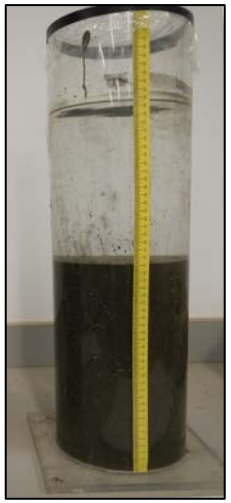
Test Setup Summary

Drainage	Undrained
Chamber	3
D_0 (cm)	14.05
A_0 (cm^2)	155.06
H_0 (cm)	50.20
V_0 (cm^3)	7784.09

Filter Cloth	N/A
Wet + Tare (g)	14137
Tare (g)	2676
Wet Wt (g)	11461
Dry Wt (g)	5728

Water Content (%)	100.21
Solids Content (%)	49.95
Wet Density (g/cm^3)	1.47
Dry Density (g/cm^3)	0.74





Remarks:

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Column Settling Test

Reference: Golder SOP

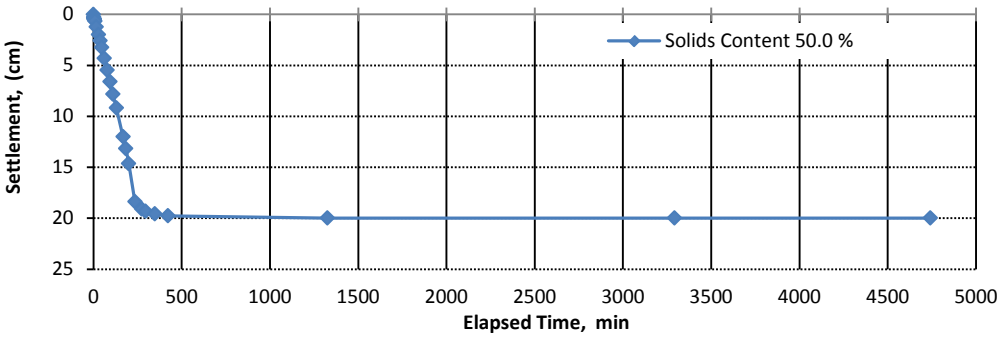
Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 1)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

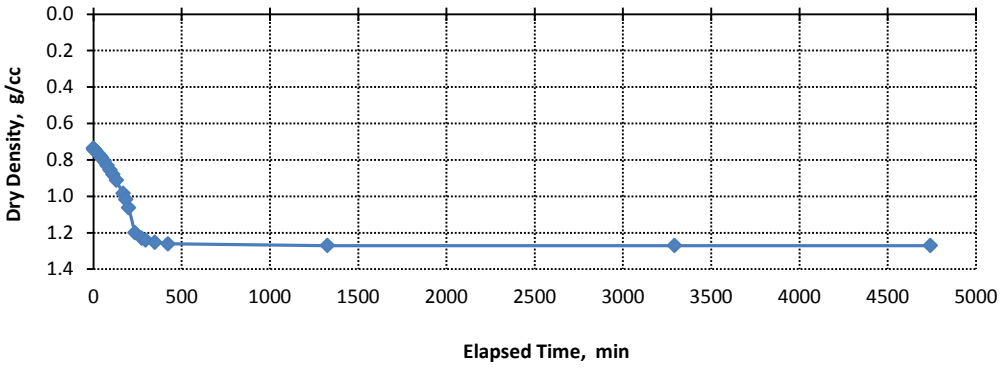
General Remarks

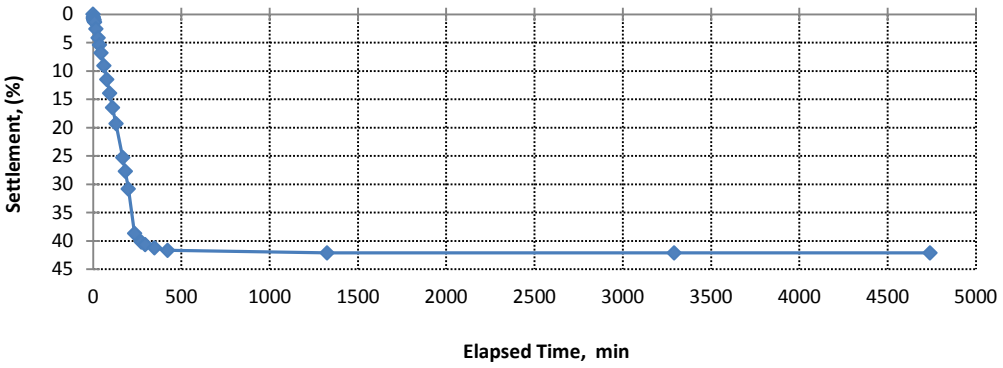
Description:	SILT (tailings)
Drainage:	Undrained
Specific Gravity:	2.87

Test Results

ΔT (min)	Δh_{soil} (cm)	ρ_{dry} (g/cm^3)
0	0.00	0.74
1	0.25	0.74
2	0.35	0.74
3	0.43	0.74
5	0.45	0.74
6	0.55	0.74
9	0.67	0.75
16	1.22	0.75
29	1.97	0.77
37	2.58	0.78
46	3.23	0.79
62	4.30	0.81
78	5.46	0.83
94	6.61	0.85
110	7.82	0.88
130	9.17	0.91
168	12.00	0.98
183	13.15	1.02
200	14.62	1.06
235	18.36	1.20
273	19.08	1.23
295	19.30	1.24
348	19.57	1.25
423	19.76	1.26
1325	19.98	1.27
3292	19.98	1.27
4741	19.98	1.27







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Column Settling Test

Reference
Golder SOP

Project No.:	1416474	**Sample No.:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Test ID:**	Tailings Composite (Test 1)
Location:	Back River	**Target SC**	50%
Client:	SRK	**Lab ID No:**	393

Test Setup Summary

Drainage	Undrained
Chamber	2
D_0 (cm)	14.05
A_0 (cm^2)	155.06
H_0 (cm)	47.45
V_0 (cm^3)	7357.67

Filter Cloth	N/A
Wet + Tare (g)	13502
Tare (g)	2673
Wet Wt (g)	10829
Dry Wt (g)	5412

Water Content (%)	100.10
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Wet Density (g/cm^3)	1.47
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Remarks:

TM/MM	November 21, 2014	LL	November 25, 2014
TESTED BY	DATE	CHECKED BY	DATE

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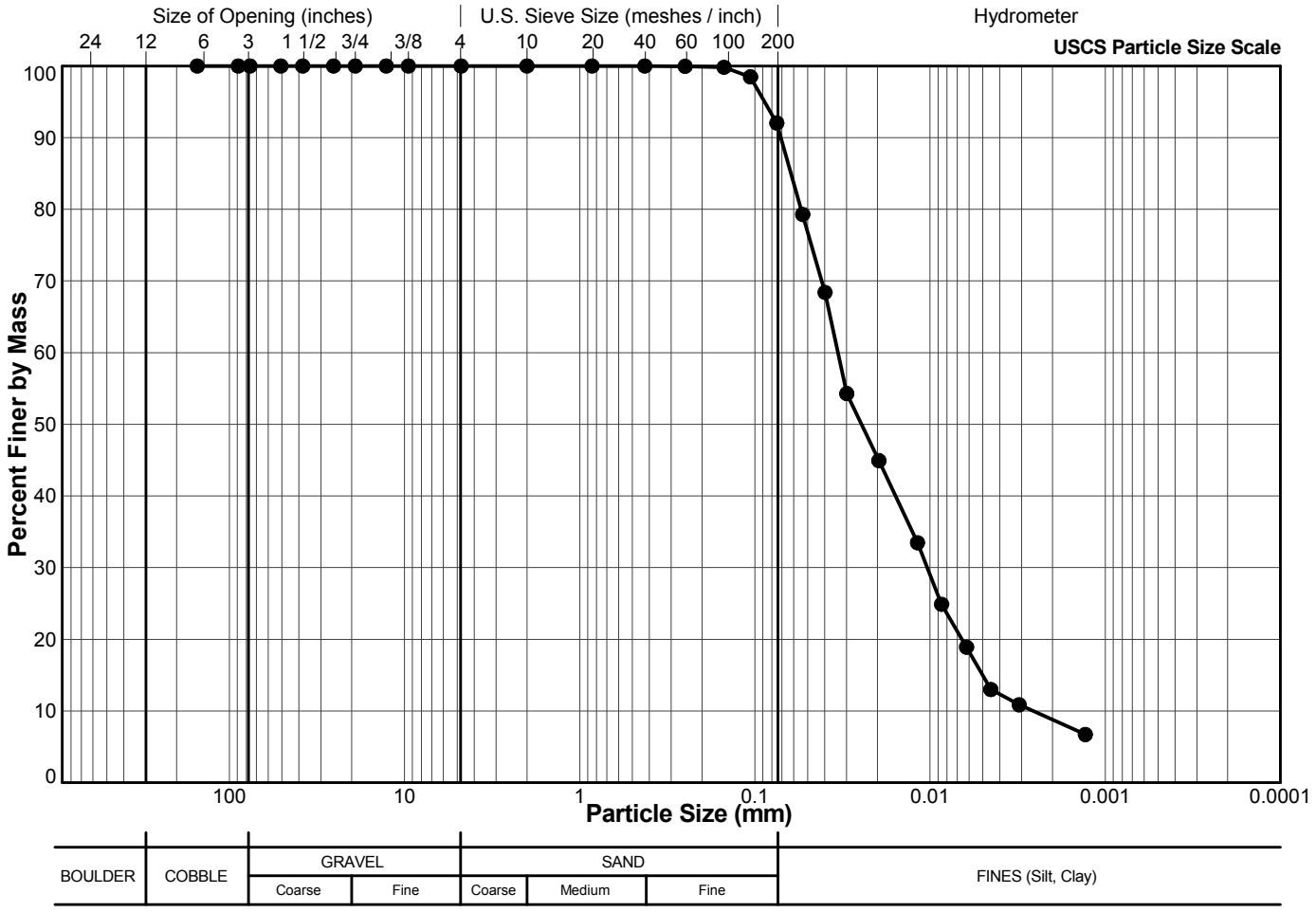
SUMMARY OF PARTICLE SIZE DISTRIBUTION

Reference(s)
ASTM D 422

Client:	SRK	**Sample Location:**	KM 4030-147
Project:	Mine Tailings - PO# 1CS020.006	**Sample No.:**	Tailings Composite 1
Location:	Back River	**Depth (m):**	N/A
Project No.:	1416474	**Lab Schedule No.:**	393



Legend

Sieve Size (USS)	(mm)	Particle Size (mm)	Percent Passing
6"	152.4		100.0
3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
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		0.0118	33.5
		0.0086	24.9
		0.0062	18.9
		0.0045	13.0
		0.0031	10.9
		0.0013	6.7

MM/OA	11/24/2014	LP	11/26/2014
Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:597 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) MMiller 11/26/14

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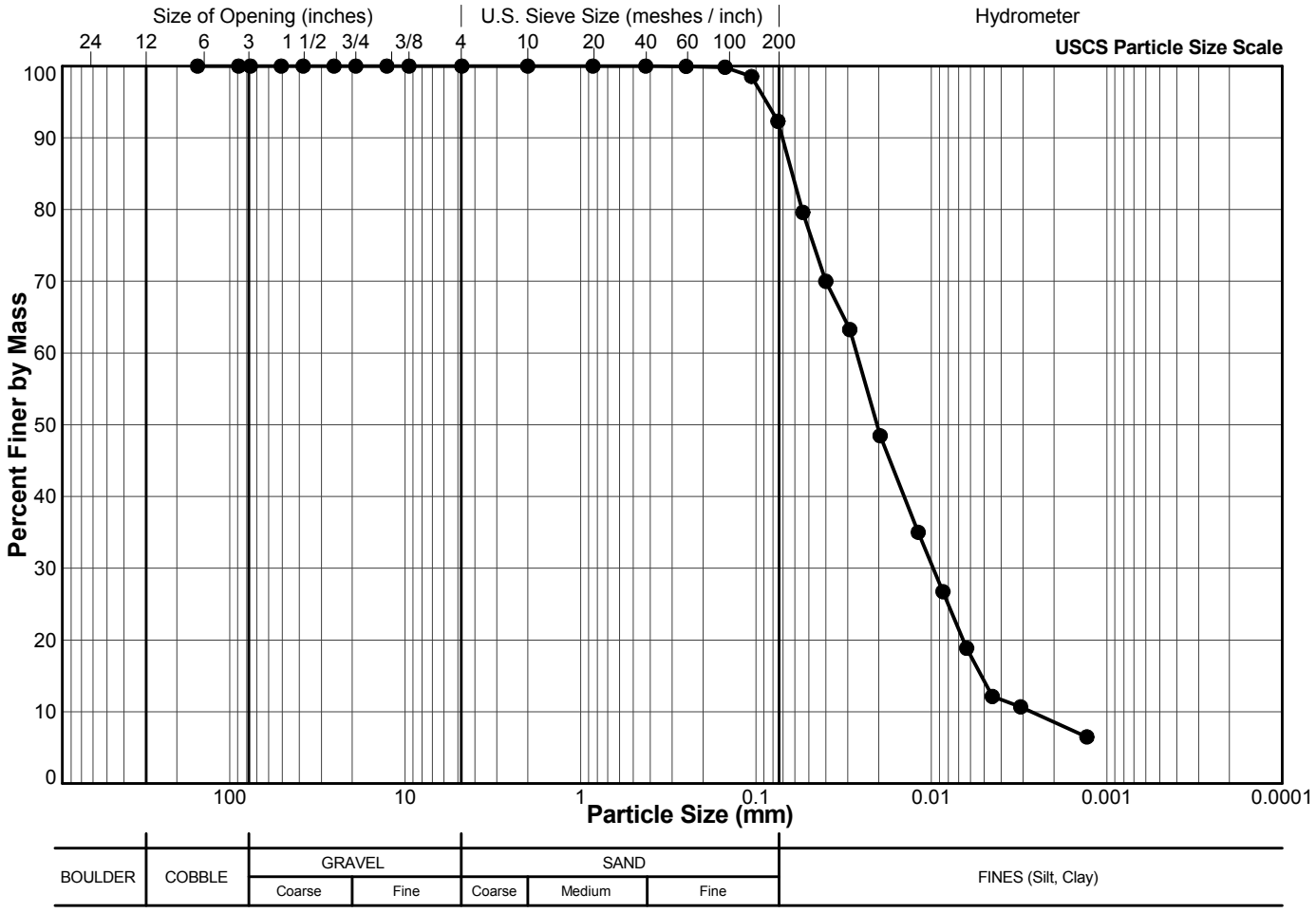
SUMMARY OF PARTICLE SIZE DISTRIBUTION

Reference(s)
ASTM D 422

Client:	SRK	**Sample Location:**	KM 4030-147
Project:	Mine Tailings - PO# 1CS020.006	**Sample No.:**	Tailings Composite 2
Location:	Back River	**Depth (m):**	N/A
Project No.:	1416474	**Lab Schedule No.:**	393



Legend

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3.5"	88.9		100.0
3"	76.2		100.0
2"	50.8		100.0
1 1/2"	38.1		100.0
1"	25.4		100.0
3/4"	19.1		100.0
1/2"	12.7		100.0
3/8"	9.5		100.0
#4 US MESH	4.75		100.0
#10 US MESH	2		100.0
#20 US MESH	0.85		100.0
#40 US MESH	0.425		100.0
#60 US MESH	0.25		100.0
#100 US MESH	0.15		99.8
#140 US MESH	0.106		98.6
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		0.0541	79.6
		0.0400	70.0
		0.0292	63.3
		0.0196	48.5
		0.0119	35.0
		0.0086	26.7
		0.0063	18.9
		0.0045	12.1
		0.0031	10.7
		0.0013	6.5

	MM/OA	**11/24/2014**	**LP**	**11/26/2014**
	Tech	Date	Checked	Date

National IM Server:GINT_GAL_NATIONALIM Unique Project ID:597 Output Form:_LAB_PARTICLE SIZE (W/ GRADATIONS) MMiller 11/26/14

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Golder Associates

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX OF SOILS

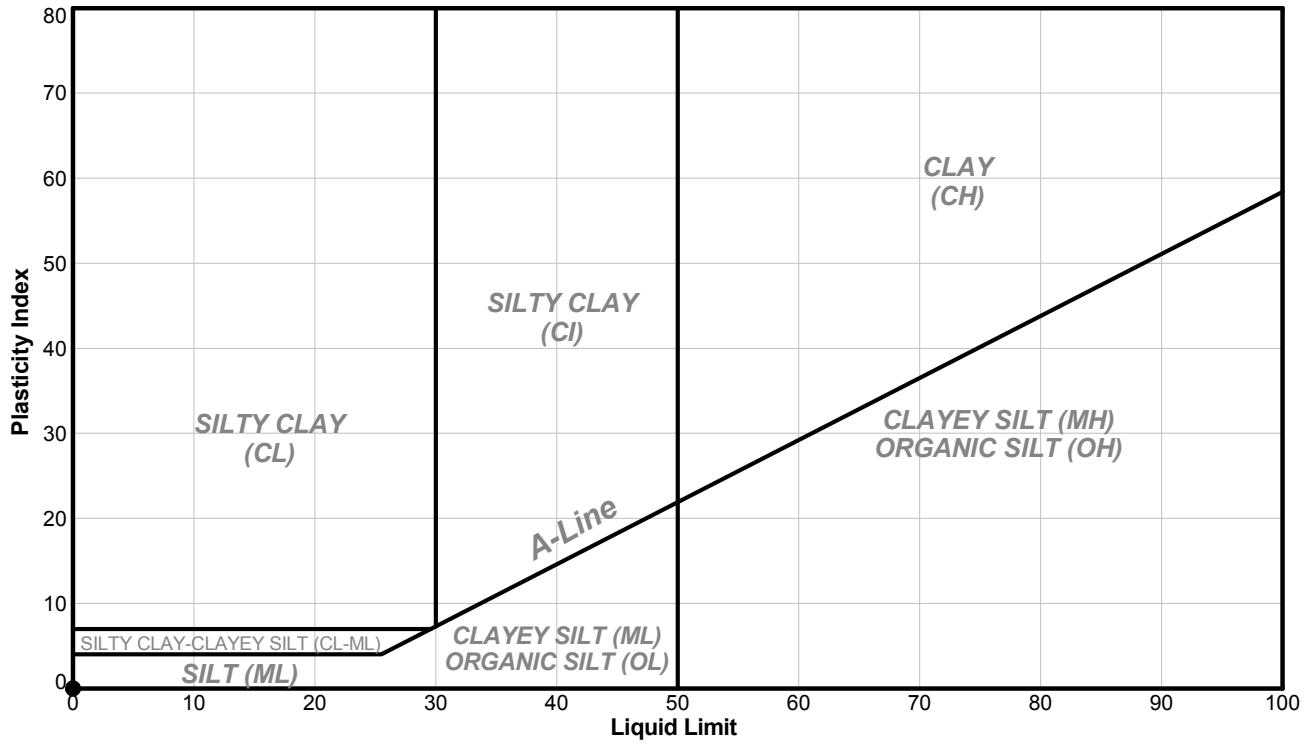
Reference(s)
ASTM D 4318-10

Client:	SRK	**ID:**	**KM 4030-147**
Project:	Mine Tailings - PO# 1CS020.006	**Sample No.:**	**Tailings Composite**
Location:	Back River	**Depth (m):**	N/A
Project No.:	1416474	**Lab Schedule No.:**	393

Other Remarks: **N/A**

Test Method: **A-Multi Point** | **Preparation Method:** **Air Dried**

PLASTICITY CHART



Sym.	Sample Location	Sample / Specimen Number	Depth (m)	Bottom (m)	Percent Passing #40 Sieve (%)	Liquid Limit	Plastic Limit	Plasticity Index	Natural Water Content (%)	Liquidity Index
●	KM 4030-147	Tailings Composite	0.00	0.00	ND	NP	NP	NP		NP

NP - NON-PLASTIC RESULT ND - NOT DETERMINED

Note: The test data given herein pertain to the sample provided only. This report constitutes a testing service only.

TM	11/25/2014	LP	11/26/2014
Tech	Date	Checked	Date

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Appendix C - TSF Tailings Deposition Plan

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Memo

To:	Project File	**Client:**	Sabina Gold & Silver Corp.
From:	Trevor Podaima, PEng	**Project No:**	1CS020.008
Reviewed By:	Maritz Rykaart, PhD, PEng	**Date:**	September 24, 2015
Subject:	TSF Tailings Deposition Plan – Final		

1 Introduction

The proposed Back River Project (the Project) Tailings Storage Facility (TSF) is located approximately 2 km south of Goose Main open pit, in a wide open natural valley. The road distance from the Goose Property processing mill facility is approximately 6.5 km (Figure 1).

The first two years of tailings deposition for the Project will be in the TSF. The deposition strategy will be subaerial tailings with a feed solids density of 47%. The TSF Containment Dam has been designed as a water retaining structure, and will provide storage for the tailings solids, processing water as well as all site contact water while the facility is active, plus some period after. A small tailings retaining structure (South Dyke) is required along the south end of the TSF to provide containment of the potential development area (PDA). The South Dyke will be comprised of run-of-mine waste rock and no impermeable element will be required as tailings will be deposited from the dam, which will push the water north and away from the structure. Additional design details for the TSF Containment Dam and South Dyke are provided in the main report.

This memo presents two possible tailings deposition strategies, and concludes with a recommendation regarding the preferred strategy.

2 Objectives, Operational Criteria and Assumptions

The tailings deposition plan has been completed to determine the following:

- Allow for the development of an accurate tailings surface which would facilitate the development of a representative stage-capacity curve for the TSF through its life;
- Determining the optimum tailings discharge locations and durations within the deposition sequence;
- Optimization of deposition locations to increase pond depth (to facilitate use of reclaim water) and limit ice entrainment; and
- Identify the optimum water reclaim location.

Tailings deposition planning was completed using Autodesk Civil3D 2014. The deposition modeling assumptions are summarized in Table 1, are based on actual site data, or past experience with tailings that have similar characteristics.

Table 1: Summary of Tailings Deposition Modeling Assumptions

Component	Value
Tailings Storage Requirement	3.7 Mm^3 (4.4 Mt)
Deposited Tailings Dry Density	1.2 t/m^3 (based on laboratory testing)
Ice Entrainment Allowance	0.7 Mm^3 (20% by volume)
Run-off and Contact Water Allowance	2.9 Mm^3
Tailings Beach Slope (Subaerial Portion)	1.0%
Tailings Beach Slope (Sub-aqueous Portion)	1.0%
TSF Freeboard	1.1 m
Discharge Method	Single point discharge

The maximum tailings discharge rate will be approximately 3,000 tpd; however, there will be a ramp-up period as illustrated in Table 2.

Table 1: Summary of Tailings Production Rates

Quarter	Tonnes/Day
Q4	0.0
Y1 Q1	1,217
Y1 Q2	2,106
Y1 Q3	2,530
Y1 Q4	2,827
Y2 Q1 to End	3,000

3 Alternate Deposition Strategies

Two alternate tailings deposition strategies were evaluated:

- Option 1: tailings deposition will initially occur at the north end of the TSF and subsequently move towards the southeast flank, forcing the pond to the center of the facility (Figure 2) and away from the TSF Containment Dam; and
- Option 2: tailings deposition will primarily occur from the south end of the TSF, forcing the pond against the TSF Containment Dam (Figure 3).

The intent of deposition Option 1 is to commence tailings deposition from the crest of the TSF Containment Dam so that a continuous beach is formed along the upstream face of the structure. This configuration will increase the seepage path upstream of the low permeable element in the dam, lower the hydraulic gradient and thus lower seepage rates through the structure. The reclaim could be situated 500 m from the TSF Containment Dam at the east or west shoreline of

the TSF. Alternatively, a reclaim barge could be used; however, there may be operational issues should it become frozen-in.

Deposition Option 2 is essentially the opposite of Option 1 as tailings deposition would commence from the south end of the TSF (i.e. center of South Dam). The tailings surface would push the pond against the TSF Containment Dam and the deepest section of the pond would be near the west abutment of the structure. This configuration maximizes the pond depth; however, seepage rates through and below the TSF Containment Dam may be higher than Option 1 with a pond situated directly against the structure. The optimal location of the reclaim would be near the west abutment of the TSF Containment Dam where the pond is deepest. The South Dam is required at the south end of the facility so that Period 1 deposition can commence from the crest of that structure. The intent of Period 1 deposition is to establish a tailings beach along the south side of the TSF and along the upstream slope of the South Dam, which will provide containment for Period 2 deposition.

Both deposition options will store the required tailings volume and have the same storage capacity for contact and reclaim water. Supernatant water storage for the final tailings configurations for both deposition Options 1 and 2 is approximately 2.9 Mm^3. Tailings storage capacity, spigot elevations, discharge durations and available water capacity are provided in Figures 2 and 3.

Figures 2 and 3 also show the anticipated tailings configuration at the end of the TSF operation for deposition Options 1 and 2, respectively. A north to south cross-sectional view through the center of the TSF at the end of operations is shown in Figures 4 and 5 for deposition Options 1 and 2, respectively. It should be noted that the configurations shown in the figures are dependent on the deposition locations, the actual production rates and the duration of deposition at the assumed spigot locations, and can be expected to vary during operations.

The advantages and disadvantages for each tailings deposition option is provided in Table 3.

Table 3: Advantages and Disadvantages for Tailings Deposition Options 1 and 2

Deposition Option	Advantages	Disadvantages
Option 1 (North and South Deposition)	• Potential for reduced seepage rates. • Potential for the TSF Containment Dam foundation to thaw will be reduced.	• Shallower pond and lower pond capacity. • Reclaim located further from the mill (longer reclaim line/additional pumping). • Additional spigot locations, potentially more difficult to operate.
Option 2 (South Deposition)	• The TSF will have a deeper pond that is less susceptible to freeze. • Additional pond capacity. • Less spigot locations, potentially less difficult to operate. • Reclaim located closer to the mill (shorter reclaim line/reduced pumping). • Final tailings configuration may be easier to reclaim at closure.	• Potential for higher seepage rates. • TSF Containment Dam foundation may be more susceptible to thaw.

4 Preferred Tailings Deposition Strategy

Option 2 is the preferred tailings deposition strategy. The key disadvantage of this strategy is the fact that the TSF must operate a water retaining dam for its operating life; however considering the fact that the TSF Containment Dam has been designed for that condition for a life in excess of the mine life, this is not a concern.

The two key variables that will influence performance of the TSF regardless of the deposition option chosen are the tailings beach slope and ice content. A tailings beach slope of 1% was assumed; however, it is possible that this slope could be as steep as 4% for subaqueous deposition (i.e. where tailings meet the pond surface). The deposited tailings slope should be surveyed during initial operations and compared to the deposition plan. If the average slope is steeper than 1%, additional spigot locations may be required to achieve the required storage capacity.

Tailings deposition from the Period 2 spigot location will need to be monitored to ensure the tailings beach does not trap supernatant water against the South Dam/west shoreline. If field monitoring forecasts this as a potential issue, the Period 2 spigot location can be shifted to the north and there will be a slight reduction in the water storage capacity.

The storage of ice will decrease the volume available for tailings and discharging of tailings over ice sheets that form on the pond should be avoided. Ice entrainment may be reduced by continuous discharge from one location as long as possible during cold conditions. Similarly, the development of long tailings beaches increases the exposure time to the cold and will increase ice entrainment. Should a change of the discharge location be required during cold conditions, the tailings should be discharged at a location where the pond is not frozen.

Figures

N

N 7272500

N 7270000

N 72□7500

E 432500

E 435000

Llama Lake

Llama □ RSA

Llama Open Pit

□mwelt Lake

□mwelt □ RSA

□mwelt Open Pit

□mwelt □nderground Laydown Area

Gira□e Lake

Goose Lake

Propeller Lake

Goose Plant Site

Goose Main Open Pit

Goose Airstrip

TSF Containment Dam

Tailings Storage Facility

Rascal Lake

South Dyke

LEGEND

- Pro□ect Development Area
- All-□eather Roads
- Lakes
- TSF □ater
- Tailings

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1 : 30000

srk consulting

SRK □OB NO.: 1CS020.008

FILE NAME: 1CS020.00□3400 - GA.dwg

Sabina GOLD & SILVER CORP.

BACK RIVER PRO□ECT

pRELIMINARYTSF DESIGN

General Arrangement Plan

DATE: Sept. 2015

APPROVED: IM

FIG. □RE: 1

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