

MEMORANDUM

To:	Australia Hualong	Date:	26 th June 2017
Attn:	Dr Joe Xie	Our Ref:	BR801-00136 EJT M17001
cc:	Laurie Veska	From:	Ed Tuplin

RE: COMSTOCK MINE – GEOCHEMICAL CHARACTERISATION OF CLAY SAMPLES

1. INTRODUCTION

Knight Piésold (KP) were engaged by Australia Hualong (AH) to conduct a geochemical assessment of in-situ clay material intended to be used as capping material for the Swansea waste rock dump at the Comstock mine, which is understood to contain potentially acid forming (PAF) materials. Ten clay samples were made available for testing and sent to Intertek Genalysis (Perth) for geochemical analysis, following gamma irradiation at Steritech (Dandenong). Of the ten samples provided, KP selected six for geochemical analysis. These samples were selected to provide a reasonable geographical spread based on a sampling location plan provided by AH. This sampling plan is reproduced in Figure 1.1.

This memorandum summarises the results of the test work conducted by Intertek Genalysis and an assessment of the geochemical suitability of the material for use in a cover system. Details of the testwork methods and interpretation principles are provided in Appendix A, with laboratory test certificates for the analytical testing provided in Appendix B.

2. GEOCHEMICAL CHARACTERISTICS

2.1 INTRODUCTION

The testwork results are presented and discussed in the following sections. As part of the quality control and assurance program conducted by the laboratory, duplicate analyses were conducted on a randomly selected sample (Sample No. 6). The results presented in the following sections for Sample No. 6 are the average of the original and duplicate tests.

2.2 ACID BASE ACCOUNTING

The results of the analysis are summarised in Table 2.1 and indicate that the samples had sulfur contents varying from negligible (i.e. below the detection limit of 0.01%) to 0.09% which is considered very low. The sulfate analysis results indicate that the majority of sulfur is present as sulfate, with the estimated sulfide concentrations varying from negligible to 0.03%. These sulfide contents equate to very low maximum potential acidity (MPA) values up to 0.9 kg H₂SO₄/t.

The acid neutralising capacity (ANC) of the samples was determined along with the carbonate content. The two results can be used as a check against one another and to identify the contribution of ANC from carbonates and other non-carbonate minerals. The results of the analysis are provided in Table 2.1 and indicate that the samples had low to moderate ANC values of between 2 and 15 kg H₂SO₄/t. However, the ANC estimated as being available from carbonate minerals was typically high, with four of the six samples recording values greater than 16 kg H₂SO₄/t. The results indicate that the carbonate minerals are not fully available to buffer acidity and, as such, were not recorded in the

ANC test. One possible reason may be the presence of siderite (FeCO_3). Siderite does not provide any neutralising benefit because the acid consumed during dissolution is re-released upon oxidation of aqueous iron and precipitation of iron oxyhydroxides. The ANC test method specified by Knight Piésold accounts for the possible presence of siderite by adding hydrogen peroxide (H_2O_2) to the digest solution to ensure that the aqueous iron is oxidised and hydrolysed to re-release any acid consumed by siderite before completion of the back titration. This ensures that the ANC is not overestimated. However, the precipitation of iron oxyhydroxides causes the digest solution to become a distinct orange colour, which was not noted during the ANC test. Therefore, the cause of the variability in measured ANC and carbonate ANC is unclear, but it is recommended that the measured ANC values are relied upon rather than the carbonate ANC values when considering acid forming potential.

All samples recorded negative net acid producing potential (NAPP) values of between -4 and -15 kg $\text{H}_2\text{SO}_4/\text{t}$. These values indicate that the samples have low to moderate excess neutralising capacity.

2.3 NET ACID GENERATION

The net acid generation (NAG) test aids in interpretation of acid formation potential classifications. It also identifies whether the sulfides and neutralising minerals contained in the sample are readily available to produce and consume acid respectively.

The results of the NAG test are given in Table 2.1 and indicate that following extreme oxidation, the final pH of the NAG solutions were circum neutral ranging from 5.4 to 7.4. However, the paste pH results ranged from pH 4.0 to 5.2, including four samples with pH values less than pH 4.5. This indicates that the samples contain residual acidity, possibly from previous sulfide oxidation, whereas ongoing oxidation of the samples is unlikely to produce any further acid above what is already present.

2.4 ACID FORMATION POTENTIAL

The acid formation potential of a sample is typically determined based on the acid base accounting results and the NAG test. The acid base accounting results recorded negative NAPPs and circum neutral NAG pH values. Therefore, applying the standard classification system the clay samples would be classified as Non Acid Forming (NAF), as shown in Figure 2.1. However, based on the residual acidity contained in these samples, further consideration of the acid forming potential is required. This is discussed further in Section 3.1.

Table 2.1: Acid Base Accounting Results

Sample ID	Sulfur Species			ANC	Carbon Species				Calculations			NAG			pH
	S	S-SO ₄	Sulfide-S	ANC	C	TIC	Calcite equivalent	CaCO ₃ -ANC	MPA	ANC/MPA	NAPP	NAG (7.0)	NAG (4.5)	NAGpH	Paste
	%	%	%	kgH ₂ SO ₄ /t	%	%	% CaCO ₃	kgH ₂ SO ₄ /t	kgH ₂ SO ₄ /t		kgH ₂ SO ₄ /t	kgH ₂ SO ₄ /t	kgH ₂ SO ₄ /t	NONE	NONE
Sample No. 1	0.01	0.01	0.00	15	0.22	0.06	0.50	4.9	0.0	N/A	-15	0	0	7.3	4.1
Sample No. 5	0.04	0.01	0.03	9	0.98	0.48	4.00	39.2	0.9	9.8	-8	3	0	5.6	4.0
Sample No. 6	0.03	0.04	0.00	12	0.08	0.01	0.08	0.8	0.0	N/A	-12	0	0	7.4	4.2
Sample No. 8	0.05	0.05	0.00	7	0.42	0.34	2.83	27.8	0.0	N/A	-7	0	0	6.7	5.2
Sample No. 9	0.04	0.05	0.00	2	0.26	0.20	1.67	16.3	0.0	N/A	-2	2	0	5.4	4.3
Sample No. 15	0.09	0.07	0.02	3	1.19	0.74	6.17	60.4	0.6	4.9	-2	1	0	5.8	4.7

Note: Values have been rounded

2.5 MULTI-ELEMENT RESULTS

2.5.1 Element Enrichments

Whole rock multi-element analysis was conducted to assess element enrichments within the samples. Multi-element analysis results were compared to the average crustal abundances to calculate the geochemical abundance indices. The geochemical abundance index (GAI) quantifies an assay result for a particular element in terms of average crustal abundance (ACA). The assay results and ACAs are provided in Table 2.2, with the corresponding GAIs provided in Table 2.3. The results of the assessment are summarised below:

- Overall the samples are considered to have a low to moderate number of element enrichments.
- Sample No. 1 had the lowest number of enrichments being only significantly enriched in antimony and slightly enriched in silver.
- All samples were slightly to highly enriched in silver.
- All samples were significantly to highly enriched in antimony.
- Five of the samples were highly enriched in lead.
- Five of the samples were significantly to highly enriched in arsenic.
- Five of the samples were slightly to highly enriched in selenium.
- Three samples were slightly to significantly enriched in bismuth.
- Three samples were slightly enriched in magnesium.
- Two samples were slightly enriched in manganese.
- Two samples were slightly enriched in tin.
- Single sample enrichments were noted for boron, cadmium, molybdenum and zinc.

2.5.2 Preliminary Soil Quality Screening

The results of the multi-element analysis have also been compared to a set of soil quality screening guidelines. The results are presented in Tables 2.4 to 2.6 and summarised below.

Human Health

- Sample No. 1 met the human health criteria.
- Five samples exceeded the criterion for lead.
- Two samples exceeded the threshold for arsenic.

Ecology

- No samples met the ecological criteria.
- All samples exceeded the threshold for antimony.
- Five samples exceeded the criteria for lead and zinc.
- Four samples exceeded the criteria for arsenic and selenium.
- The threshold for chromium was exceeded in three samples.
- Two samples exceeded the criteria for vanadium, manganese and copper, with a single sample also exceeding the criteria for cadmium, silver and sulfur.

Site Contamination

- Sample No. 1 recorded concentrations below the site contamination criteria.
- Five samples exceeded the threshold for lead.
- Four samples exceeded the criterion for arsenic.
- Three samples exceeded the threshold for antimony.
- Two samples exceeded the criterion for vanadium.
- One sample exceeded the threshold for sulfur.

The implications of the multi-element results are discussed in Section 3.

Table 2.2: Multi-element Assay Results

Element	Unit	ACA	Assay Result					
			Sample No. 1	Sample No. 5	Sample No. 6	Sample No. 8	Sample No. 9	Sample No. 15
Ag	ppm	0.07	0.6	0.9	0.7	1.5	5.3	28.5
Al	ppm	82000	3586	33289	3435	13191	116688	9425
As	ppm	1.5	4	69	43	1185	486	113
B	ppm	10	50	50	50	50	191	50
Ba	ppm	500	2.9	5.7	52.9	19.1	463	1.4
Be	ppm	2.6	0.1	0.3	0.1	0.1	2.3	0.6
Bi	ppm	0.048	0.03	0.94	0.06	0.32	1.69	0.12
Ca	ppm	41000	108	60	82	135	104	50
Cd	ppm	0.11	0.1	0.1	0.2	0.2	0.1	3
Cl	ppm	130	200	200	200	200	200	500
Co	ppm	20	0.7	0.5	3.3	2.9	0.8	0.7
Cr	ppm	100	115	30	5	39	107	13
Cu	ppm	50	10	63	11	49	8	86
F	ppm	950	50	584	186	100	711	235
Fe	ppm	41000	12300	25400	23900	148000	58700	53900
Hg	ppm	0.05	0.09	0.15	0.03	0.18	0.19	0.02
K	ppm	21000	77	41	80	356	34483	75
Mg	ppm	23000	130245	149248	183942	38078	8736	159140
Mn	ppm	950	444	1281	6261	8301	200	1007
Mo	ppm	1.5	0.9	21.4	0.2	2.1	7.3	2.3
Na	ppm	23000	86	315	85	96	318	165
Ni	ppm	80	3	2	1	1	6	4
P	ppm	1000	50	213	50	73	822	363
Pb	ppm	14	54	1169	4136	5656	4188	4419
S	ppm	260	100	400	300	500	400	900
Sb	ppm	0.2	3.0	13.1	7.1	57.8	30.4	29.1
Se	ppm	0.05	0.11	5.07	0.41	4.11	2.52	0.76
Sn	ppm	2.2	2.8	11.8	0.50	20.5	24.1	4.4
Sr	ppm	370	1.05	3.22	1.03	5.86	11.7	0.37
Th	ppm	12	0.15	4.56	0.41	3.82	23.6	1.62
U	ppm	2.4	0.23	6.69	0.38	1.94	7.37	2.63
V	ppm	160	8	643	11	57	527	68
Zn	ppm	75	95	116	64	294	90	678

Table 2.3: Geochemical Abundance Indices

Element	GAI					
	Sample No. 1	Sample No. 5	Sample No. 6	Sample No. 8	Sample No. 9	Sample No. 15
Ag	2	3	2	3	5	6
Al	0	0	0	0	0	0
As	0	4	4	6	6	5
B	1	1	1	1	3	1
Ba	0	0	0	0	0	0
Be	0	0	0	0	0	0
Bi	0	3	0	2	4	0
Ca	0	0	0	0	0	0
Cd	0	0	0	0	0	4
Cl	0	0	0	0	0	1
Co	0	0	0	0	0	0
Cr	0	0	0	0	0	0
Cu	0	0	0	0	0	0
F	0	0	0	0	0	0
Fe	0	0	0	1	0	0
Hg	0	1	0	1	1	0
K	0	0	0	0	0	0
Mg	1	2	2	0	0	2
Mn	0	0	2	2	0	0
Mo	0	3	0	0	1	0
Na	0	0	0	0	0	0
Ni	0	0	0	0	0	0
P	0	0	0	0	0	0
Pb	1	5	6	6	6	6
S	0	0	0	0	0	1
Sb	3	5	4	6	6	6
Se	0	6	2	5	5	3
Sn	0	1	0	2	2	0
Sr	0	0	0	0	0	0
Th	0	0	0	0	0	0
U	0	0	0	0	1	0
V	0	1	0	0	1	0
Zn	0	0	0	1	0	2

Legend:

Not Enriched
Slightly Enriched
Significantly Enriched
Highly Enriched

Table 2.4: Multi-Element Analysis Results and Human Health Screening Guidelines

Element	Human Health-Based Investigation Levels ¹	Sample No. 1	Sample No. 5	Sample No. 6	Sample No. 8	Sample No. 9	Sample No. 15
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	N/G	3.0	13.1	7.1	57.8	30.4	29.1
Arsenic	300	4	69	43	1185	486	113
Barium	N/G	3	6	53	19	463	1
Beryllium	90	0.1	0.3	0.1	0.1	2.3	0.6
Boron	20000	50	50	50	50	191	50
Cadmium	90	0.1	0.1	0.2	0.2	0.1	3
Chromium	N/G	115	30	5	39	107	13
Cobalt	300	0.7	0.5	3.3	2.9	0.8	0.7
Copper	17000	10	63	11	49	8	86
Lead	600	54	1169	4136	5656	4188	4419
Manganese	19000	444	1281	6261	8301	200	1007
Mercury	80	0.09	0.15	0.03	0.18	0.19	0.02
Molybdenum	N/G	0.9	21.4	0.2	2.1	7.3	2.3
Nickel	1200	3	2	1	1	6	4
Phosphorus	N/G	50	213	50	73	822	363
Selenium	700	0.1	5.1	0.4	4.1	2.5	0.8
Silver	N/G	0.6	0.9	0.7	1.5	5.3	28.5
Sulfur	N/G	100	400	300	500	400	900
Sulfate	N/G	100	100	350	500	500	700
Tin	N/G	2.8	11.8	0.5	20.5	24.1	4.4
Vanadium	N/G	8	643	11	57	527	68
Zinc	30000	95	116	64	294	90	678

Notes:

¹ National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1). Health Investigation Levels for Soil Contaminants, Generic Land Use HIL C – Recreational.

Values in red bold indicate where a guideline value has been exceeded.

Table 2.5: Multi-Element Analysis Results and Ecological Screening Guidelines

Element	Ecological Soil Screening Levels ^{2,3}	Sample No. 1	Sample No. 5	Sample No. 6	Sample No. 8	Sample No. 9	Sample No. 15
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	0.27	3.0	13.1	7.1	57.8	30.4	29.1
Arsenic	46	4	69	43	1185	486	113
Barium	2000	3	6	53	19	463	1
Beryllium	21	0.1	0.3	0.1	0.1	2.3	0.6
Boron	N/G	50	50	50	50	191	50
Cadmium	0.36	0.1	0.1	0.2	0.2	0.1	3
Chromium	34	115	30	5	39	107	13
Cobalt	230	0.7	0.5	3.3	2.9	0.8	0.7
Copper	49	10	63	11	49	8	86
Lead	56	54	1169	4136	5656	4188	4419
Manganese	4000	444	1281	6261	8301	200	1007
Mercury	N/G	0.09	0.15	0.03	0.18	0.19	0.02
Molybdenum	N/G	0.9	21.4	0.2	2.1	7.3	2.3
Nickel	130	3	2	1	1	6	4
Phosphorus	2000	50	213	50	73	822	363
Selenium	0.63	0.1	5.1	0.4	4.1	2.5	0.8
Silver	14	0.6	0.9	0.7	1.5	5.3	28.5
Sulfur	600	100	400	300	500	400	900
Sulfate	2000	100	100	350	500	500	700
Tin	N/G	2.8	11.8	0.5	20.5	24.1	4.4
Vanadium	280	8	643	11	57	527	68
Zinc	79	95	116	64	294	90	678

Notes:

² United States Environmental Protection Agency (U.S. EPA) Ecological Soil Screening Levels (Eco-SSLs), <http://www.epa.gov/ecotox/ecossl/> (mammalian wildlife).

³ Ecological guideline values for phosphorous, sulfur and sulfate are based on National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999). These former Australian ecological investigation levels for urban areas have been included for reference purposes in the absence of other more applicable ecological assessment criteria. Applies to phosphorous, sulfur and sulfate.

Values in red bold indicate where a guideline value has been exceeded.

Table 2.6: Multi-Element Analysis Results and Site Contamination Guidelines

Element	Soil Remediation Intervention Values ⁴	Sample No. 1	Sample No. 5	Sample No. 6	Sample No. 8	Sample No. 9	Sample No. 15
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	15	3.0	13.1	7.1	57.8	30.4	29.1
Arsenic	55	4	69	43	1185	486	113
Barium	625	3	6	53	19	463	1
Beryllium	30	0.1	0.3	0.1	0.1	2.3	0.6
Boron	N/G	50	50	50	50	191	50
Cadmium	12	0.1	0.1	0.2	0.2	0.1	3
Chromium	380	115	30	5	39	107	13
Cobalt	240	0.7	0.5	3.3	2.9	0.8	0.7
Copper	190	10	63	11	49	8	86
Lead	530	54	1169	4136	5656	4188	4419
Manganese	N/G	444	1281	6261	8301	200	1007
Mercury	10	0.09	0.15	0.03	0.18	0.19	0.02
Molybdenum	200	0.9	21.4	0.2	2.1	7.3	2.3
Nickel	210	3	2	1	1	6	4
Phosphorus	N/G	50	213	50	73	822	363
Selenium	100	0.1	5.1	0.4	4.1	2.5	0.8
Silver	15	0.6	0.9	0.7	1.5	5.3	28.5
Sulfur	N/G	100	400	300	500	400	900
Sulfate	N/G	100	100	350	500	500	700
Tin	900	2.8	11.8	0.5	20.5	24.1	4.4
Vanadium	250	8	643	11	57	527	68
Zinc	720	95	116	64	294	90	678

Notes:

⁴ Netherlands Ministry of Housing, Spatial Planning and the Environment (VROM) 2000. Circular on Target Values and Intervention Values for Soil Remediation, Reference DBO/1999226863. Soil remediation intervention values. In the absence of intervention values for beryllium, selenium, silver, tin and vanadium, "indicative levels for serious soil contamination" have been applied.

Values in red bold indicate where a guideline value has been exceeded.

2.6 DISTILLED WATER EXTRACT

The distilled water extract test was conducted to examine the solubility of various elements contained within the samples. The results of the testing give an indication of short term leaching potential of the samples.

The results of the distilled water extract tests have been compared to reference water quality standards for release of water from mining operations and livestock drinking water. As shown in Table 2.7, no samples met the reference criteria, with all samples recording pH values below the lower bound cut off of pH 6. In addition, elevated concentrations of certain metals were recorded, notably lead in five samples. Two samples also exceeded the threshold for aluminium, with single sample exceedances of arsenic, cadmium, iron and zinc. The poorest water quality was recorded in Sample No. 15, with lead over one hundred times the water quality criterion and zinc more than thirty times the threshold.

The comparison of the water extract results with Australian drinking water guidelines is shown in Table 2.8. All samples recorded pH values below the lower bound drinking water cut-off, together with exceedances in dissolved lead. In addition, five samples exceeded the drinking water standard for manganese, with four samples exceeding the aluminium guideline value. Three samples exceeded the guideline for antimony, while two samples exceeded arsenic and iron and single samples exceeded cadmium, nickel, selenium and zinc. The highest level of exceedance was recorded for lead, which ranged from twice the threshold in Sample No. 8 to over 1,000 times the drinking water limit in Sample No. 15.

The implications of these results are discussed in Section 3.

Table 2.6: Distilled Water Extract Comparison to Release and Livestock Guidelines

Parameter	Reference Release Value (mg/L)	Sample No. 1	Sample No. 5	Sample No. 6	Sample No. 8	Sample No. 9	Sample No. 15
pH	9	4.4	4.3	4.3	5.3	4.4	4.8
TDS	2000	79	129	76	50	56	130
Aluminium	5	8.06	13.8	0.17	0.01	0.22	0.82
Antimony	N/G	0.005	0.03	0.0001	0.00003	0.0002	0.06
Arsenic	0.1	0.01	0.12	0.001	0.003	0.001	0.04
Barium	N/G	0.01	0.02	0.13	0.002	0.02	0.01
Boron	5	0.02	0.03	0.03	0.01	0.01	0.01
Cadmium	0.01	0.0006	0.0005	0.0008	0.0005	0.0009	0.25
Calcium	1000	2.3	4.2	2.8	1.3	0.8	2.9
Chloride	N/G	5	14	5	6	9	7
Chromium	1	0.01	0.02	0.01	0.01	0.01	0.01
Cobalt	1	0.012	0.004	0.05	0.002	0.0002	0.006
Copper	0.3	0.13	0.10	0.01	0.01	0.01	0.05
Fluoride	2	0.10	0.10	0.10	0.10	0.10	0.10
Iron	2	3.2	0.9	0.01	0.01	0.3	0.6
Lead	0.1	0.21	1.95	4.9	0.02	0.19	10.9
Magnesium	2000	2.9	5.8	4.4	1.6	1.4	6.1
Manganese	N/G	0.18	0.45	29.8	2.35	0.06	1.3
Mercury	0.002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Molybdenum	0.15	0.002	0.04	0.0001	0.0001	0.0001	0.0001
Nickel	0.5	0.03	0.02	0.01	0.02	0.01	0.02
Phosphorus	N/G	0.10	0.10	0.10	0.10	0.10	0.10
Selenium	0.02	0.002	0.01	0.002	0.002	0.004	0.002
Silver	0.5	0.00001	0.00001	0.00002	0.00001	0.00001	0.00001
Sodium	N/G	4	6	4	4	5	5
Sulfate	1000	15	56	85	8	4	64
Tin	N/G	0.0001	0.001	0.0001	0.0002	0.0001	0.0001
Uranium	0.2	0.0005	0.002	0.0001	0.00001	0.00004	0.0005
Vanadium	N/G	0.06	1.19	0.01	0.01	0.01	0.01
Zinc	0.5	0.16	0.26	0.05	0.01	0.08	17.1

Notes:

N/G = No guideline.

Values in red bold indicate where a guideline value has been exceeded.

Table 2.7: Distilled Water Extract Comparison to Drinking Water Guideline Values

Parameter	Reference Drinking Water Value (mg/L)	Sample No. 1	Sample No. 5	Sample No. 6	Sample No. 8	Sample No. 9	Sample No. 15
pH	8.5	4.4	4.3	4.3	5.3	4.4	4.8
TDS	600	79	129	76	50	56	130
Aluminium	0.2	8.06	13.8	0.17	0.01	0.22	0.82
Antimony	0.003	0.005	0.03	0.0001	0.00003	0.0002	0.06
Arsenic	0.01	0.01	0.12	0.001	0.003	0.001	0.04
Barium	2	0.01	0.02	0.13	0.002	0.02	0.01
Boron	4	0.02	0.03	0.03	0.01	0.01	0.01
Cadmium	0.002	0.0006	0.0005	0.0008	0.0005	0.0009	0.2466
Calcium	N/G	2.3	4.2	2.8	1.3	0.8	2.9
Chloride	250	5	14	5	6	9	7
Chromium	N/G	0.01	0.02	0.01	0.01	0.01	0.01
Cobalt	N/G	0.012	0.004	0.05	0.002	0.0002	0.006
Copper	1	0.13	0.10	0.01	0.01	0.01	0.05
Fluoride	1.5	0.10	0.10	0.10	0.10	0.10	0.10
Iron	0.3	3.2	0.9	0.01	0.01	0.3	0.6
Lead	0.01	0.21	1.95	4.9	0.02	0.19	10.9
Magnesium	N/G	2.9	5.8	4.4	1.6	1.4	6.1
Manganese	0.1	0.18	0.45	29.8	2.35	0.06	1.3
Mercury	0.001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Molybdenum	0.05	0.002	0.04	0.0001	0.0001	0.0001	0.0001
Nickel	0.02	0.03	0.02	0.01	0.02	0.01	0.02
Phosphorus	N/G	0.10	0.10	0.10	0.10	0.10	0.10
Selenium	0.01	0.002	0.01	0.002	0.002	0.004	0.002
Silver	0.1	0.00001	0.00001	0.00002	0.00001	0.00001	0.00001
Sodium	180	4	6	4	4	5	5
Sulfate	250	15	56	85	8	4	64
Tin	N/G	0.0001	0.001	0.0001	0.0002	0.0001	0.0001
Uranium	0.017	0.0005	0.002	0.0001	0.00001	0.00004	0.0005
Vanadium	N/G	0.06	1.19	0.01	0.01	0.01	0.01
Zinc	3	0.16	0.26	0.05	0.01	0.08	17.1

Notes:

N/G = No guideline.

Values in red bold indicate where a guideline value has been exceeded.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 ACID FORMING POTENTIAL

The acid forming potential of samples is usually based on the NAPP and NAG test results. Following this classification method, the Comstock clay samples would be classified as non acid forming (NAF). However, the paste pH values ranged from pH 4 to 5.2 and the distilled water extracts became acidic with pH measuring between 4.3 and 5.3. As such, these samples have residual acidity which is readily released upon contact with water. Unlike the majority of samples, where acid generation is caused by sulfide oxidation, these samples have already oxidised and acidified. Therefore, in consideration of the testwork results, it is recommended that these samples be considered "Potentially Acid Forming – Low Capacity".

3.2 ELEMENT ENRICHMENT

The samples were found to have a moderate level of element enrichments with silver, arsenic, lead, antimony and selenium the most commonly enriched metals and metalloids. Comparison of the multi-element results with soil quality screening guidelines indicate that with the materials would not be suitable for use in the outer surface of a cover system. As a minimum, the clay would need to be covered with a growth medium.

3.3 LEACHING POTENTIAL

The potential for the clay samples to release metals and metalloids was assessed using the distilled water extract test. Although the test encourages metal release through bottle rolling the solutions for 24 hours, it is a useful indicator as to whether the metals are readily soluble in water. The distilled water extract solution for each sample became weakly acidic, with several metals released at elevated concentrations when compared to reference guidelines for release, livestock drinking water and human drinking water guidelines. Notably lead was elevated in all samples ranging from 0.02 to almost 11 mg/L, which corresponds to twice to over one thousand times the drinking water value for lead respectively. Individual samples also exceeded the drinking water guidelines by over one hundred times for cadmium and manganese. As such, the run-off from this material is likely to be of a poor quality not suitable for release off site without prior treatment.

3.4 SUITABILITY OF CLAY IN COVER SYSTEM

Based on the geochemical testing, the clay is not considered suitable for use in a waste rock cover system primarily due to the potential for leaching of metals and metalloids. As such, it is recommended that alternative sources of clay away from mineralised zones be assessed for geochemical and geotechnical suitability.

We trust this memorandum report meets your current requirements, however, please do not hesitate to contact us should you have any queries.

Yours faithfully

KNIGHT PIÉSOLD PTY LTD



ED TUPLIN

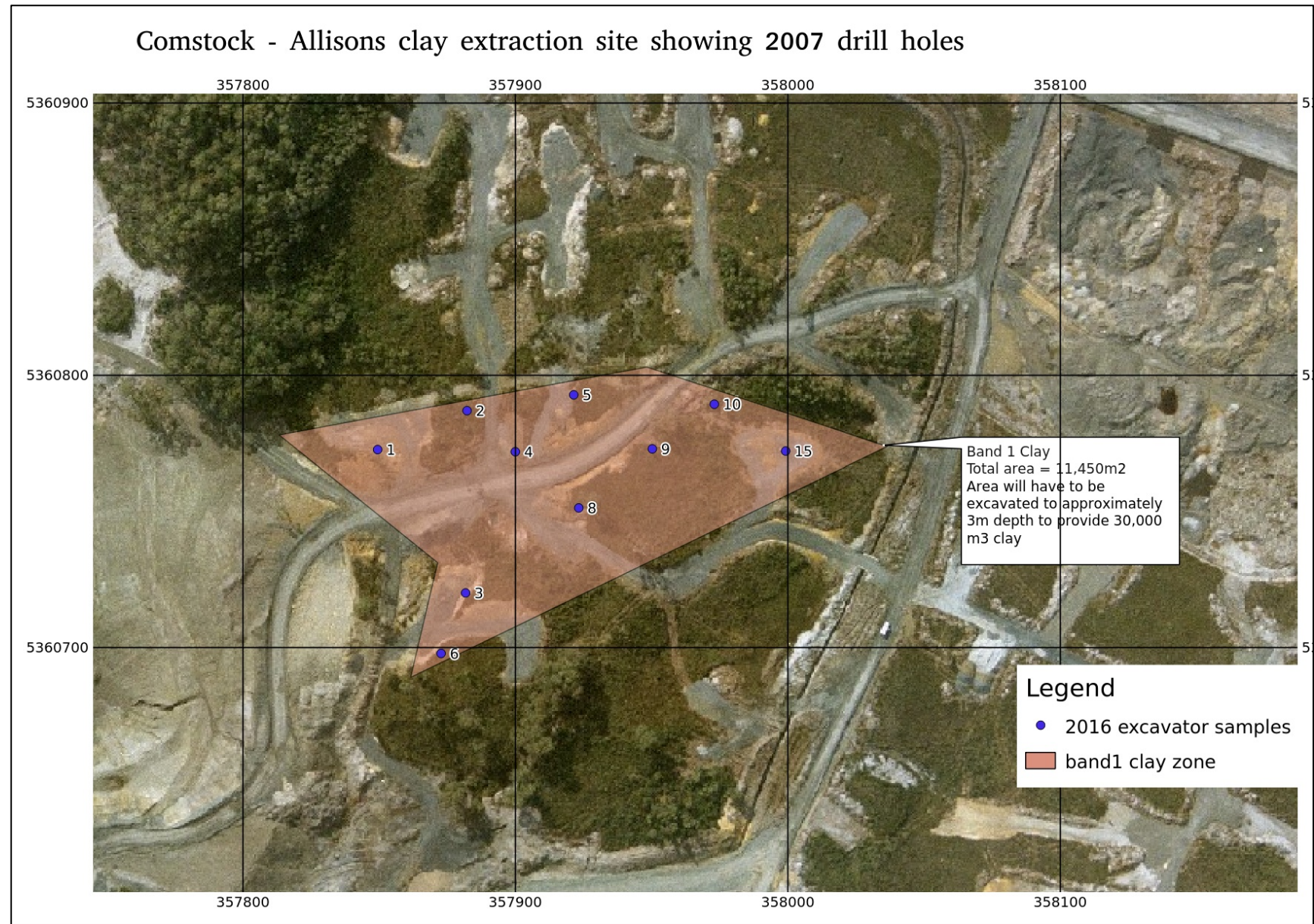
Senior Project Engineer



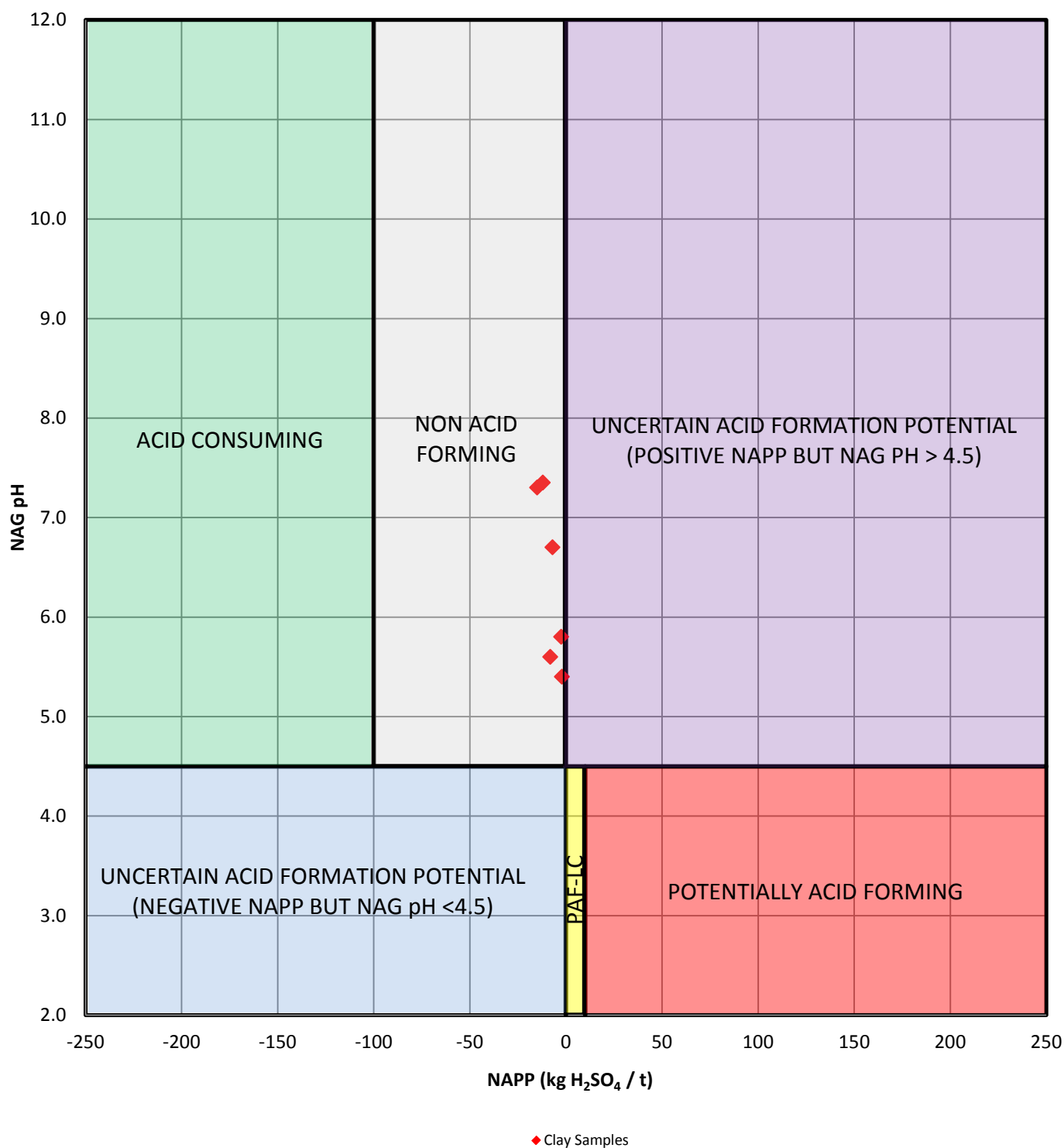
TIM ROWLES

Regional Manager, Queensland

FIGURES



Acid Formation Potential



Acid Formation Potential	NAPP (kg H ₂ SO ₄ / t)	NAG pH
Potential Acid Forming (PAF)	>10	<4.5
Potential Acid Forming - Low Capacity (PAF - LC)	0 to 10	<4.5
Non Acid Forming (NAF)	Negative	≥4.5
Acid Consuming (AC)	Less than - 100	≥4.5
Uncertain	Positive	≥4.5
	Negative	<4.5

APPENDIX A

Testwork Methods and Interpretation Principles

A. TESTWORK METHODS

A.1 ACID BASE ACCOUNTING

Acid base accounting (ABA) assesses a sample's potential to form acid from the oxidation of sulfides and the ability to neutralise acid by the dissolution of minerals, especially carbonates, contained in the sample. The test work methods used were based on the ABA methodology defined in the Mine Environment Neutral Drainage (MEND) Acid Rock Drainage Prediction Manual (Ref. 1) and Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (Ref. 2), as detailed below.

Total carbon and total inorganic carbon were determined by LECO induction furnace, with infrared detection. Sulfate sulfur was determined by HCl digest with ICP detection. Acid Neutralising Capacity (ANC) was determined by digestion in a standard solution of HCl, followed by back titration with NaOH to determine the amount of acid consumed. The technique used was based on Sobek et al (Ref. 3), however, a siderite correction step has been added to the method, after Stewart et al (Ref. 4).

The results of the ABA test work are used to calculate the Maximum Potential Acidity (MPA) which is a measure of the maximum amount of sulfuric acid which can be produced from the total oxidation of all sulfides within the sample, assuming all sulfide is present as pyrite.

The Net Acid Producing Potential (NAPP) is the balance between the Maximum Potential Acidity and the Acid Neutralising Capacity. A negative NAPP indicates that there is an excess neutralising capacity and a positive NAPP indicates there is excess potential acidity.

A.2 NET ACID GENERATION

Net Acid Generation (NAG) test work is a direct measure of the sample's ability to produce acid through sulfide oxidation. The addition of hydrogen peroxide to samples causes rapid oxidation of the contained sulfides to produce sulfuric acid.

The procedure employed is based upon the Static NAG Test (Ref. 5 and 6). The static NAG test involves the addition of 250 mL of 15% hydrogen peroxide to 2.5 g of pulverised sample. The sample is allowed to react overnight prior to heating for a period of three hours. Once the sample has cooled the pH of the sample is measured prior to titration back to pH 4.5 and 7 to determine the acidity produced by the oxidation reactions.

A.3 ACID FORMING POTENTIAL

The acid formation potential of a sample is calculated based on the acid base accounting, i.e. the balance between a sample's ability to produce acid from the oxidation of sulfide minerals (MPA) and the sample's ability to neutralise acid by the dissolution of alkaline minerals contained within the sample (ANC).

Historically a safety margin was applied to ratio between the ANC and MPA to allow for variability in the rates of acid production and neutralisation processes and the potential for geographic separation of the acid producing and acid neutralising phases. This safety margin was generally set by industry at 2 in North America and 3 in Australia.

With recent advances in the understanding and acceptance of the NAG test there has been a move away from this method of classifying materials based solely on the ANC and MPA as these calculated parameters do not take into consideration the true availability of acid producing and acid neutralising phases.

Knight Piésold prefers to utilise the results of the acid base accounting in combination with the NAG testing results to classify the acid formation potential of materials.

Knight Piésold's classification system is summarised in Table A.1. It is based on the Australian Government publication; Managing Acidic and Metalliferous Drainage (Ref. 7) and is broadly similar to the classification system contained within the AMIRA ARD Test Handbook (Ref. 8), which is advocated by the Global Acid Rock Drainage Guidelines (Ref. 9).

Table A.1: Acid Formation Potential Classification System

Acid Formation Potential Class	NAPP (kg H ₂ SO ₄ /t)	NAG pH
Potentially Acid Forming (PAF)	>10	<4.5
Potentially Acid Forming – Low Capacity (PAF-LC)	0 to 10	<4.5
Non Acid Forming (NAF)	Negative	≥4.5
Acid Consuming (AC)	Less than -100	≥4.5
Uncertain (UC)	Positive	≥4.5
	Negative	<4.5

A.4 MULTI-ELEMENT ANALYSIS OF SOLIDS

A.4.1 Geochemical Enrichments

Multi-element analysis of the samples was conducted to assess element enrichments. The four acid digestion method used results in near total digestion of the sample to assess the whole rock geochemistry.

Multi-element analysis results were compared to average crustal abundances to calculate the geochemical abundance indices. The Geochemical Abundance Index (GAI) quantifies an assay result for a particular element in terms of average crustal abundance.

The GAI is calculated from the following formula:

$$\text{GAI} = \text{Log}_2 (\text{C}_n / (1.5 \times \text{B}_n))$$

Where:

C_n = measured concentration of element in sample

B_n = average crustal abundance (Bowen, Ref. 10)

The GAI is expressed on a scale of 0 to 6, with 0 indicating that the element concentration is less than or similar to average crustal abundance, and a GAI of 6 indicating an element concentration of more than 96 times the average crustal abundance. The enrichment ranges for GAIs are as follows:

- GAI = 0 represents <3 times crustal abundance.
- GAI = 1 represents 3 to 6 times crustal abundance.
- GAI = 2 represents 6 to 12 times crustal abundance.
- GAI = 3 represents 12 to 24 times crustal abundance.
- GAI = 4 represents 24 to 48 times crustal abundance.
- GAI = 5 represents 48 to 96 times crustal abundance.
- GAI = 6 represents more than 96 times crustal abundance.

Knight Piésold has assigned an arbitrary scale to the GAI, with indices of 0 and 1 being classified as “not enriched”, an index of 2 being classed as “slightly enriched”, indices of 3 and 4 being classed as “significantly enriched” and indices of 5 and 6 being classified as “highly enriched”.

A.4.1 Soil Quality Screening for Closure Planning

The multi-element analysis results were also compared to guideline concentrations for soil quality based on risk to human health and ecology for preliminary assessment of possible closure requirements, such as construction of engineered cover systems or limiting land use / access.

The Australian National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (Ref. 11) has been used to assess risk to human health, based on an assumed 'recreational' closure land use. This assumes the final landform will comprise public open space such as parks and playing fields rather than undeveloped public open space where the potential for exposure will be lower. However, these values assume that no planting of crops for human consumption will occur.

To assess ecological risk, the U.S. Environmental Protection Agency Ecological Soil Screening Levels (Eco-SSLs) (Ref. 12) have been applied. These values apply to sites where terrestrial organisms may be exposed directly or indirectly to contaminated soil. The Eco-SSL values for mammalian wildlife have been adopted for this study. The Eco-SSLs do not provide guideline values for sulfur, sulfate or phosphorous. Therefore, the former National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999) (Ref. 13) ecological investigation levels for these substances have been included for reference purposes in the absence of other more applicable ecological assessment criteria.

The Netherlands Ministry of Housing, Spatial Planning and the Environment (VROM) has developed a series of soil-screening values for contaminated sites as part of the Dutch Soil Protection Act (VROM 2000) (Ref. 14). Soil quality is assessed and managed using target and intervention values which are independent of land use. Soils with contaminant concentrations below target values are considered to be at no risk and no restrictions on their use have been set. Soils with contaminant concentrations exceeding the intervention values require remediation as a matter of urgency, as the functional properties of the soil for humans, plant and animal life is seriously impaired or threatened. Therefore, for preliminary screening purposes, the intervention values have been applied in this study. For certain substances where intervention values have not been set, so-called "indicative levels for serious contamination" have been provided. These have also been included in this study, where appropriate.

The establishment of these soil quality screening values is to allow for evaluation only and it is not implied by production of these values that the Comstock Mine will be required to meet these reference levels or that these reference levels should be used as the regulatory framework.

A.5 DISTILLED WATER EXTRACT

Distilled water extract tests were conducted to assess the potential for leaching of environmentally significant elements from the samples, which could have a detrimental effect on the quality of surface water or near surface groundwater. These tests differ from the multi-element tests in that they only record the readily soluble elements, whereas the multi-element tests give the total elemental enrichment of the samples.

The procedure employed was based on the Shake Flask Method as described in the Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia (Ref. 2), as described below.

The samples were crushed to minus 2 mm particle size, with 50 grams of each sample then mixed with 150 mL of deionized water in suitably sized vessels. The mixtures were then bottle rolled for 24 hours. The pH and the conductivity of the solutions were then measured and the bottles left to stand for a minimum of 3 hours. The solution was then siphoned off and filtered through a 0.45 µm membrane before preservation of the solution

by acid addition prior to analysis. The analysis was by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) or Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) depending on the element being analysed and the detection limits required

The results have been compared to a set of reference water quality standards, which are discussed in Section A.6.

A.6 REFERENCE WATER QUALITY STANDARDS

To allow assessment of the results of the distilled water extract analysis, two sets of reference values have been established as follows:

- Reference Set 1 – IFC guidelines for release of water from mining operations (Ref. 15 and 16) and the ANZECC water quality guideline for livestock drinking water (Ref. 17). These reference values are summarised in Table A.2.
- Reference Set 2 – Australian drinking water standards (Ref. 18). These reference values are presented in Table A.3.

The establishment of these reference water quality values is to allow for evaluation only and it is not implied by production of the reference water quality values that the Comstock Mine will be required to meet these reference levels or that these reference levels should be used as the regulatory framework.

Table A.2: Reference Guidelines for Water Release and Livestock Drinking Water

Parameter	Unit	ANZECC Livestock	IFC 2004	IFC 2007	Adopted Reference Level
pH	S.U.		6 to 9	6 to 9	6 to 9
TDS	mg/kg	2000			2000
Cyanide-Total	mg/L			1	1
Cyanide-WAD	mg/L		0.5	0.5	0.5
Cyanide-Free	mg/L			0.1	0.1
Aluminum	mg/L	5			5
Antimony	mg/L				N/G
Arsenic	mg/L	0.5	0.1	0.1	0.1
Barium	mg/L				N/G
Boron	mg/L	5			5
Cadmium	mg/L	0.01	0.1	0.05	0.01
Calcium	mg/L	1000			1000
Chloride	mg/L				N/G
Chromium	mg/L	1			1
Cobalt	mg/L	1			1
Copper	mg/L	0.4	0.5	0.3	0.3
Fluoride	mg/L	2	20		2
Iron	mg/L		3.5	2	2
Lead	mg/L	0.1	0.1	0.2	0.1
Magnesium	mg/L	2000			2000
Manganese	mg/L				N/G
Mercury	mg/L	0.002	0.01	0.002	0.002
Molybdenum	mg/L	0.15			0.15
Nickel	mg/L	1	0.5	0.5	0.5
Phosphorus	mg/L				N/G
Selenium	mg/L	0.02	0.1		0.02
Silver	mg/L		0.5		0.5
Sodium	mg/L				N/G
Sulfate	mg/L	1000			1000
Tin	mg/L				N/G
Uranium	mg/L	0.2			0.2
Vanadium	mg/L				N/G
Zinc	mg/L	20	2	0.5	0.5

N/G – No guideline

Table A.3: Australian Drinking Water Guidelines

Parameter	Unit	Health	Aesthetic	Adopted Reference Level
pH	S.U.		6.5 to 8.5	6.5 to 8.5
TDS	mg/kg		600	600
Cyanide-Total	mg/L	0.08		0.08
Cyanide-WAD	mg/L			N/G
Cyanide-Free	mg/L			N/G
Aluminum	mg/L		0.2	0.2
Antimony	mg/L	0.003		0.003
Arsenic	mg/L	0.01		0.01
Barium	mg/L	2.0		2.0
Boron	mg/L	4		4
Cadmium	mg/L	0.002		0.002
Calcium	mg/L			N/G
Chloride	mg/L		250	250
Chromium	mg/L			N/G
Cobalt	mg/L			N/G
Copper	mg/L	2	1	1
Fluoride	mg/L	1.5		1.5
Iron	mg/L		0.3	0.3
Lead	mg/L	0.01		0.01
Magnesium	mg/L			N/G
Manganese	mg/L	0.5	0.1	0.1
Mercury	mg/L	0.001		0.001
Molybdenum	mg/L	0.05		0.05
Nickel	mg/L	0.02		0.02
Phosphorus	mg/L			N/G
Selenium	mg/L	0.01		0.01
Silver	mg/L	0.1		0.1
Sodium	mg/L		180	180
Sulfate	mg/L	500	250	250
Tin	mg/L			N/G
Uranium	mg/L	0.02		0.02
Vanadium	mg/L			N/G
Zinc	mg/L		3	3

N/G – No guideline

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12. United States Environmental Protection Agency (U.S. EPA) Ecological Soil Screening Levels (Eco-SSLs), <http://www.epa.gov/ecotox/ecossl/>.
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15. IFC (2004). IFC Environmental, Health and Safety Guidelines for Precious Metal Mining (Draft).
16. IFC (2007). IFC Environmental, Health and Safety Guidelines for Mining.
17. Australian and New Zealand Environmental and Conservation Council (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
18. NHMRC, NRMCC (2011). Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra.

APPENDIX B

Laboratory Reports

ANALYTICAL REPORT

KNIGHT PIESOLD PTY LIMITED
PO Box 6837
EAST PERTH, W.A. 6892
AUSTRALIA

JOB INFORMATION

JOB CODE : 752.0/1703716
No. of SAMPLES : 7
No. of ELEMENTS : 46
CLIENT O/N : BR801-00316/01 (Job 1 of 0)
SAMPLE SUBMISSION No. : BR801-00316/01 SS17001
PROJECT : COMSTOCK
STATE : Other
DATE RECEIVED : 14/03/2017
DATE COMPLETED : 12/04/2017
DATE PRINTED : 12/04/2017
ANALYSING LABORATORY : Intertek Genalysis Perth

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
() = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method
OV = Value over-range for Package

MAIN OFFICE AND LABORATORY NATA: 3244 3273

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Tel: +61 7 4774 3655 Fax: +61 7 4774 4692

SAMPLE DETAILS

DISCLAIMER

Intertek Genalysis wishes to make the following disclaimer pertaining to the accompanying analytical results.

All work is performed in accordance with the Intertek Minerals Standard Terms and Conditions of work <http://www.intertek.com/terms/>

This report relates specifically to the sample(s) that were drawn and/or provided by the client or their nominated third party. The reported result(s) provide no warranty or verification on the sample(s) representing any specific goods and/or shipment and only relate to the sample(s) as received and tested. This report was prepared solely for the use of the client named in this report. Intertek accepts no responsibility for any loss, damage or liability suffered by a third party as a result of any reliance upon or use of this report.

The results provided are not intended for commercial settlement purposes.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Intertek Genalysis accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of \$4.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at \$150.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

1. Note: Detection Limit only apply when TDS <100mg/l for MS and TDS<5000mg/l for OES except when indicated in spreadsheet

ANALYSIS

ELEMENTS	Ag	Al	ANC	As	B	Ba
UNITS	ppm	ppm	kgH2SO4/t	ppm	ppm	ppm
DETECTION LIMIT	0.1	50	1	1	50	0.1
DIGEST	4AB/	4AB/	ANCx/	4AB/	FP1/	4AB/
ANALYTICAL FINISH	MS	OE	VOL	MS	OE	MS
SAMPLE NUMBERS						
0001 1	0.6	3586	15	4	X	2.9
0002 5	0.9	3.33%	9	69	X	5.7
0003 6	0.7	3446	12	43	X	51.6
0004 8	1.5	1.32%	7	1185	X	19.1
0005 9	5.3	11.67%	2	486	191	463.3
0006 15	28.5	9425	3	113	X	1.4

CHECKS

0001 6	0.7	3423	12	43	X	54.2
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STANDARDS

0001 0.5%NaCl-1						
0002 AMIS0160					642	
0003 AMIS0343						
0004 ANC-2			120			
0005 HgSTD-6						
0006 NAG Std 3						
0007 OREAS 45d						
0008 OREAS 922	0.9	7.33%		8		467.6
0009 OREAS 97.01						
0010 PD-1						
0011 TOC-1						
0012 AMIS0161					579	
0013 AMIS0162					382	

BLANKS

0001 Control Blank	X	X	0	X	X	X
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ANALYSIS

ELEMENTS	Be	Bi	C	Ca	Cd	Cl
UNITS	ppm	ppm	%	ppm	ppm	%
DETECTION LIMIT	0.1	0.01	0.01	50	0.1	0.02
DIGEST	4AB/	4AB/		4AB/	4AB/	CL1/
ANALYTICAL FINISH	MS	MS	/CSA	OE	MS	COL
SAMPLE NUMBERS						
0001 1	X	0.03	0.22	108	X	X
0002 5	0.3	0.94	0.98	60	X	X
0003 6	X	0.05	0.07	88	0.2	X
0004 8	0.1	0.32	0.42	135	0.2	X
0005 9	2.3	1.69	0.26	104	X	X
0006 15	0.6	0.12	1.19	X	3.0	0.05

CHECKS

0001 6	X	0.06	0.08	76	0.2	X
--------	---	------	------	----	-----	---

STANDARDS

0001 0.5%NaCl-1						0.31
0002 AMIS0160						
0003 AMIS0343						
0004 ANC-2						
0005 HgSTD-6						
0006 NAG Std 3						
0007 OREAS 45d			1.03			
0008 OREAS 922	3.0	9.95		4791	0.3	
0009 OREAS 97.01						
0010 PD-1						
0011 TOC-1						
0012 AMIS0161						
0013 AMIS0162						

BLANKS

0001 Control Blank	X	X	X	X	X	X
--------------------	---	---	---	---	---	---

ANALYSIS

ELEMENTS	Co	ColourChange	Cr	Cu	EC	F
UNITS	ppm	NONE	ppm	ppm	uS/cm	ppm
DETECTION LIMIT	0.1	0	5	1	10	50
DIGEST	4AB/	ANCx/	4AB/	4AB/	Paste/	FC7/
ANALYTICAL FINISH	MS	QUAL	OE	OE	MTR	SIE
SAMPLE NUMBERS						
0001 1	0.7	No	115	10	257	X
0002 5	0.5	No	30	63	393	584
0003 6	3.2	No	X	10	432	213
0004 8	2.9	No	39	49	117	100
0005 9	0.8	No	107	8	95	711
0006 15	0.7	No	13	86	354	235

CHECKS

0001 6	3.4	No	X	11	438	159
--------	-----	----	---	----	-----	-----

STANDARDS

0001 0.5%NaCl-1						
0002 AMIS0160						
0003 AMIS0343						2183
0004 ANC-2						
0005 HgSTD-6						
0006 NAG Std 3						
0007 OREAS 45d						
0008 OREAS 922	20.3		77	2102		
0009 OREAS 97.01						
0010 PD-1						
0011 TOC-1						
0012 AMIS0161						
0013 AMIS0162						

BLANKS

0001 Control Blank	X		X	X	X	X
--------------------	---	--	---	---	---	---

ANALYSIS

ELEMENTS	Fe	Final-pH	Fizz-Rate	Hg	K	Mg
UNITS	%	NONE	NONE	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.1	1	0.01	20	20
DIGEST	4AB/	ANCx/	ANCx/	HG1/	4AB/	4AB/
ANALYTICAL FINISH	OE	MTR	QUAL	CV	OE	OE
SAMPLE NUMBERS						
0001 1	1.23	1.0	X	0.09	77	13.02%
0002 5	2.54	1.0	X	0.15	41	14.92%
0003 6	2.38	1.1	X	0.03	75	18.46%
0004 8	14.80	1.1	X	0.18	356	3.81%
0005 9	5.87	1.1	X	0.19	3.45%	8736
0006 15	5.39	1.1	X	0.02	75	15.91%

CHECKS

0001 6	2.40	1.1	X	0.03	84	18.32%
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STANDARDS

0001 0.5%NaCl-1						
0002 AMIS0160						
0003 AMIS0343						
0004 ANC-2		1.4				
0005 HgSTD-6				1.70		
0006 NAG Std 3						
0007 OREAS 45d						
0008 OREAS 922	5.38				2.47%	1.55%
0009 OREAS 97.01						
0010 PD-1						
0011 TOC-1						
0012 AMIS0161						
0013 AMIS0162						

BLANKS

0001 Control Blank	X	1.0		X	X	X
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ANALYSIS

ELEMENTS	Mn	Mo	Na	NAG	NAGpH	NAG(4.5)
UNITS	ppm	ppm	ppm	kgH2SO4/t	NONE	kgH2SO4/t
DETECTION LIMIT	1	0.1	20	1	0.1	1
DIGEST	4AB/	4AB/	4AB/	NAGx/	NAGx/	NAGx/
ANALYTICAL FINISH	OE	MS	OE	VOL	MTR	VOL
SAMPLE NUMBERS						
0001 1	444	0.9	86	0	7.3	0
0002 5	1281	21.4	315	3	5.6	0
0003 6	6320	0.2	85	0	7.4	0
0004 8	8301	2.1	96	0	6.7	0
0005 9	200	7.3	318	2	5.4	0
0006 15	1007	2.3	165	1	5.8	0

CHECKS

0001 6	6202	0.2	85	0	7.3	0
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STANDARDS

0001 0.5%NaCl-1						
0002 AMIS0160						
0003 AMIS0343						
0004 ANC-2						
0005 HgSTD-6						
0006 NAG Std 3				24	2.5	20
0007 OREAS 45d						
0008 OREAS 922	837	0.8	4274			
0009 OREAS 97.01						
0010 PD-1						
0011 TOC-1						
0012 AMIS0161						
0013 AMIS0162						

BLANKS

0001 Control Blank	X	X	X	5	4.3	0
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ANALYSIS

ELEMENTS	Ni	P	Pb	pH	pH Drop	S
UNITS	ppm	ppm	ppm	NONE	NONE	%
DETECTION LIMIT	1	50	2	0.1	0.1	0.01
DIGEST	4AB/	4AB/	4AB/	Paste/	ANCx/	
ANALYTICAL FINISH	OE	OE	MS	MTR	MTR	/CSA
SAMPLE NUMBERS						
0001 1	3	X	54	4.1	4.0	X
0002 5	2	213	1169	4.0		0.04
0003 6	X	X	4122	4.2		0.03
0004 8	X	73	5656	5.2		0.05
0005 9	6	822	4188	4.3		0.04
0006 15	4	363	4419	4.7	3.9	0.09

CHECKS

0001 6	1	X	4150	4.2		0.03
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STANDARDS

0001 0.5%NaCl-1						
0002 AMIS0160						
0003 AMIS0343						
0004 ANC-2						
0005 HgSTD-6						
0006 NAG Std 3						
0007 OREAS 45d						0.04
0008 OREAS 922	37	646	70			
0009 OREAS 97.01						
0010 PD-1						
0011 TOC-1						
0012 AMIS0161						
0013 AMIS0162						

BLANKS

0001 Control Blank	X	X	X	5.7		X
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ANALYSIS

ELEMENTS	S-SO4	Sb	Se	Sn	Sr	Th
UNITS	%	ppm	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.05	0.01	0.1	0.05	0.01
DIGEST	S71/	4AB/	SE1/	4AB/	4AB/	4AB/
ANALYTICAL FINISH	OE	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 1	X	2.95	0.11	2.8	1.05	0.15
0002 5	0.01	13.06	5.07	11.8	3.22	4.56
0003 6	0.04	7.13	0.41	0.5	1.01	0.41
0004 8	0.05	57.78	4.11	20.5	5.86	3.82
0005 9	0.05	30.37	2.52	24.1	11.66	23.57
0006 15	0.07	29.07	0.76	4.4	0.37	1.62

CHECKS

0001 6	0.03	7.11	0.40	0.5	1.04	0.40
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STANDARDS

0001 0.5%NaCl-1						
0002 AMIS0160						
0003 AMIS0343						
0004 ANC-2						
0005 HgSTD-6						
0006 NAG Std 3						
0007 OREAS 45d						
0008 OREAS 922		1.30		9.9	58.39	17.45
0009 OREAS 97.01			0.64			
0010 PD-1	4.29					
0011 TOC-1						
0012 AMIS0161						
0013 AMIS0162						

BLANKS

0001 Control Blank	X	X	X	X	X	X
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ANALYSIS

ELEMENTS	TIC	U	V	Zn
UNITS	%	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.01	2	1
DIGEST	C72/	4AB/	4AB/	4AB/
ANALYTICAL FINISH	CSA	MS	OE	OE
SAMPLE NUMBERS				
0001 1	0.06	0.23	8	95
0002 5	0.48	6.69	643	116
0003 6	X	0.37	11	64
0004 8	0.34	1.94	57	294
0005 9	0.20	7.37	527	90
0006 15	0.74	2.63	68	678

CHECKS				
0001 6	X	0.38	11	64

STANDARDS				
0001 0.5%NaCl-1				
0002 AMIS0160				
0003 AMIS0343				
0004 ANC-2				
0005 HgSTD-6				
0006 NAG Std 3				
0007 OREAS 45d				
0008 OREAS 922		3.39	92	262
0009 OREAS 97.01				
0010 PD-1				
0011 TOC-1	1.40			
0012 AMIS0161				
0013 AMIS0162				

BLANKS				
0001 Control Blank	X	X	X	X

METHOD CODE DESCRIPTION

<u>Method Code</u>	<u>Analysing Laboratory</u> <u>NATA Laboratory Accreditation</u>	<u>NATA Scope of Accreditation</u>
/CSA	Intertek Genalysis Perth 3244 3237	MPL_W043, CSA : MPL_W043
Induction Furnace Analysed by Infrared Spectrometry		
4AB/MS	Intertek Genalysis Perth 3244 3237	4AB/ : MPL_W001, MS : ICP_W003
Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Beakers. Analysed by Inductively Coupled Plasma Mass Spectrometry.		
4AB/OE	Intertek Genalysis Perth 3244 3237	4AB/ : MPL_W001, OE : ICP_W004
Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Beakers. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.		
ANCx/MTR	Intertek Genalysis Perth 3244 3237	
Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement		
ANCx/QUAL	Intertek Genalysis Perth 3244 3237	
Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection		
ANCx/VOL	Intertek Genalysis Perth 3244 3237	
Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.		
C72/CSA	Intertek Genalysis Perth 3244 3237	ENV_W017, CSA : ENV_W017
Digestion by hot acid(s) Analysed by Infrared Spectrometry		
CL1/COL	Intertek Genalysis Perth 3244 3237	ENV_W014, COL : ENV_W014
Carbonate leach specific for Chlorine. Analysed by UV-Visible Spectrometry.		
FC7/SIE	Intertek Genalysis Perth 3244 3237	ENV_W012, SIE : ENV_W012
Alkaline fusion (Nickel crucible) specific for Fluorine. Analysed by Specific Ion Electrode.		
FP1/OE	Intertek Genalysis Perth 3244 3237	FP1/ : MPL_W011, OE : ICP_W004
Sodium peroxide fusion (Zirconia crucibles) and Hydrochloric acid to dissolve the melt. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.		
HG1/CV	Intertek Genalysis Perth 3244 3237	
Low temperature Perchloric acid digest specific for Mercury. Analysed by Cold Vapour Generation Atomic Absorption Spectrometry.		
NAGx/MTR	Intertek Genalysis Perth 3244 3237	
Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement		

METHOD CODE DESCRIPTION

<u>Method Code</u>	<u>Analysing Laboratory</u> <u>NATA Laboratory Accreditation</u>	<u>NATA Scope of Accreditation</u>
NAGx/VOL	Intertek Genalysis Perth 3244 3237	
Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.		
Paste/MTR	Intertek Genalysis Perth 3244 3237	
Water Extraction using a specific sample:water ratio. Analysed with Electronic Meter Measurement		
S71/OE	Intertek Genalysis Perth 3244 3237	
Digestion to eliminate sulphides. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.		
SE1/MS	Intertek Genalysis Perth 3244 3237	
Aqua-Regia digest followed by Precipitation and Concentration. Specific for Selenium. Analysed by Inductively Coupled Plasma Mass Spectrometry.		

ANALYTICAL REPORT

KNIGHT PIESOLD PTY LIMITED
PO Box 6837
EAST PERTH, W.A. 6892
AUSTRALIA

JOB INFORMATION

JOB CODE : 752.0/1703717
No. of SAMPLES : 6
No. of ELEMENTS : 36
CLIENT O/N : BR801-00316/01 (Job 1 of 0)
SAMPLE SUBMISSION No. : BR801-00316/01 SS17001
PROJECT : COMSTOCK
STATE : Other
DATE RECEIVED : 14/03/2017
DATE COMPLETED : 12/04/2017
DATE PRINTED : 12/04/2017
ANALYSING LABORATORY : Intertek Genalysis Perth

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
() = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method
OV = Value over-range for Package

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SAMPLE DETAILS

DISCLAIMER

Intertek Genalysis wishes to make the following disclaimer pertaining to the accompanying analytical results.

All work is performed in accordance with the Intertek Minerals Standard Terms and Conditions of work <http://www.intertek.com/terms/>

This report relates specifically to the sample(s) that were drawn and/or provided by the client or their nominated third party. The reported result(s) provide no warranty or verification on the sample(s) representing any specific goods and/or shipment and only relate to the sample(s) as received and tested. This report was prepared solely for the use of the client named in this report. Intertek accepts no responsibility for any loss, damage or liability suffered by a third party as a result of any reliance upon or use of this report.

The results provided are not intended for commercial settlement purposes.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Intertek Genalysis accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of \$4.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at \$150.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

1. Note: Detection Limit only apply when TDS <100mg/l for MS and TDS<5000mg/l for OES except when indicated in spreadsheet

ANALYSIS

ELEMENTS	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Cl
UNITS	ug/l	mg/l	ug/l	mg/l	ug/l	ug/l	ug/l	mg/l	ug/l	mg/l
DETECTION LIMIT	0.01	0.01	0.1	0.01	0.05	0.1	0.005	0.01	0.5	2
DIGEST										
ANALYTICAL FINISH	/MS	/OE	/MS	/OE	/MS	/MS	/MS	/OE	/MS	/COL

SAMPLE NUMBERS										
0001 1	X	8.06	8.8	0.02	10.64	0.1	0.005	2.25	0.6	5
0002 5	X	13.78	116.1	0.03	21.50	0.3	0.048	4.23	X	14
0003 6	X	0.17	0.8	0.03	136.25	X	X	2.70	0.8	5
0004 8	X	X	2.7	X	2.13	X	X	1.27	X	6
0005 9	X	0.22	1.1	X	24.53	X	X	0.78	0.9	9
0006 15	X	0.82	38.0	X	7.05	0.3	X	2.91	246.6	7

CHECKS

0001 6	0.02	0.16	0.8	0.03	130.32	X	X	2.89	0.8	5
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STANDARDS

0001 GWS-1										34
0002 TMDW	2.01		80.4		49.72	19.5	9.952		10.0	

BLANKS

0001 Control Blank	X	X	X	0.02	X	X	X	X	X	X
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ANALYSIS

ELEMENTS	Co	Cr	Cu	EC	F	Fe-Sol	Hg	K	Mg	Mn
UNITS	ug/l	mg/l	mg/l	uS/cm	mg/l	mg/l	ug/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.1	0.01	0.01	10	0.1	0.01	0.1	0.1	0.01	0.01
DIGEST										
ANALYTICAL FINISH	/MS	/OE	/OE	/MTR	/SIE	/OE	/MS	/OE	/OE	/OE
SAMPLE NUMBERS										
0001 1	12.3	X	0.13	131	X	3.22	X	1.2	2.86	0.18
0002 5	3.7	0.02	0.10	215	X	0.88	X	1.4	5.83	0.45
0003 6	49.6	0.01	X	252	X	0.01	X	0.7	4.47	30.28
0004 8	1.6	X	X	83	X	X	X	0.6	1.58	2.35
0005 9	0.2	X	X	93	X	0.28	X	1.9	1.42	0.06
0006 15	6.4	X	0.05	217	X	0.56	X	0.7	6.07	1.30

CHECKS

0001 6	45.7	X	X	249	X	0.01	X	0.7	4.33	29.41
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STANDARDS

0001 GWS-1					0.5					
0002 TMDW	24.7						X			

BLANKS

0001 Control Blank	X	X	X	X	X	X	X	0.1	X	X
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ANALYSIS

ELEMENTS	Mo	Na	Ni	P	Pb	pH	S	Sb	Se	Sn
UNITS	ug/l	mg/l	mg/l	mg/l	ug/l	NONE	mg/l	ug/l	ug/l	ug/l
DETECTION LIMIT	0.05	0.1	0.01	0.1	2	0.1	0.1	0.01	0.5	0.1
DIGEST										
ANALYTICAL FINISH	/MS	/OE	/OE	/OE	/MS	/MTR	/OE	/MS	/MS	/MS
SAMPLE NUMBERS										
0001 1	1.56	3.8	0.03	X	209	4.4	5.0	4.88	1.9	0.1
0002 5	41.05	6.3	0.02	X	1945	4.3	18.6	32.80	11.8	0.6
0003 6	X	4.1	0.01	X	4980	4.3	28.4	0.05	2.1	X
0004 8	X	3.5	0.02	X	18	5.3	2.6	0.03	1.7	0.2
0005 9	X	5.1	X	X	194	4.4	1.4	0.22	3.6	X
0006 15	X	5.3	0.02	X	10909	4.8	21.2	57.71	1.6	X
CHECKS										
0001 6	X	3.9	0.01	X	4789	4.3	28.1	0.06	2.2	X
STANDARDS										
0001 GWS-1										
0002 TMDW	99.27				41			9.87	10.1	X
BLANKS										
0001 Control Blank	X	X	X	X	X	5.7	0.1	X	X	X

ANALYSIS

ELEMENTS	Sr	TDSCon	Th	U	V	Zn
UNITS	ug/l	mg/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.02	20	0.005	0.005	0.01	0.01
DIGEST						
ANALYTICAL FINISH	/MS	/CALC	/MS	/MS	/OE	/OE

SAMPLE NUMBERS

0001 1	7.55	79	0.105	0.453	0.06	0.16
0002 5	30.72	129	0.356	2.041	1.19	0.26
0003 6	16.20	151	X	0.118	X	0.05
0004 8	5.94	50	X	X	X	X
0005 9	9.11	56	X	0.037	X	0.08
0006 15	10.31	130	0.047	0.457	X	17.12

CHECKS

0001 6	16.27		X	0.116	X	0.05
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STANDARDS

0001 GWS-1						
0002 TMDW	252.45		X	10.049		

BLANKS

0001 Control Blank	X		X	X	X	X
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METHOD CODE DESCRIPTION

Method Code**Analysing Laboratory****/CALC**

Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Results Determined by calculation from other reported data.

/COL

Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed by UV-Visible Spectrometry.

/MS

Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/MTR

Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed with Electronic Meter Measurement

/OE

Intertek Genalysis Perth

Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

/SIE

Intertek Genalysis Perth

No digestion or other pre-treatment undertaken. Analysed by Specific Ion Electrode.