AUSTRALIA HUALONG PTY LTD
TENTH LEGION IRON ORE PROJECT



GEOCHEMICAL CHARACTERISATION REPORT – WASTE ROCK, TAILINGS AND ORE

PREPARED FOR:

Australia Hualong Pty Ltd
19 Gubbuteh Road
Little Bay NSW 2036

PREPARED BY:

Knight Piésold Pty Limited
Level 1, 36 Cordelia Street
South Brisbane, QLD 4101, AUSTRALIA
p. +61 (0)7 3007 6901 • f. +61 (0)7 3007 6999

BR801-00283/02
Rev. A
January 2016

Knight Piésold
CONSULTING
www.knightpiesold.com

DOCUMENT CONTROL PAGE

AUSTRALIA HUALONG PTY LTD

TENTH LEGION MAGNETITE PROJECT

GEOCHEMICAL CHARACTERISATION REPORT – WASTE ROCK, TAILINGS AND ORE

KP Job No. BR801-00283/01

KP Report No. BR801-00283/02

CONTRACT

DOCUMENT INFORMATION

REV	DESCRIPTION	PREPARED	REVIEW	KNIGHT PIESOLD APPROVAL	DATE
A	Issued for Client Review	EJT	TDR	TDR	12/01/2016

DOCUMENT DISTRIBUTION

REV	DESTINATION	HARD COPY	ELECTRONIC COPY
A	AUSTRALIA HUALONG PTY LTD	0	1

CONTENTS **PAGE**

CONTENTS **PAGE**

DEFINITION OF TECHNICAL TERMS

Acronym or Symbol	Parameter	Brief Description	Determination / Source	Unit
ACA	Average Crustal Abundance	Average concentration of a particular element in Earth's crust.	References	ppm
AFP	Acid Formation Potential	The potential of a material to form acid.	Calculation	N/A
ANC	Acid Neutralising Capacity	A materials ability to neutralise acid generally through mineral dissolution.	Analysis Result	kg H_2SO_4/tonne
ARD	Acid Rock Drainage	Acid metal rich leachate resulting from sulfide oxidation.		N/A
C_n	Element Concentration	Measure of concentration of an element in a particular sample.	Analysis Result	ppm or %
CRS	Chromium Reducible Sulfur	A laboratory test to determine the sulfide content of a sample	Analysis Result	ppm or %
EC	Electrical Conductivity	A measure of electrical current transported by the ions in solution.	Analysis Result	mS/cm
GAI	Geochemical Abundance Index	A scale of enrichment based on C_n and ACA.	Calc.(GAI = Log_2 (C_n / (1.5 x ACA))	None
MPA	Maximum Potential Acidity	The max. amount of acid which can be produced by oxidization of contained sulfides.	Calc.(MPA = Sulfide-S x 30.6)	kg H_2SO_4/tonne
NAF	Non Acid Forming	Material does not produce acid either as a result of low sulfide contents or due to excess acid neutralising capacity.	Calculation	N/A
NAG	Net Acid Generation	A direct measure of acid production under extreme oxidising conditions.	Analysis Result	kg H_2SO_4/tonne
NAPP	Net Acid Producing Potential	The balance between MPA and ANC.	Calc.(NAPP = ANC – MPA)	kg H_2SO_4/tonne
HCl	Hydrochloric Acid	A mineral acid.		N/A
H_2O_2	Hydrogen Peroxide	A strong oxidising agent.		N/A
H_2SO_4	Sulfuric Acid	A mineral acid.		N/A
PAF	Potentially Acid Forming	Material has potential to produce acid through sulfide oxidation.	Calculation	N/A
Sulfate-S	Sulfate Sulfur	The sulfur present in the oxidised state.	Result	%
Sulfide-S	Sulfide Sulfur	The sulfur present in the reduced state.	Calc.(Sulfide-S = Total-S – Sulfate-S)	%
TDS	Total Dissolved Solids	A measure of the total amount of material dissolved in a solution.	Analysis Result	ppm
Total-S	Total Sulfur	The total amount of sulfur present.	Analysis Result	%

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Knight Piésold (KP) was engaged by Australia Hualong Pty Ltd to conduct geochemical characterisation of the waste rock, tailings and ore which will be produced from the development of the Tenth Legion Magnetite Project.

1.2 SCOPE OF WORK

The assessment has been conducted as a phased investigation as summarised below:

- Acid base accounting and multi-element analysis of forty eight waste rock samples, two tailings samples and two ore samples.
- Distilled water extract testing of thirteen waste rock samples, two tailings samples and two ore samples.
- Quantitative mineralogy of ten waste rock samples.
- Fibre identification of six samples of waste rock.

All geochemical testing was conducted by Intertek Genalysis (Perth) with fibre analysis by FibreLab (Perth). This report presents the geochemical analysis results and the implications for management of waste rock, tailings and ore. Reports previously prepared by KP and relevant to this study are listed below:

- Tenth Legion Magnetite Project – Waste Rock Sample Selection Study, April 2015 (Ref. 1).
- Tenth Legion Magnetite Project – Preliminary Waste Rock Geochemical Results, September 2015 (Ref. 2).

1.3 GEOLOGICAL SETTING

A summary of the site geology is provided below, based on the information provided in the mineral resource estimation report (Ref. 3).

The Tenth Legion locality is dominated by the Devonian Heemskirk granite batholith, which outcrops to the immediate northwest of the prospect forming the prominent Heemskirk Range. The Heemskirk granite is responsible for much of the tin-tungsten, lead-zinc, magnetite and nickel skarn mineralisation in the district.

The Tenth Legion deposit is a carbonate hosted magnetite skarn deposit formed within Precambrian sedimentary rocks of the Oonah Formation on the south-eastern edge of the Heemskirk Granite. The skarn strikes west-northwest and dips steeply to the north. The skarn extends approximately east-west for 500 m in strike length and has been drilled to approximately 200 m depth. Mineralised lenses vary from 1 to 12 m in

thickness. Hornfelsed quartzite forms the hangingwall and footwall to the host sequence.

Mineralisation is hosted in what is interpreted to have been impure limestone beds associated with pale grey siltstones within the Oonah Formation. The host sequence is bounded by Oonah Formation quartzite, siltstone and black shales to the north and south.

Variable amounts of pyrrhotite, galena and sphalerite to 2-5% are sometimes associated with the magnetite. Increased sulfide contents were recorded at the south end of the Central Lode. Minor amounts of chalcopyrite-pyrite and trace tin, tungsten, gold and bismuth have been reported.

The Oonah Formation is strongly deformed and has been thrust over the younger Cambrian mafic-ultramafic complex and Crimson Creek volcaniclastics by the low angle Tenth Legion Thrust. Later brittle faulting and folding has disrupted the Proterozoic and Cambrian lithologies.

1.4 SAMPLE SELECTION

A total of forty eight waste rock sampling intervals were nominated by KP based on a review of the geological database. The sampling intervals were selected from a range of boreholes and depths to achieve a reasonable lateral and vertical spread weighted towards the most common waste lithologies. Samples from depths greater than 100 m in inclined holes were disregarded given the design pit depth of approximately 80 m. Efforts were also made to select samples from within the design pit shell. The sampling was predominantly focused on waste rock (i.e. iron contents less than 15%), with a limited number of low grade ore samples included (i.e. 15% to 25% iron). Details of the selected waste rock samples are provided in Table 1.1. Overall the samples selected by the site geologist typically coincided with the intended lithologies.

Guangzhou Research Institute of Non-Ferrous Metals carried out metallurgical test work on two composite fresh ore samples (Samples C and S) in July 2014. Sub-samples of these ore samples and the associated tailings produced during beneficiation tests were obtained by KP and analysed as part of this geochemical study.

Table 1.1: Waste Rock Samples Selected for Geochemical Analysis

Sample No.	Sample ID	Sample Description	Sample Weight (g)
1	254601	Dark grey sulfidic dolomite with 3-4% sphalerite, 1% chalcopyrite, 1% pyrrhotite and 20% magnetite.	1440
2	254602	Dark grey pyritic (1-2%), moderately carbonaceous siltstone.	1130
3	254603	Light grey-green mottled diopside-epidote hornfelsed quartzite.	1714
4	254604	Yellowish-grey banded sericitic quartzite with trace chalcopyrite.	2005
5	254605	Mottled grey siltstone with calc-silicate veining.	1290
6	254606	Grey-brown mottled hornfelsed shale with a trace of very fine-grained disseminated pyrite.	1523
7	254607	Dark grey siltstone/black shale, moderately weathered with 2-3% pyrite present as fine-grained disseminations.	1470
8	254608	Dark grey to black weakly sulfidic (1-2% pyrrhotite?) serpentinite.	1572
9	254609	Dark grey to black serpentinite with some calc-silicate bands. Trace disseminated pyrite.	1237
10	254610	Mixed interval of calc-silicate, magnetite and serpentinite. Serpentinite contains 3-4% pyrite.	1310
11	254611	Indurated ligt grey dolomite with disseminated magnetite (5%) and a trace of fracture-fill pyrite veinlets.	1907
12	254612	Yellowish-green epidote-diopside altered quartzite	1002
13	254613	Greenish-grey hornfelsed siltstone with 1-2% fine-grained disseminated pyrite.	1850
14	254614	Grey-green banded hornfelsed shale, trace of pyrite.	1654
15	254615	Greenish-grey mottled sericitic quartzite, trace fine grained disseminated pyrite.	1470
16	254616	Mottled grey-yellow hornfelsed shale.	1809
17	254617	Greyish-yellow altered lime-hornfelsed quartzite with approximately 1% pyrrhotite.	1480
18	254618	Medium-grey indurated dolomite	1606
19	254619	Dark grey-green serpentinite-magnetite with pyrrhotite, some calc-silicate content.	1284
20	254620	Grey-yellow clay after calc-silicate	1280
21	254621	Greyish-green very strongly weathered serpentinite? Appears that original sulfides have since leached out.	2070
22	254622	Iron-stained, leached and weakly weathered calc-silicate with 10% magnetite fragments	1134
23	254623	Yellow, iron-stained clay after calc-silicate	1248
24	254624	Light grey, leached, relatively fresh calc-silicate with iron-staining	1375
25	254625	Relatively fresh magnetite (30%) and calc-silicate (70%)	1933
26	254626	Strongly weathered and calc-silicate altered calcareous sediment – dolomitic?	1258
27	254627	Moderately weathered gravelly light grey-brown calc-silicate containing 15% magnetite content	1117
28	254628	Grey to brown extremely weathered calc-silicate approaching clay. Oxidation post drilling indicates very fine-grained pyrite may have been present originally.	1550
29	254629	Dark-grey to brown hornfelsed shale and siltstone with iron staining along fracture surfaces.	1930
30	254630	Yellow-pink-grey mottled ferruginous clay after calc-silicate	1584
31	254631	Moderately weathered gravelly light grey calc-silicate containing 15% magnetite content	1146
32	254632	Dark grey altered siltstone? with magnetite and serpentinite, trace pyrrhotite.	1571
33	254633	Dark grey serpentinite-magnetite-brucite skarn, trace sulfide – pyrrhotite?	1229
34	254634	Dark grey dolomite/dolomitic siltstone with 1-2% disseminated pyrite.	1482
35	254635	Altered calcareous siltstone cataclasite with visible pyrite, trace chalcopyrite?	1524
36	254636	Friable yellow-grey mottled, highly weathered calc-silicate approaching clay, minor magnetite content	1025
37	254637	Grey partially weathered and altered calcareous siltstone	1661
38	254638	Green grey calc-silicate and serpentinite with 1-2% pyrrhotite and several % magnetite.	1416
39	254639	Light-brown to grey clay after calc-silicate.	1516
40	254640	Light grey to yellow-brown clay after calc-silicate.	1761
41	254641	Grey quartz-veined and weakly calc-silicate altered siltstone. Moderately weathered and some voids probably after pyrite.	1703
42	254642	Greyish-white brecciated and quartz-veined calcareous siltstone with 1-2% very fine-grained pyrite.	1735
43	254643	Light grey highly micaceous greisen-altered siltstone	1490
44	254644	Medium grey calc-silicate/magnetite altered calcareous siltstone?	1003
45	254645	Dark grey altered carbonaceous siltstone? with magnetite and trace disseminated pyrite.	1665
46	254646	Moderately weathered iron-stained calc-silicate with 15% magnetite content	1229
47	254647	Light grey-white massive calc-silicate	1757
48	254648	Dark grey hornfelsed siltstone? Inter-fingered with pale calc-silicate. Sulfides present (2-3%) including sphalerite, galena and pyrrhotite.	1825

2. TESTWORK METHODS

2.1 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, predominantly carbonates, contained in the sample.

Total sulfur, total carbon and total inorganic carbon were determined by Leco induction furnace, with infrared detection. Sulfate sulfur was determined by ICP following a hydrochloric acid digest. The testwork methods specified are based on the ABA methodology defined in the Mine Environment Neutral Drainage (MEND) Acid Rock Drainage Prediction Manual (Ref. 4) and Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia (Ref. 5).

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. 6), with a siderite correction step added.

The results of the ABA testwork 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 sulfides are present as pyrite.

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

2.2 NET ACID GENERATION (NAG)

Net Acid Generation (NAG) testwork is a direct measure of a 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 specified procedure is based on the Static NAG Test (Ref. 7 and 8). The static NAG test involves the addition of 250 mL of 15 per cent 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 oxidization reactions.

2.3 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 oxidisation of sulfide minerals (MPA) and neutralise acid by the dissolution of alkaline minerals (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.

KP 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. KP's classification system, as summarised in Table 2.1, is based the Australian Government Guidelines on Managing Acidic and Metalliferous Drainage (Ref. 9) and is similar to the classification system provided within the AMIRA ARD Test Handbook (Ref. 10) and the Global Acid Rock Drainage (GARD) Guide (Ref. 11).

Table 2.1: Acid Formation Potential Classification System

Acid Formation Potential Class	NAPP (kg H_2SO_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

2.4 MULTI-ELEMENT ANALYSIS

2.4.1 Geochemical Enrichments

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

Multi-element analysis results are compared to the average crustal abundance to determine 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:

$$\mathbf{GAI = Log_2 (C_n / (1.5 \times B_n))}$$

Where:

C_n = measured concentration of element in sample

B_n = average crustal abundance (Bowen, Ref. 12)

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

KP has assigned an arbitrary scale to the GAI, with indices of 0 and 1 being classified as “not enriched”, indices 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”.

2.4.2 Soil Quality Screening

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. 13) 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. 14) 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. 15) 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. 16). 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 Tenth Legion project will be required to meet these reference levels or that these reference levels should be used as the regulatory framework. The regulatory requirements for the project will be determined by the relevant regulatory authorities during the environmental design phase of the project.

2.5 QUANTITATIVE MINERALOGY

Quantitative powder X-ray diffraction (XRD) phase analysis of the crystalline and amorphous contents was conducted on selected samples to determine the mineralogical composition.

The samples were initially dried at 50°C and milled to <60 µm before being coned and quartered down to approximately 20 g. A grab sample of each aliquot was then taken

for analysis. Each sample was prepared as an un-orientated powder mount of the total sample.

The XRD patterns were produced on a PANalytical Cubix^3 XRD fitted with copper radiation (operating at 45 kV and 40 mA). A graphite monochromator was used in the diffracted beam.

Qualitative analysis was performed with Bruker Diffrac.EVA 3.2 Search/Match software with the ICDD PDF-2 (2011) database. Quantitative phase analysis was performed using SIROQUANT Version 4 software.

2.6 FIBRE IDENTIFICATION

Fibre identification was undertaken using scanning electron microscopy (SEM) on bulk samples. The microscope uses a beam of electrons from a filament in a vacuum. The SEM produces an image of the topography of the sample and the electron beam interacts with the atoms on the surface of the sample to provide information on the composition. SEM can be used at magnifications of up to 5,000 times for fibre analysis.

The identification work was conducted by FibreLab on selected samples to determine whether fibrous material observed in the XRD mineralogy comprised asbestos.

2.7 DISTILLED WATER EXTRACT

Distilled water extract tests were conducted on selected samples to assess the potential for leaching of environmentally significant elements from samples, which could have a detrimental effect on seepage water quality. The procedure specified is based on the Shake Flask Method as described in the Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia (Ref. 5), as described below.

Initially 50 grams of each sample was mixed with 150 mL of deionized water. The mixtures were then bottle rolled for 24 hours. The pH and the conductivity of the solutions were measured and the bottles left to stand for a minimum of three 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 typically 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.

2.8 REFERENCE WATER QUALITY STANDARDS

To allow assessment of the distilled water extract results, a set of reference values has been established. These reference values were compiled from internationally accepted guidelines for water quality for release from mining operations (IFC environmental, health and safety guidelines (Ref. 17 and 18) and the ANZECC water quality guideline

for livestock drinking water (Ref. 19)). The use of several guidelines is required as no single guideline contains target concentrations for all parameters. Where a target concentration for a specific element is at different levels in various guidelines, the lowest concentration has been adopted. These reference values are summarised in Table 2.2.

The water quality results of the distilled water extracts have also been compared to Australian drinking water guidelines (Ref. 20) with the Australia drinking water guideline values provided in Table 2.3.

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 Tenth Legion project will be required to meet these reference levels or that these reference levels should be used as the regulatory framework. The regulatory requirements for the project will be determined by the relevant regulatory authorities during the environmental design phase of the project.

Table 2.2: Reference Guidelines for Water Release and Livestock Drinking Water

Parameter	Units	ANZECC Livestock	IFC 2004	IFC 2007	Adopted Reference Level
pH	pH Units		6 to 9	6 to 9	6 to 9
TDS	mg/kg	2000			2000
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
Phosphate	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 2.3: Australian Drinking Water Guidelines

Parameter	Units	Health	Aesthetic	Adopted Reference Level
pH	pH Units		6.5 to 8.5	6.5 to 8.5
TDS	mg/kg		600	600
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
Phosphate	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

3. GEOCHEMICAL RESULTS – WASTE ROCK

3.1 INTRODUCTION

The static testing results are discussed in the following sections with summary tables provided. Copies of all laboratory test reports are provided in Appendix A, with expanded results tables provided in Appendices B, C and D.

As part of the quality control and assurance programme conducted by Intertek Genalysis, duplicate analyses were conducted on selected samples. Where duplicate analyses have been undertaken, the results presented in the following sections are the average of the original and duplicate tests.

3.2 ACID BASE ACCOUNTING

The sulfur speciation results indicate that the total sulfur contents of the samples ranged from below the detection limit of 0.01% to 13.7%, at an average of 0.62% which is high. However, excluding the sample which recorded the extremely high sulfur content of 13.7%, the average is moderate at 0.35%. Further, the median sulfur content is low at 0.08%.

Typically the majority of the sulfur is indicated to be present as sulfide, with the measured sulfate concentrations varying from below detection to 0.8% at an average of 0.07%. Conversely, sulfide contents were calculated as varying from negligible to 12.8% at an average of 0.56%. Excluding the highest sulfide content, the average drops to 0.3%.

The maximum potential acidity was calculated from the sulfide sulfur content varying from negligible to 393 kg H_2SO_4 / tonne of waste rock at an average of 17 kg H_2SO_4 / t which is considered to be high. However, excluding the high sulfur sample, the average MPA is 9 kg H_2SO_4 / t which is low.

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. Carbonate carbon is estimated based on the total inorganic carbon (TIC) data.

The results indicated carbonate contents up to 90% (i.e. within two samples of dolomite) at an average of 5.2% which is very high. The calculated carbonate ANC values varied from 0.8 to 891 kg H_2SO_4 / t at an average of 51 kg H_2SO_4 / t and median of 2.9 kg H_2SO_4 / t, indicating highly variable but generally high carbonate-derived ANC throughout the waste rock. The measured ANC values were typically higher than the carbonate-ANC estimates, ranging between 2 and 1002 kg H_2SO_4 / t at an average of 168 kg H_2SO_4 / t which is extremely high. These results indicate that significant

neutralising capacity is likely to be available from both carbonate and non-carbonate minerals. However, ANC provided by non-carbonate minerals is typically released much more slowly than that provided by carbonates and may only be available under low pH conditions.

The Net Acid Producing Potential (NAPP) of the samples was calculated from the MPA and the ANC, along with the ANC/MPA ratio. Only one sample recorded a positive NAPP and ANC/MPA ratio less than one, indicating excess acid producing potential. However, the average NAPP was -152 kg H_2SO_4 / t and the average ANC/MPA ratio was 84, indicating overall significant excess neutralising capacity.

The acid base accounting results for all samples are presented in Table 3.1.

3.3 NET ACID GENERATION

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

The results of the net acid generation test indicate that acid was produced by ten samples under extreme oxidising conditions up to a maximum of 290 kg H_2SO_4 / t, with the other nine samples with averaging just 3.7 kg H_2SO_4 / t. The final pH of the NAG solutions varied from pH 2.2 to 10.1 at a numerical average of 6.9 (noting that pH is based on a logarithmic scale). The pH of the NAG solutions dropped below pH 4.5 in four samples, ranging between pH 2.2 and 3.8. The NAG results for all samples are presented in Table 3.1.

3.4 ACID FORMING POTENTIAL

The acid formation potential is calculated based on the acid base accounting results and the NAG test. The classification of the samples is summarised below and shown graphically in Figures 3.1 and 3.2:

- Fifteen samples (31%) classified as Acid Consuming.
- Twenty nine samples (60%) classified as Non Acid Forming.
- Three samples (6%) classified as having an uncertain acid forming potential (negative NAPP but NAG pH less than 4.5).
- One sample (2%) classified as Potentially Acid Forming (PAF).

Overall, the waste rock samples had a low acid generation risk given that 91% of samples were classified as acid consuming (AC) or non acid forming (NAF). However, the uncertain (UC) and potentially acid forming (PAF) samples account for almost 10%

of the samples. The PAF sample had an extremely high NAPP despite having a high ANC of 108 kg H_2SO_4 / t due to a sulfide content of almost 13%. The paste pH of 4.3 indicates that the PAF sample is highly reactive and it will be important for waste rock management to determine what proportion of waste rock is likely to have such high sulfide contents, despite the abundant ANC in a high proportion of the waste. Further, the PAF sample recorded an iron content of 20%, placing it in the low range ore category and the geological logging notes indicate the sample to comprise serpentinite-magnetite with pyrrhotite.

The UC samples recorded conflicting acid base accounting results, with negative NAPPs indicating excess neutralising capacity but NAG pH values below 4.5, indicating excess acidity following complete oxidation of the sulfides. The uncertain samples recorded measured ANC values significantly higher than the ANC estimated as being available from carbonate minerals. As such, it is likely that the majority of the ANC in these samples is only available to buffer acidity at very low pHs (the ANC test procedure involves dropping the pH to around 1.5 and boiling the solution to fully dissolve all neutralising minerals). This can be further assessed by quantitative mineralogy, the results of which are presented and discussed in Section 3.5. However, based on the acid base accounting and NAG results, it is recommended that the uncertain samples be considered potentially acid forming.

Table 3.1: Acid Base Accounting, NAG and Acid Forming Potential Results

Sample ID	Lithology	Sulfur Species			ANC	Carbon Species				Calculations			NAG		AFP
		Total-S	SO_4-S	Sulfide-S		C	TIC	Calcite Equivalent	$CaCO_3$-ANC	MPA	ANC/MPA	NAPP	NAG (7.0)	NAG pH	
		%	%	%	kgH_2SO_4/t	%	%	%	kgH_2SO_4/t	kgH_2SO_4/t		kgH_2SO_4/t	kgH_2SO_4/t	NONE	
254601	DM	2.58	0.14	2.44	760	0.100	0.030	0.25	2.45	74.7	10.2	-685.3	0	6	AC
254602	SBS	0.66	0.06	0.60	49	0.900	0.010	0.1	0.82	18.4	2.7	-30.6	4	3.8	UC
254603	MQZ	0.05	0.01	0.04	86	0.620	0.610	5.08	49.82	1.2	70.3	-84.8	0	9.7	NAF
254604	MQZ	0.16	0.01	0.15	42	0.150	0.130	1.08	10.62	4.6	9.2	-37.4	0	9	NAF
254605	H	0.97	0.08	0.89	696	3.550	3.500	29.17	285.83	27.2	25.6	-668.8	0	8.8	AC
254606	H	0.39	0.05	0.34	34	0.200	0.180	1.50	14.70	10.4	3.3	-23.6	1	4.7	NAF
254607	SBS	0.20	0.03	0.17	12	0.570	0.020	0.17	1.63	5.2	2.3	-6.8	1	5	NAF
254608	IUS	2.07	0.14	1.93	139	0.060	0.010	0.08	0.82	59.1	2.4	-79.9	17	3.2	UC
254609	IUS	0.04	0.01	0.03	183	0.050	0.020	0.17	1.63	0.9	199.3	-182.1	0	8.2	AC
254610	CM	0.14	0.02	0.12	416	0.640	0.630	5.25	51.45	3.7	113.3	-412.3	0	8.6	AC
254611	DM	2.33	0.18	2.15	872	10.540	10.540	87.83	860.75	65.8	13.3	-806.2	0	8.2	AC
254612	MQZ	0.03	0.01	0.02	40	0.290	0.290	2.42	23.68	0.6	65.4	-39.4	0	10.1	NAF
254613	H	0.32	0.05	0.27	45	0.120	0.110	0.92	8.98	8.3	5.4	-36.7	0	7.3	NAF
254614	H	0.10	0.02	0.08	37	0.010	0.010	0.08	0.82	2.4	15.1	-34.6	0	6.7	NAF
254615	MQZ	0.19	0.04	0.15	106	0.030	0.030	0.25	2.45	4.6	23.1	-101.4	0	7.1	AC
254616	H	0.48	0.03	0.45	45	0.100	0.060	0.50	4.90	13.8	3.3	-31.2	2	4.8	NAF
254617	MQZ	0.51	0.03	0.48	124	0.050	0.040	0.33	3.27	14.7	8.4	-109.3	0	6.6	AC
254618	SDL	0.04	0.01	0.03	1002	10.920	10.910	90.91	890.96	0.9	1091.5	-1001.1	0	9	AC
254619	IUS	13.67	0.83	12.84	108	0.180	0.180	1.50	14.70	392.9	0.3	284.9	290	2.2	PAF
254620	C	0.08	0.05	0.03	4	0.080	0.050	0.42	4.08	0.9	4.4	-3.1	0	6	NAF
254621	IUS	0.06	0.25	0.00	64	0.020	0.010	0.08	0.82	0.0		-64.0	0	7.3	NAF
254622	CM	0.02	0.01	0.01	9	0.055	0.030	0.25	2.45	0.3	29.4	-8.7	0	7.55	NAF
254623	C	0.02	0.02	0.00	16	0.110	0.070	0.58	5.72	0.0		-16.0	0	7.6	NAF
254624	C	0.01	0.01	0.00	49	0.030	0.010	0.08	0.82	0.0		-49.0	0	7.4	NAF
254625	CM	0.08	0.01	0.07	103	0.050	0.030	0.25	2.45	2.1	48.1	-100.9	0	7.3	AC
254626	SDL	0.04	0.03	0.01	64	1.390	1.360	11.33	111.06	0.3	209.2	-63.7	0	7.2	NAF
254627	CM	0.01	0.03	0.00	16	0.040	0.020	0.17	1.63	0.0		-16.0	0	8.1	NAF
254628	C	1.24	0.44	0.80	63	0.630	0.010	0.08	0.82	24.5	2.6	-38.5	5	3.6	UC
254629	H	0.02	0.01	0.01	70	0.020	0.010	0.08	0.82	0.3	228.8	-69.7	0	7.9	NAF
254630	C	0.07	0.07	0.00	2	0.070	0.020	0.17	1.63	0.0		-2.0	0	5.1	NAF
254631	CM	0.03	0.01	0.02	53	0.040	0.010	0.08	0.82	0.6	86.6	-52.4	0	7.5	NAF
254632	H	0.01	0.01	0.00	790	0.040	0.040	0.33	3.27	0.0		-790.0	0	8.1	AC
254633	IUS	0.01	0.01	0.00	613	0.150	0.110	0.92	8.98	0.0		-613.0	0	7.6	AC
254634	SDL	0.49	0.05	0.44	46	0.180	0.010	0.08	0.82	13.5	3.4	-32.5	1	4.5	NAF
254635	H	0.57	0.04	0.53	201	0.060	0.040	0.33	3.27	16.2	12.4	-184.8	0	7.4	AC
254636	C	0.03	0.04	0.00	12	0.020	0.010	0.08	0.82	0.0		-12.0	0	6.6	NAF
254637	H	0.43	0.04	0.39	90	0.010	0.010	0.08	0.82	11.9	7.5	-78.1	0	6	NAF
254638	C	0.81	0.16	0.65	151	0.030	0.020	0.17	1.63	19.9	7.6	-131.1	0	5.7	AC
254639	C	0.05	0.04	0.01	4	0.280	0.170	1.42	13.88	0.3	13.1	-3.7	0	5.5	NAF
254640	C	0.07	0.03	0.04	8	0.090	0.040	0.33	3.27	1.2	6.5	-6.8	1	5.4	NAF

Sample ID	Lithology	Sulfur Species			ANC	Carbon Species				Calculations			NAG		AFP
		Total-S	SO_4-S	Sulfide-S		C	TIC	Calcite Equivalent	$CaCO_3$-ANC	MPA	ANC/MPA	NAPP	NAG (7.0)	NAG pH	
		%	%	%	kgH_2SO_4/t	%	%	%	kgH_2SO_4/t	kgH_2SO_4/t		kgH_2SO_4/t	kgH_2SO_4/t	NONE	
254641	H	0.02	0.01	0.01	37	0.050	0.020	0.17	1.63	0.3	120.9	-36.7	0	7.3	NAF
254642	H	0.42	0.03	0.39	48	0.140	0.010	0.08	0.82	11.9	4.0	-36.1	2	4.5	NAF
254643	H	0.06	0.01	0.05	94	0.200	0.170	1.42	13.88	1.5	61.4	-92.5	0	9.1	NAF
254644	CM	0.02	0.01	0.01	27	0.030	0.010	0.08	0.82	0.3	88.2	-26.7	0	7.8	NAF
254645	H	0.25	0.07	0.18	79	0.180	0.070	0.58	5.72	5.5	14.3	-73.5	0	7.6	NAF
254646	CM	0.01	0.01	0.00	33	0.010	0.010	0.08	0.82	0.0		-33.0	0	7.4	NAF
254647	C	0.03	0.01	0.02	101	0.360	0.320	2.67	26.13	0.6	165.0	-100.4	0	9.8	AC
254648	H	0.04	0.01	0.03	461	0.080	0.070	0.58	5.72	0.9	502.2	-460.1	0	8.8	AC

Lithology	Code
Dolomite with Magnetite	DM
Black Shale	SBS
Quartzite	MQZ
Shale and Siltstone	H
Serpentinite	IUS
Calc-silicate rock with Magnetite	CM
Dolomite	SDL
Calc-silicate rock	C

3.5 QUANTITATIVE MINERALOGY

The three samples classified as uncertain were selected for XRD analysis to determine the minerals present and their influence on the acid forming characteristics. In addition, the PAF sample and six other samples which recorded measured ANC values significantly higher than the ANC estimated as being available from non-carbonate minerals were selected.

The results of XRD analysis are summarised in Table 3.2 and indicate that two minerals were present in all samples; chlorite and pyrite. Pyrite contents varied from 1% to 17% at an average of 3%. Other sulfide minerals identified comprise marcasite (5% in one samples), pyrrhotite (3% in one samples), sphalerite (1% in one sample) and manganese sulfide (1% in one sample).

Calcite was not encountered in any samples, the only carbonate minerals identified comprising ankerite and siderite (both observed at 1% in one sample). Siderite ($FeCO_3$) is an important mineral in acid base accounting as it does not provide a net neutralising benefit. This is because the acid consumed during dissolution is re-released upon oxidation of aqueous iron and precipitation of iron oxyhydroxides.

The XRD analysis identified an abundance of non-carbonate neutralising minerals, which likely explains the cause of high ANC values compared to the calculated ANC from carbonate minerals as observed in the majority of samples. These include amphibole, apatite, calcium sodium plagioclase, chlorite, epidote, goethite, illite/muscovite, potassium feldspar, pyroxene, serpentine, sodium plagioclase and talc, all of which provide varying degrees of acid neutralisation capacity.

Table 3.2: Summary of XRD Results

Phase	Units	Minimum Content (%)	Average Content (%)	Maximum Content (%)	No. Samples Containing Mineral
Amorphous content	wt%	9	18	29	10
Amphibole	wt%	2	5	7	6
Ankerite	wt%	1	1	1	1
Apatite	wt%	1	1	1	1
Calcium sodium plagioclase	wt%	11	12	12	2
Chlorite	wt%	1	11	27	10
Epidote	wt%	1	2	2	2
Expanding clay	wt%	1	3	6	3
Forsterite	wt%	2	4	6	2
Goethite	wt%	9	9	9	1
Grossular	wt%	2	3	4	3
Hematite	wt%	1	1	1	3
Illite/Muscovite	wt%	2	13	28	8
Jarosite	wt%	1	1	1	1
Kaolin	wt%	2	2	2	1
Magnetite	wt%	1	8	17	5
Manganese sulfide	wt%	1	1	1	1
Marcasite	wt%	5	5	5	1
Mixed layer clay	wt%	7	7	7	1
Potassium feldspar	wt%	3	8	15	4
Pyrite	wt%	1	3	17	10
Pyroxene	wt%	19	27	43	4
Pyrrhotite	wt%	3	3	3	1
Quartz	wt%	1	21	32	5
Serpentine	wt%	1	20	72	6
Siderite	wt%	1	1	1	1
Sodium plagioclase	wt%	5	14	32	3
Sphalerite	wt%	1	1	1	2
Spinel	wt%	2	2	2	1
Talc	wt%	1	6	16	4

3.6 FIBRE IDENTIFICATION

Fibres thought to comprise chrysotile asbestos were observed in one the samples during the XRD mineralogy analysis. As such, sub-samples of all six samples which were identified as containing serpentine in the XRD work were sent to FibreLab for formal fibre identification using SEM. Samples containing serpentine were selected for analysis as chrysotile is from the serpentine mineral group. The results of the analysis are summarised in Table 3.3 with laboratory reports provided in Appendix A. The analysis indicated that all samples contained asbestos in varying forms. Chrysotile was identified in the sample originally indicated to potentially contain the mineral during the XRD work, with all other samples containing actinolite asbestos. In addition, one sample contained both actinolite and amosite asbestos. Actinolite and amosite are both amphibole minerals and, therefore, not associated with the serpentine identified in the XRD. This indicates that asbestos in the deposit may be associated with both serpentine and amphibole minerals. Reference to the sample descriptions and ABA results also indicates all samples to have significant sulfide contents, even sample 254628 which is extremely weathered but thought to originally contain very fine grained pyrite and was found to contain 0.80% sulfide in the acid base accounting.

Table 3.3: Fibre Identification Results

Sample ID	Lithology	Sulfide Content (from ABA)	Fibre Mineral Type
254601	Sulfidic dolomite	2.44%	**Chrysotile**
254608	Weakly sulfidic serpentinite	1.93%	**Actinolite**, chlorite, mica, inorganic
254619	Sulfidic serpentinite-magnetite	12.84%	**Actinolite, amosite**
254628	Extremely weathered calc-silicate approaching clay	0.80%	**Actinolite**
254635	Altered calcareous siltstone	0.53%	**Actinolite**
254638	Calc-silicate and serpentinite	0.65%	**Actinolite**, smectite

Note: Asbestos minerals highlighted in bold

3.7 MULTI-ELEMENT ANALYSIS

3.7.1 Element Enrichments

The results of the multi-element analysis indicate the samples typically have high levels of element enrichments, with a summary of enrichment presented in Table 3.4 and complete GAI results included as Appendix B.

Arsenic, bismuth and antimony were the most commonly enriched metals. Other metals found to be highly enriched include tin, boron, selenium, sulfur, silver, zinc, cadmium and lead, with significant enrichments also including copper, manganese and molybdenum. Only one sample comprising dolomite was found to have no element enrichments.

Table 3.4: Summary of Element Enrichments

Element	Percent of Samples in Each Category			
	Non Enriched	Slightly Enriched	Significantly Enriched	Highly Enriched
Ag	52%	21%	23%	4%
Al	100%	0%	0%	0%
As	15%	21%	29%	35%
B	33%	23%	38%	6%
Ba	100%	0%	0%	0%
Be	100%	0%	0%	0%
Bi	6%	10%	35%	48%
Ca	100%	0%	0%	0%
Cd	67%	15%	10%	8%
Cl	100%	0%	0%	0%
Co	96%	4%	0%	0%
Cr	100%	0%	0%	0%
Cu	92%	6%	2%	0%
F	100%	0%	0%	0%
Fe	96%	4%	0%	0%
Hg	100%	0%	0%	0%
K	100%	0%	0%	0%
Mg	94%	6%	0%	0%
Mn	92%	6%	2%	0%
Mo	85%	13%	2%	0%
Na	100%	0%	0%	0%
Ni	100%	0%	0%	0%
P	100%	0%	0%	0%
Pb	60%	23%	15%	2%
S	58%	8%	25%	8%
Sb	4%	13%	40%	44%
Se	52%	13%	21%	15%
Sn	29%	23%	29%	19%
Sr	100%	0%	0%	0%
Th	100%	0%	0%	0%
U	100%	0%	0%	0%
V	100%	0%	0%	0%
Zn	63%	15%	19%	4%

3.7.1 Soil Quality Screening

The results of the multi-element analysis have also been compared to a set of soil quality screening guidelines for human health and ecology, which indicated that no samples met all of the soil screening criteria, particularly the ecological guidelines. Complete tabulated results compared to the assessment criteria are presented in Appendix C.

3.8 DISTILLED WATER EXTRACT

A set of reference values has been established to allow assessment of the results of the distilled water extract analysis. These reference values were compiled from internationally accepted guidelines for water quality for release from mining operations (IFC environmental, health and safety guidelines (Ref. 17 and 18) and the ANZECC water quality guideline for livestock drinking water (Ref. 19)).

The water quality results of the distilled water extracts have also been compared to Australian drinking water guidelines (Ref. 20).

Tabulated distilled water extract results compared to the reference water quality guidelines are presented in Appendix D and discussed in the following sections.

3.8.1 Comparison to Guidelines for Release and Livestock Drinking Water

The distilled water extract results were found to be of a reasonable quality compared to reference drinking water standards, with exceedances noted for the following:

- pH in 31% of samples (three samples acidic and one sample alkaline)
- TDS in 15% of samples
- Aluminium in 8% of samples (i.e. one sample)
- Cadmium in 15% of samples
- Cobalt in 15% of samples
- Iron in 15% of samples
- Nickel in 15% of samples
- Selenium in 8% of samples (i.e. one sample)
- Sulfate in 15% of samples
- Zinc in 15% of samples

Sample 254619 was classified as PAF and recorded the poorest water quality in the distilled water extract test. The elevated concentrations of dissolved metals are likely primarily due to the pH of the extract solution dropping to pH 3.7. This is indicates that

the sulfide minerals in the PAF material are likely to have short lag times to oxidation and acidification, which in turn may lead to increased metal solubility. The other sample which recorded poor water quality was sample 254628 which was classified as having an uncertain acid forming potential due to a negative NAPP and NAG pH of 3.6. This sample recorded a pH of 4.8 in the distilled water extract test indicating that the ANC of 63 kg H_2SO_4 /t is not available to buffer pH under weakly acidic conditions. A sample classified as NAF (254630) also recorded a pH of 4.8 in the distilled water extract test but recorded no metals above the water quality criteria. Therefore, it appears that pH is not the only controlling factor for metal solubility in the waste rock. Further, samples 254619 and 254628 recorded the highest overall element enrichment levels of the samples selected for distilled water extract testing, indicating that enrichment levels in the rock is likely an additional factor in determining leachate quality.

3.8.2 Comparison to Drinking Water Guidelines

None of the samples tested met the drinking water guidelines, with exceedances summarised below:

- pH in 54% of samples (three samples acidic and four samples alkaline)
- TDS in 15% of samples
- Aluminium in 62% of samples
- Antimony in 38% of samples
- Cadmium in 23% of samples
- Copper in 8% of samples (i.e. one sample)
- Fluoride in 8% of samples (i.e. one sample)
- Iron in 69% of samples
- Lead in 15% of samples
- Manganese in 46% of samples
- Nickel in 23% of samples
- Selenium in 23% of samples
- Sulfate in 15% of samples
- Uranium in 8% of samples (i.e. one sample)
- Zinc in 15% of samples

Samples 254619 and 254628 recorded the highest number of exceedances in the for distilled water extract testing when compared to drinking water guidelines. Notably,

manganese and nickel concentrations in sample 254619 were over 100 times the drinking water guidelines, with iron more than 400 times the guideline. In addition, cadmium and zinc were measured at more than 100 times the drinking water guideline in sample 254628, with manganese and nickel more than 1500 times the guidelines.

4. GEOCHEMICAL RESULTS – TAILINGS AND ORE

4.1 INTRODUCTION

The static testing results are discussed in the following sections with summary tables provided. Copies of all laboratory test reports are provided in Appendix A, with expanded summary tables provided in Appendices B, C and D.

As part of the quality control and assurance programme conducted by Intertek Genalysis, duplicate analyses were conducted on selected samples. Where duplicate analyses have been undertaken, the results presented in the following sections are the average of the original and duplicate tests.

4.2 ACID BASE ACCOUNTING

The results of the sulfur speciation results indicate that the total sulfur contents of the ore samples were very low ranging from 0.02% to 0.03%, comprising a relatively even proportion of sulfate and sulfide.

The tailings samples produced variable results, with S sample recording very low sulfur at 0.04%, of which 0.03% comprised sulfate. However, C sample recorded low total sulfur at 0.23% and 0.02% sulfate, indicating a sulfide content of around 0.21%.

The maximum potential acidity was calculated from the sulfide sulfur content varying from 0.3 to 6.4 kg H_2SO_4 / tonne which is very low to low.

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. Carbonate carbon is estimated based on the total inorganic carbon (TIC) data.

The ANC of the ore samples ranged from 70 to 119 kg H_2SO_4 / t which is very high, while the ANC of the tailings was extremely high at 700 to 770 kg H_2SO_4 / t given the overall much higher percentage of neutralising minerals in the tailings following the removal of 90 to 95% of the iron.

The ANC calculated as being available from carbonates were much lower than the measured ANC, indicating that significant neutralising capacity is likely to be available from both carbonate and non-carbonate minerals, as was found in the waste rock analysis. However, ANC provided by non-carbonate minerals is typically released much more slowly than that provided by carbonates and may only be available under low pH conditions.

The Net Acid Producing Potential (NAPP) of the samples was calculated from the MPA and the ANC, along with the ANC/MPA ratio. All samples recorded strongly negative

NAPPs and ANC/MPA ratios over 100 indicating significant excess acid neutralising potential. The acid base accounting results for the tailings and ore samples are presented in Table 4.1.

4.3 NET ACID GENERATION

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

The results of the net acid generation test indicate that no measurable acid was produced by any of the samples under extreme oxidising conditions. The final pH of the NAG solutions varied from pH 8.9 to 9.1. The NAG results for all samples are presented in Table 4.1.

4.4 ACID FORMING POTENTIAL

The acid formation potential is calculated based on the acid base accounting results and the NAG test. Both tailings samples and S sample ore were classified as acid consuming, with C sample ore classed as non acid forming (NAF). These classifications are shown graphically in Figures 4.1.

Table 4.1: Acid Base Accounting, NAG and Acid Forming Potential Results

Sample ID	Sulfur Species			ANC	Carbon Species				Calculations			NAG		AFP
	Total-S	SO_4-S	Sulfide-S		C	TIC	Calcite Equivalent	$CaCO_3$-ANC	MPA	ANC /MPA	NAPP	NAG (7.0)	NAG pH	
	%	%	%	kgH_2SO_4/t	%	%	%	kgH_2SO_4/t	kgH_2SO_4/t		kgH_2SO_4/t	kgH_2SO_4/t	NONE	
C Sample Tailings	0.23	0.02	0.21	706	5.72	5.65	47.08	461.41	6.4	109.9	-700	0	8.9	AC
S Sample Tailings	0.04	0.03	0.01	770	0.18	0.16	1.33	13.07	0.3	2516.3	-770	0	9.1	AC
C Sample Ore	0.03	0.01	0.02	70	0.58	0.54	4.50	44.10	0.6	114.4	-69	0	9	NAF
S Sample Ore	0.02	0.01	0.01	119	0.08	0.06	0.50	4.90	0.3	388.9	-119	0	9	AC

4.5 MULTI-ELEMENT ANALYSIS

4.5.1 Element Enrichments

The results of the multi-element analysis indicate the tailings and ore samples to have high levels of element enrichments, as shown in Tables 4.2 and 4.3.

Both ore samples were highly enriched in arsenic and bismuth, with the C sample ore also highly enriched in boron, antimony and tin. Both ore samples were significantly enriched in iron, with the S sample ore also significantly enriched in boron, antimony and selenium.

Both tailings samples were highly enriched in arsenic, boron, bismuth and antimony, with C sample tailings also highly enriched in cobalt and significantly enriched in silver, cadmium, lead and zinc.

Table 4.2: Multi-Element Analysis Results and Average Crustal Abundance

Element	Unit	Assay Result				ACA
		C Sample Tailings	S Sample Tailings	C Sample Ore	S Sample Ore	
Ag	ppm	3.3	0.2	0.3	0.1	0.07
Al	ppm	6087	2046	336	604	82000
As	ppm	1560.0	516.0	115.0	88.5	1.5
B	ppm	9919	548	910	148	10
Ba	ppm	32	6	3	2.2	500
Be	ppm	2.5	0.7	0.2	0.55	2.6
Bi	ppm	8771.78	45.82	535.31	73.425	0.048
Ca	ppm	78061	2889	6995	887	41000
Cd	ppm	3.5	0.2	0.1	0.2	0.11
Cl	ppm	200	200	200	200	130
Co	ppm	1029.5	7.6	172.1	36.8	20
Cr	ppm	7	7	15	9	100
Cu	ppm	66	12	8	6.5	50
F	ppm	3948	1092	384	215.5	950
Fe	ppm	65900	22200	645600	588600	41000
Hg	ppm	0.05	0.01	0.04	0.015	0.05
K	ppm	391	192	42	50.5	21000
Mg	ppm	162921	250224	22471	35707.5	23000
Mn	ppm	2569	1904	1855	4895.5	950
Mo	ppm	2.7	0.9	1.8	1.95	1.5
Na	ppm	420	145	304	315	23000
Ni	ppm	41	6	10	8	80
P	ppm	181	123	18	19.5	1000
Pb	ppm	342	26	30	12	14
S	ppm	2300	400	300	200	260
Sb	ppm	51	16	15	5.62	0.2
Se	ppm	9.77	0.16	0.17	0.13	0.05
Sn	ppm	408.8	18.8	137.9	39.55	2.2
Sr	ppm	135	8	13	1.95	370
Th	ppm	0.4	0.4	0.1	0.15	12
U	ppm	4.2	0.7	1.1	0.39	2.4
V	ppm	3	3	6	20.5	160
Zn	ppm	1379	119	280	112	75

Table 4.3: Geochemical Abundance Indices

Element	GAI			
	C Sample Tailings	S Sample Tailings	C Sample Ore	S Sample Ore
Ag	4	0	1	0
Al	0	0	0	0
As	6	6	5	5
B	6	5	5	3
Ba	0	0	0	0
Be	0	0	0	0
Bi	6	6	6	6
Ca	0	0	0	0
Cd	4	0	0	0
Cl	0	0	0	0
Co	5	0	2	0
Cr	0	0	0	0
Cu	0	0	0	0
F	1	0	0	0
Fe	0	0	3	3
Hg	0	0	0	0
K	0	0	0	0
Mg	2	2	0	0
Mn	0	0	0	1
Mo	0	0	0	0
Na	0	0	0	0
Ni	0	0	0	0
P	0	0	0	0
Pb	4	0	0	0
S	2	0	0	0
Sb	6	5	5	4
Se	6	1	1	0
Sn	6	2	5	3
Sr	0	0	0	0
Th	0	0	0	0
U	0	0	0	0
V	0	0	0	0
Zn	3	0	1	0

Not Enriched
Slightly Enriched
Significantly Enriched
Highly Enriched

4.5.2 Soil Quality Screening

The results of the multi-element analysis have also been compared to a set of soil quality screening guidelines for human health and ecology, which indicated that the two tailings samples did not meet the soil screening criteria. Elevated metals included antimony, arsenic and zinc in both samples plus cobalt in the C sample tailings. This has implications for closure design of the tailings storage facility, as discussed in Section 6.

The two ore samples were found to meet the criteria for human health, but not the ecological guidelines due to elevated antimony, arsenic and zinc. S sample ore also exceeded the ecological criteria for manganese. This has implications for project closure and rehabilitation should any ore stockpiles remain following cessation of operations, as discussed in Section 6.

Complete tabulated results compared to the assessment criteria are presented in Tables 4.4 to 4.6.

Table 4.4: Multi-Element Analysis Results and Human Health Screening Guidelines

Element	Human Health-Based Investigation Levels [1] (ppm)	C Sample Tailings	S Sample Tailings	C Sample Ore	S Sample Ore
Antimony	N/G	51.11	16.40	14.52	5.62
Arsenic	300	**1560**	**516**	115	88.5
Barium	N/G	32	6	3	2
Beryllium	90	2.5	0.7	0.2	0.55
Boron	20000	9919	548	910	148
Cadmium	90	3.5	0.2	0.1	0.2
Chromium	N/G	7	7	15	9
Cobalt	300	**1029.5**	7.6	172.1	36.8
Copper	17000	66	12	8	6.5
Lead	600	342	26	30	12
Manganese	19000	2569	1904	1855	4895.5
Mercury	80	0.05	0.01	0.04	0.015
Molybdenum	N/G	2.7	0.9	1.8	2.0
Nickel	1200	41	6	10	8
Phosphorus	N/G	181	123	18	19.5
Selenium	700	9.8	0.2	0.2	0.1
Silver	N/G	3.3	0.2	0.3	0.1
Sulfur	N/G	2300	400	300	200
Sulfate	N/G	200	300	100	100
Tin	N/G	408.8	18.8	137.9	39.6
Vanadium	N/G	3	3	6	21
Zinc	30000	1379	119	280	112

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 4.5: Multi-Element Analysis Results and Ecological Screening Guidelines

Element	Ecological Soil Screening Levels [2,3] (ppm)	C Sample Tailings	S Sample Tailings	C Sample Ore	S Sample Ore
Antimony	0.27	**51.11**	**16.40**	**14.52**	**5.62**
Arsenic	46	**1560**	**516**	**115**	**88.5**
Barium	2000	32	6	3	2
Beryllium	21	2.5	0.7	0.2	0.55
Boron	N/G	9919	548	910	148
Cadmium	0.36	**3.5**	0.2	0.1	0.2
Chromium	34	7	7	15	9
Cobalt	230	**1029.5**	7.6	172.1	36.8
Copper	49	**66**	12	8	6.5
Lead	56	**342**	26	30	12
Manganese	4000	2569	1904	1855	**4895.5**
Mercury	N/G	0.05	0.01	0.04	0.015
Molybdenum	N/G	2.7	0.9	1.8	2.0
Nickel	130	41	6	10	8
Phosphorus	2000	181	123	18	19.5
Selenium	0.63	**9.8**	0.2	0.2	0.1
Silver	14	3.3	0.2	0.3	0.1
Sulfur	600	**2300**	400	300	200
Sulfate	2000	200	300	100	100
Tin	N/G	408.8	18.8	137.9	39.6
Vanadium	280	3	3	6	21
Zinc	79	**1379**	**119**	**280**	**112**

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.

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

Table 4.6: Multi-Element Analysis Results and Intervention Guidelines

Element	Soil Remediation Intervention Values [4] (ppm)	C Sample Tailings	S Sample Tailings	C Sample Ore	S Sample Ore
Antimony	15	**51.11**	**16.40**	14.52	5.62
Arsenic	55	**1560**	**516**	**115**	**88.5**
Barium	625	32	6	3	2
Beryllium	30	2.5	0.7	0.2	0.55
Boron	N/G	9919	548	910	148
Cadmium	12	3.5	0.2	0.1	0.2
Chromium	380	7	7	15	9
Cobalt	240	**1029.5**	7.6	172.1	36.8
Copper	190	66	12	8	6.5
Lead	530	342	26	30	12
Manganese	N/G	2569	1904	1855	4895.5
Mercury	10	0.05	0.01	0.04	0.015
Molybdenum	200	2.7	0.9	1.8	2.0
Nickel	210	41	6	10	8
Phosphorus	N/G	181	123	18	19.5
Selenium	100	9.8	0.2	0.2	0.1
Silver	15	3.3	0.2	0.3	0.1
Sulfur	N/G	2300	400	300	200
Sulfate	N/G	200	300	100	100
Tin	900	408.8	18.8	137.9	39.6
Vanadium	250	3	3	6	21
Zinc	720	**1379**	119	280	112

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.

4.6 DISTILLED WATER EXTRACT

A set of reference values has been established to allow assessment of the results of the distilled water extract analysis. These reference values were compiled from internationally accepted guidelines for water quality for release from mining operations (IFC environmental, health and safety guidelines (Ref. 17 and 18) and the ANZECC water quality guideline for livestock drinking water (Ref. 19)).

The water quality results of the distilled water extracts have also been compared to Australian drinking water guidelines (Ref. 20.

Tabulated distilled water extract results compared to the reference water quality guidelines are presented in Table 4.7 and 4.8. and discussed in the following sections.

4.6.1 Comparison to Guidelines for Release and Livestock Drinking Water

The distilled water extract results of the tailings and ore samples were found to be of a reasonable quality compared to reference drinking water standards, with exceedances only noted for the following:

- pH in C sample ore (i.e. alkaline)
- Boron in C sample tailings
- Fluoride in C sample tailings
- Selenium in C sample tailings

4.6.2 Comparison to Drinking Water Guidelines

None of the tailings and ore samples tested met the drinking water guidelines, with exceedances summarised below:

- pH in C sample tailings and both ore samples (i.e. alkaline)
- TDS in both tailings samples and C sample ore
- Arsenic in both tailings samples
- Boron in C sample tailings
- Fluoride in C sample tailings
- Selenium in C sample tailings and ore

Table 4.7: Distilled Water Extract Comparison to Release and Livestock Guidelines

Parameter	Reference Value (mg/L)	Assay Results (mg/L)			
		C Sample Tailings	S Sample Tailings	C Sample Ore	S Sample Ore
pH	6 to 9	**8.7**	8.4	**9.3**	**8.9**
TDS	2000	184	99	60	66
Aluminum	5	0.01	0.02	0.01	0.01
Antimony	N/G	**0.04434**	**0.00536**	**0.01729**	0.00149
Arsenic	0.1	**0.023**	**0.0144**	0.0057	0.0056
Barium	N/G	0.03339	0.05548	0.0017	0.00089
Boron	5	**6.24**	0.38	0.62	0.11
Cadmium	0.01	0.00002	0.00002	0.00002	0.00002
Calcium	1000	19.93	20.28	7.33	11.24
Chloride	N/G	12	7	2	3
Chromium	1	0.01	0.01	0.01	0.01
Cobalt	1	0.001	0.0001	0.0003	0.0001
Copper	0.3	0.01	0.01	0.01	0.01
Fluoride	2	**2.1**	1	1.1	0.5
Iron	2	0.16	0.01	0.26	0.14
Lead	0.1	0.0019	0.0005	0.0007	0.0005
Magnesium	2000	23.43	20.57	7.64	6.92
Manganese	N/G	0.01	0.01	0.01	0.01
Mercury	0.002	0.0001	0.0001	0.0001	0.0001
Molybdenum	0.15	0.03644	0.00085	0.02138	0.00414
Nickel	0.5	0.01	0.01	0.01	0.01
Phosphorus	N/G	0.1	0.1	0.1	0.1
Selenium	0.02	**0.0627**	0.0012	**0.0113**	0.0012
Silver	0.5	0.00009	0.00022	0.00289	0.00001
Sodium	N/G	3	2.2	0.6	1
Sulfate	1000	68.3	6.0	12.3	16.5
Tin	N/G	0.0016	0.0009	0.0013	0.0005
Uranium	0.2	0.00013	0.00001	0.00002	0.0001
Vanadium	N/G	0.01	0.01	0.01	0.01
Zinc	0.5	0.01	0.01	0.01	0.01

Notes:
N/G = No guideline.

Table 4.8: Distilled Water Extract Comparison to Drinking Water Guideline Values

Parameter	Reference Drinking Water Value (mg/L)	Assay Results (mg/L)			
		C Sample Tailings	S Sample Tailings	C Sample Ore	S Sample Ore
pH	6.5 to 8.5	**8.7**	8.4	**9.3**	**8.9**
TDS	600	184	99	60	66
Aluminum	0.2	0.01	0.02	0.01	0.01
Antimony	0.003	**0.04434**	**0.00536**	**0.01729**	0.00149
Arsenic	0.01	**0.023**	**0.0144**	0.0057	0.0056
Barium	2	0.03339	0.05548	0.0017	0.00089
Boron	4	**6.24**	0.38	0.62	0.11
Cadmium	0.002	0.00002	0.00002	0.00002	0.00002
Calcium	N/G	19.93	20.28	7.33	11.24
Chloride	250	12	7	2	3
Chromium	N/G	0.01	0.01	0.01	0.01
Cobalt	N/G	0.001	0.0001	0.0003	0.0001
Copper	1	0.01	0.01	0.01	0.01
Fluoride	1.5	**2.1**	1	1.1	0.5
Iron	0.3	0.16	0.01	0.26	0.14
Lead	0.01	0.0019	0.0005	0.0007	0.0005
Magnesium	N/G	23.43	20.57	7.64	6.92
Manganese	0.1	0.01	0.01	0.01	0.01
Mercury	0.001	0.0001	0.0001	0.0001	0.0001
Molybdenum	0.05	0.03644	0.00085	0.02138	0.00414
Nickel	0.02	0.01	0.01	0.01	0.01
Phosphorus	N/G	0.1	0.1	0.1	0.1
Selenium	0.01	**0.0627**	0.0012	**0.0113**	0.0012
Silver	0.1	0.00009	0.00022	0.00289	0.00001
Sodium	180	3	2.2	0.6	1
Sulfate	250	68.3	6.0	12.3	16.5
Tin	N/G	0.0016	0.0009	0.0013	0.0005
Uranium	0.017	0.00013	0.00001	0.00002	0.0001
Vanadium	N/G	0.01	0.01	0.01	0.01
Zinc	3	0.01	0.01	0.01	0.01

Notes:
N/G = No guideline.

5. IMPLICATIONS FOR WASTE ROCK MANAGEMENT

The limited testwork conducted to date indicates that acid generation within waste rock dumps should not become a significant issue if appropriate management controls are employed, with 91% of the samples classified as acid consuming or non acid forming. However, one sample recorded a sulfide content of almost 13%, with a paste pH of 4.3 and distilled water extract pH of 3.7 indicating that the sample is highly reactive. As such, it will be important for waste rock management to determine what proportion of waste rock is likely to have such high sulfide contents. Three samples were also classed as having an uncertain acid forming potential due to conflicting acid base accounting results. This is due to the ANC being associated with non-carbonate minerals which are slow to provide buffering capacity and only react when the pH becomes strongly acidic. Based on the acid base accounting and mineralogy results it is recommended that the uncertain samples be considered potentially acid forming.

Based on the acid base accounting results, it appears that identifying PAF waste rock during operations using analytical techniques to allow selective handling is possible, but would require NAG testing to identify PAF waste. Classification based on sulfur block modelling or lithology will not be possible. However, around one third of sample tested were classed as acid consuming, with dolomite also present within the waste. As such it is recommended that the dolomite is identified and selectively handled and placed on the top surface of the waste dump and external batters to provide alkalinity. The outer batters and top surface of dumps should also be compacted prior to placement of the dolomite capping to reduce water ingress.

Kinetic testing of a limited number of uncertain and PAF samples would be beneficial to assess the sulfur oxidation rates and determine whether intermediate capping layers of dolomite would be required during operations to prevent acid generation. However, testing of additional samples for a reduced suite of acid base accounting including total carbon, total sulfur, ANC and NAG testing is recommended to further develop understanding of the acid formation potential according to lithology, weathering and/or any other relationships not yet identified.

The results of the multi-element analysis indicate that the samples typically have high levels of element enrichments, with arsenic, bismuth and antimony the most commonly enriched metals. Other metals found to be highly enriched include tin, boron, selenium, sulfur, silver, zinc, cadmium and lead, with significant enrichments also including copper, manganese and molybdenum. Only one sample comprising dolomite was found to have no element enrichments.

Further, none of the samples met all of the soil quality screening guidelines, particularly the ecological criteria. As such, the waste dumps would likely require a closure cover system consisting of benign waste (i.e. dolomite) and a growth medium. Appropriate dust and sediment management practices during operations should also be considered.

The distilled water extract testing indicated that the majority of the waste is unlikely to leach environmentally significant metals above the release guidelines applied in this study. However, it appears that leachability is largely controlled by pH and, therefore, placing PAF material centrally within the waste dumps and providing compaction to the top surface and outer batters, plus a dolomite capping layer to provide alkalinity should provide appropriate controls. However, this assessment is based on a limited number of samples and therefore additional testing is recommended prior to operations to verify that these controls will be effective. Further, based on comparison of the distilled water extract results with drinking water guidelines, seepage flows from the waste dumps must not be permitted to enter drinking water sources.

Asbestos minerals were identified in six samples selected for fibre identification analysis. These samples were selected following suspected identification of chrysotile fibres in one of the samples during XRD analysis. As chrysotile is a serpentine mineral, all six samples identified as containing serpentine during XRD mineralogy were further analysed for their fibrous mineral contents. The results of the fibre identification indicated that all six samples contained asbestos, however, only one contained chrysotile asbestos, with the other five containing asbestos associated with amphibole minerals. Given the significant implications of asbestos being present in the deposit, it is recommended that further studies are conducted to determine the pervasiveness of each asbestos mineral to allow appropriate risk assessments to be conducted.

6. IMPLICATIONS FOR TAILINGS AND ORE MANAGEMENT

Both tailings samples and S sample ore were classified as acid consuming, with C sample ore classed as non acid forming (NAF). As such, there are no management controls envisaged in relation to acid formation potential of tailings or ore.

The results of the multi-element analysis indicate the tailings and ore samples to have high levels of element enrichments, with commonly enriched metals including arsenic, boron, bismuth, antimony and tin. As such, operations should be designed to limit dust generation. The tailings storage facility should also be designed to contain all tailings solids during operations, with a basic cover system constructed over the tailings beach on closure based on the preliminary soil screening assessment.

Sediment control structures should be provided for ore stockpiles (e.g. bunding) during operations, with a basic cover system placed over the stockpiles on closure to limit dusting should any ore stockpiles remain following cessation of operations. The stockpiles may also require re-shaping on closure to create landforms which are resistant to erosion.

Analysis of tailings supernatant should be conducted when samples become available. However, the distilled water extract results indicate the tailings solids to be of a low leaching potential, although C sample tailings exceeded the reference release water quality guidelines for boron, fluoride and selenium. As such, the supernatant may be appropriate for release depending on the ratio of C type tailings to S tailings. However, the tailings storage facility should be constructed with appropriate storage capacity to contain all rainfall associated with the design event, such that any spillway flows will be sufficiently dilute. It is understood that the intention is to deposit tailings in the existing Comstock TSF. Therefore, the design of this facility and the existing tailings geochemistry should be reviewed to ensure suitability.

The distilled water extract results indicated that runoff from ore stockpiles should be of a suitable quality for release (i.e. after removal of sediment) based on the reference guidelines applied in this study, although the pH may become alkaline in the longer term and therefore consideration should be water management post closure should any stockpiles remain. Stockpile runoff should not be permitted to enter any potable water supplies.

Based on the findings of the waste rock analysis, further studies should be conducted to determine whether the tailings and ore contain asbestos minerals and, if so, the pervasiveness of each asbestos mineral such that appropriate risk assessments can be conducted.

7. CONCLUSIONS

The conclusions of this geochemical assessment are provided in the following sections.

7.1 ACID FORMING POTENTIAL

- Assuming that the samples analysed in this study are reflective of the overall waste rock material, around 90% of the waste rock is expected to be acid consuming or non acid forming. However, a portion of the waste rock presents a risk of acid generation due to ANC being associated with non-carbonate minerals which only buffer acid under very low pH conditions.
- Both tailings samples and the S sample ore were classified as acid consuming, with C sample ore classed as non acid forming (NAF).

7.2 ELEMENT ENRICHMENTS

- The multi-element testing typically identified high levels of element enrichments in the waste rock, with arsenic, bismuth and antimony the most commonly enriched metals. Other metals found to be highly enriched include tin, boron, selenium, sulfur, silver, zinc, cadmium and lead, with significant enrichments also including copper, manganese and molybdenum.
- The tailings and ore samples also had high levels of element enrichments, with commonly enriched metals including arsenic, boron, bismuth, antimony and tin.
- No waste rock, tailings or ore samples met all soil quality screening criteria.

7.3 METAL LEACHING

- The distilled water extract testing indicated that the majority of the waste is unlikely to leach environmentally significant metals above the release guidelines applied in this study. However, it appears that leachability is largely controlled by pH.
- Analysis of tailings supernatant should be conducted when samples become available. However, the distilled water extract results indicate the tailings solids to be of a low leaching potential.
- The distilled water extract results indicated that runoff from ore stockpiles should be of a suitable quality for release (i.e. after removal of sediment) based on the reference guidelines applied in this study, although the pH may become alkaline in the longer term.
- The extract results indicate that no samples of waste rock, tailings or ore met the drinking water guidelines.

7.4 WASTE ROCK MANAGEMENT

- It is recommended that the dolomite is identified and selectively handled and placed on the top surface of the waste dump and external batters to provide alkalinity. The outer batters and top surface of dumps should also be compacted prior to placement of the dolomite capping to reduce water ingress.
- One waste rock sample recorded a sulfur content of 13%. The occurrence of such high sulfur material within the waste should be assessed.
- Based on the multi-element data appropriate dust and sediment management practices during operations should be considered.
- It appears that leachability is largely controlled by pH and, therefore, placing PAF material centrally within the waste dumps and providing compaction to the top surface and outer batters, plus a dolomite capping should provide appropriate controls.
- Seepage flows from the waste dumps must not be permitted to enter drinking water sources.
- The results of recommended studies into the pervasiveness of asbestos minerals and associated risk assessments should be used to establish safe operating procedures associated with exposure to asbestos fibres.

7.5 TAILINGS MANAGEMENT

- There are no management controls envisaged in relation to acid formation potential of tailings.
- The tailings storage facility should also be designed to contain all tailings solids during operations, with a basic cover system constructed over the tailings beach on closure.
- The tailings storage facility should be constructed with appropriate storage capacity to contain all rainfall associated with the design event, such that any spillway flows will be sufficiently dilute.
- The design of the existing Comstock TSF and tailings geochemistry should be reviewed to ensure suitability for the Tenth Legion project.
- The results of recommended studies into the pervasiveness of asbestos minerals and associated risk assessments should be used to establish safe operating procedures associated with exposure to asbestos fibres if present within the tailings.

7.6 ORE MANAGEMENT

- There are no management controls envisaged in relation to acid formation potential of ore.
- Operations should be designed to limit dust generation.
- Sediment control structures should be provided for ore stockpiles (e.g. bunding) during operations, with a basic cover system placed over the stockpiles on closure to limit dusting should any remain following cessation of operations.
- The stockpiles may also require re-shaping on closure to create landforms which are resistant to erosion.
- Runoff from ore stockpiles should be of a suitable quality for release (i.e. after removal of sediment), although the pH may become alkaline in the longer term and therefore consideration should be water management post closure should any stockpiles remain.
- Runoff from ore stockpiles should not be permitted to enter any potable water supplies.
- The results of recommended studies into the pervasiveness of asbestos minerals and associated risk assessments should be used to establish safe operating procedures associated with exposure to asbestos fibres if present within the ore.

7.7 FURTHER WORK

- Testing of additional waste rock samples for a reduced suite of acid base accounting including total carbon, total sulfur, ANC and NAG testing is recommended to further develop understanding of the acid formation potential according to lithology, weathering and/or any relationships not yet identified.
- Additional multi-element and dissolved water extract analysis is recommended on additional waste rock samples at a reduced suite limited to metals of concern identified based on this initial assessment to further qualify the initial predictions and recommendations around multi-element enrichments and leaching potential.
- Kinetic testing of a limited number of uncertain and PAF waste rock samples would be beneficial to assess the sulfur oxidation rates and advance waste rock dump design.
- Studies to determine the presence and pervasiveness of asbestos minerals within the deposit should be conducted for risk assessment purposes. The results can then be used to establish appropriate safe operating procedures.

- Analysis of tailings supernatant should be conducted when samples are available.
- Analysis of the existing Comstock tailings should be conducted prior to recommissioning the facility for the Tenth Legion project.

8. REFERENCES

1. Knight Piésold Consulting (2015). Tenth Legion Magnetite Project – *Waste Rock Sample Selection Study.* Memorandum Report Ref: BR801-00283 EJT M15001, issued 13 April 2015.
2. Knight Piésold Consulting (2015). Tenth Legion Magnetite Project – *Preliminary Waste Rock Geochemical Results.* Memorandum Report Ref: BR801-00283 EJT M15004, issued 30 September 2015.
3. Tim Callaghan – Resource and Exploration Geology (2014). Tenth Legion Mineral Resource Estimation.
4. Mine Environment Neutral Drainage (MEND) Program (1991). Acid Rock Drainage Prediction Manual. MEND Project 1.16.1b.
5. British Columbia Ministry of Energy and Mines (1998). Guidelines for Metal Leaching and Acid Rock Drainage at Minesites in British Columbia.
6. Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M. (1978). Field and laboratory methods applicable to overburden and minesoils. Environmental Protection Technology Series, EPA-600/2-78-054.
7. Miller, S., Robertson A., Donohue, T. (1997). Advances in acid drainage prediction using the net acid generation test. In Proceedings of the Forth International Conference on Acid Rock Drainage (Vancouver, B.C.) pp 535 - 547.
8. Stewart, W., Miller, S., Smart, R., Gerson, A., Thomas, J., Skinner, W., Levay, G. and Schumann, R. (2003). Evaluation of the Net Acid Generation (NAG) Test for Assessing the Acid Generating Capacity of Sulfide Minerals. In Proceeding of the Sixth International Conference on Acid Rock Drainage (Cairns, Australia) pp 617 - 625.
9. Australian Government, Department of Industry, Tourism and Resources (2007). Managing Acid and Metalliferous Drainage.
10. AMIRA International (2002). ARD Test Handbook.
11. The International Network for Acid Prevention (INAP) (2009). Global Acid Rock Drainage Guide (GARD Guide). http://www.gardguide.com/
12. Bowen, H.J.M. (1979). Environmental Chemistry of the Elements. Academic Press, New York.
13. Australian Government (2013). National Environment Protection (Assessment of Site Contamination) Amendment Measure.

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

15. NEPC (1999). National Environment Protection (Assessment of Site Contamination) Measure.

16. VROM (2000), Circular on Target Values and Intervention Values for Soil Remediation, Reference DBO/1999226863, Ministry of Housing, Spatial Planning and the Environment, Bilthoven, Netherlands.

17. IFC (2004). IFC Environmental, Health and Safety Guidelines for Precious Metal Mining (Draft).

18. IFC (2007). IFC Environmental, Health and Safety Guidelines for Mining.

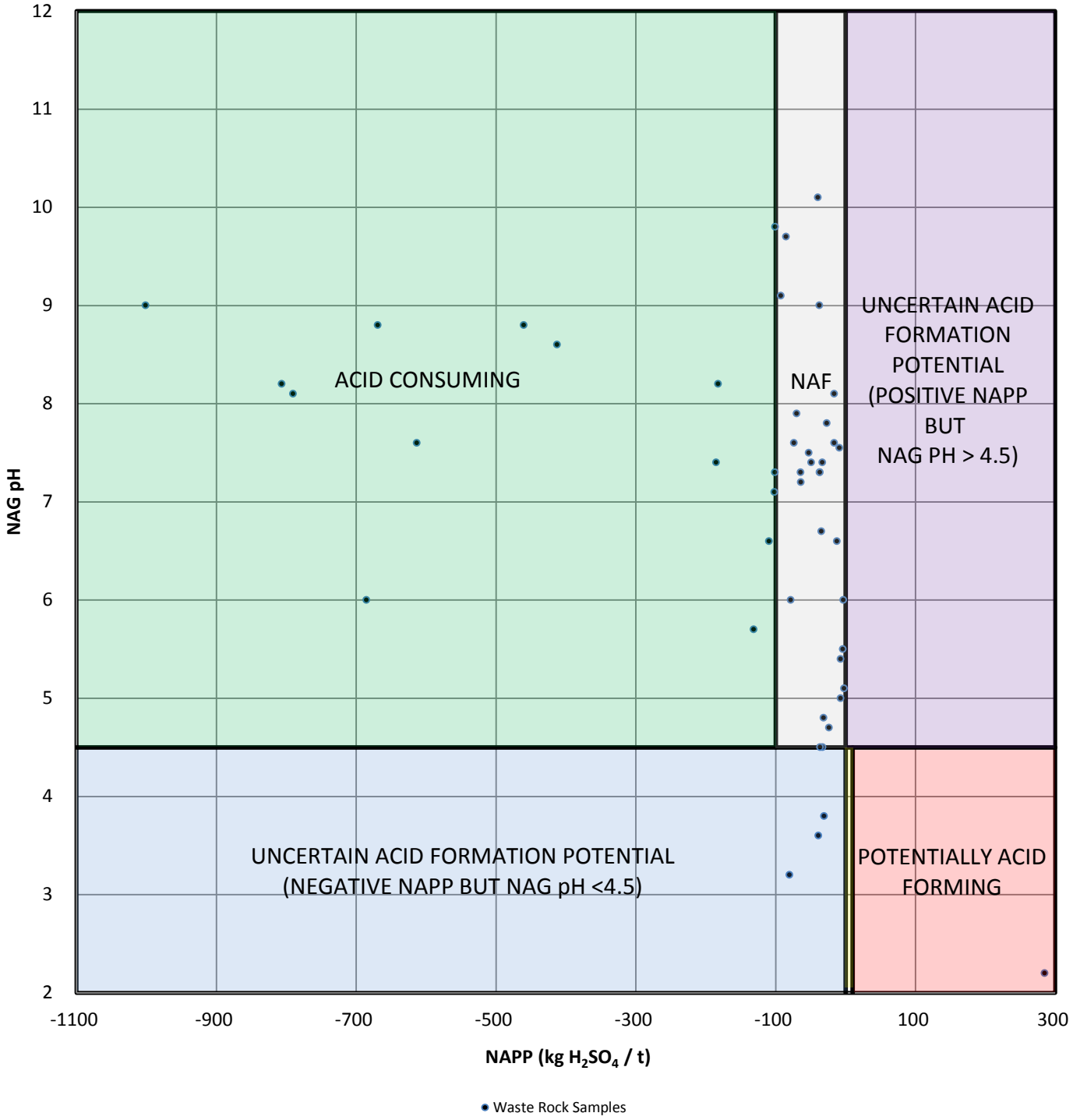
19. Australian and New Zealand Environmental and Conservation Council (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

20. NHMRC, NRMMC (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.

FIGURES

Knight Piésold
CONSULTING

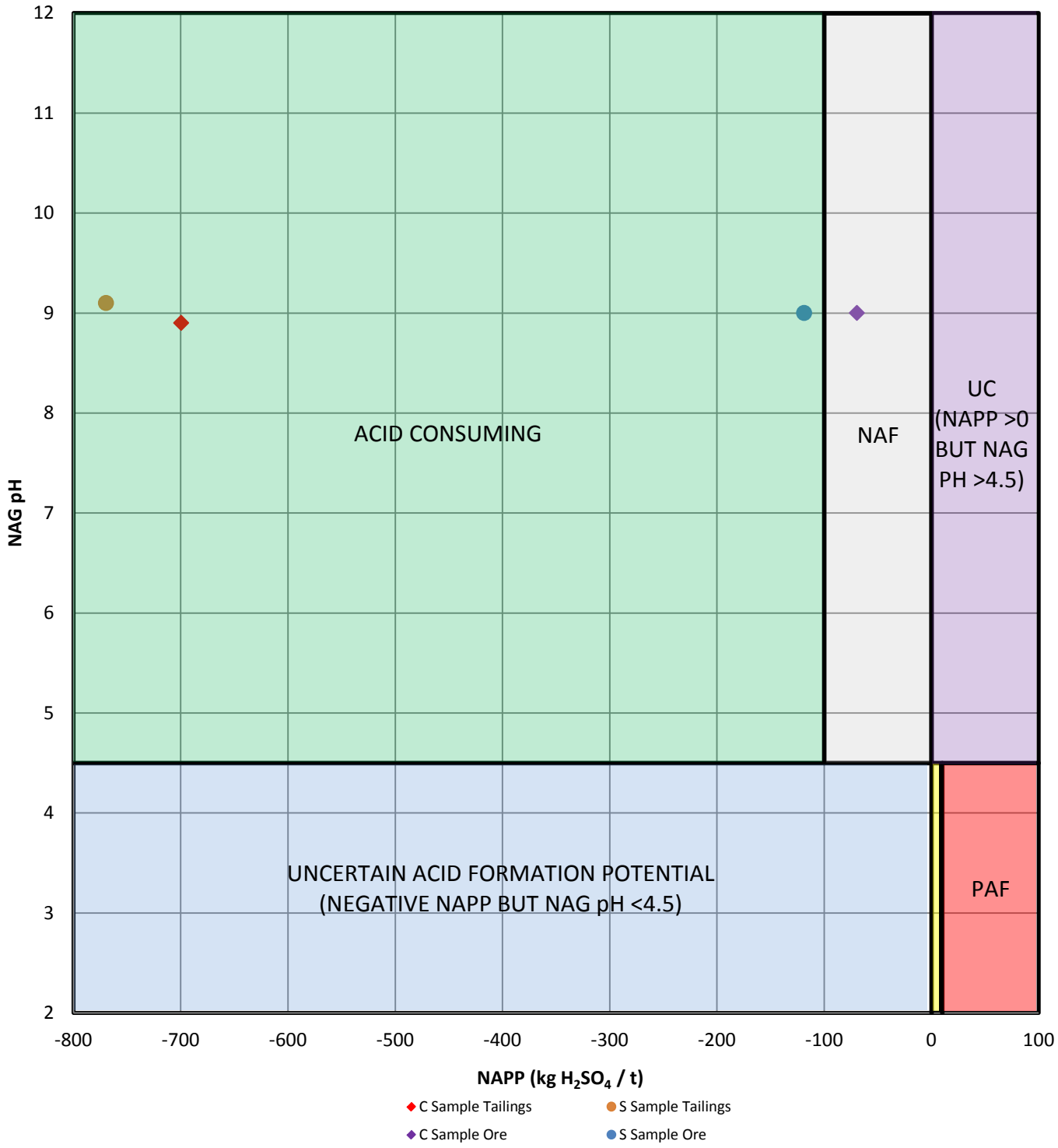
Acid Formation Potential



Note: Horizontal axis adjusted to to show samples with extremely low and high NAPP values

Acid Formation Potential	NAPP (kg H_2SO_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

Acid Formation Potential



Note: Horizontal axis adjusted to to show samples with extremely low NAPP values

Acid Formation Potential	NAPP (kg H_2SO_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

Laboratory Reports

Knight Piésold CONSULTING

ANALYTICAL REPORT

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

JOB INFORMATION

JOB CODE	:	752.0/1510011
No. of SAMPLES	:	48
No. of ELEMENTS	:	46
CLIENT O/N	:	P14027 (Job 1 of 1)
SAMPLE SUBMISSION No.	:	BR801-00283 SS15001
PROJECT	:	10TH LEGION
STATE	:	Drill core
DATE RECEIVED	:	31/07/2015
DATE COMPLETED	:	27/08/2015
DATE PRINTED	:	27/08/2015
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
15 Davison Street, Maddington 6109, Western Australia
PO Box 144, Gosnells 6990, Western Australia
Tel: +61 8 9251 8100 Fax: +61 8 9251 8110
Email: genalysis@intertek.com
Web Page: www.genalysis.com.au

KALGOORLIE SAMPLE PREPARATION DIVISION
12 Keogh Way, Kalgoorlie 6430, Western Australia
Tel: +61 8 9021 6057 Fax: +61 8 9021 3476

ADELAIDE LABORATORY
11 Senna Road, Wingfield, 5013, South Australia
Tel: +61 8 8162 9714 Fax: +61 8 8349 7444

JOHANNESBURG LABORATORY
43 Malcolm Moodie Crescent,
Jet Park, Gauteng, South Africa 1459
Tel: +27 11 552 8149 Fax: +27 11 552 8248

TOWNSVILLE LABORATORY
9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
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 254601	0.2	763	760	315	715	2.4
0002 254602	1.5	8.09%	49	100	263	887.5
0003 254603	0.2	4.67%	86	5	93	430.6
0004 254604	0.4	7.85%	42	7	186	463.3
0005 254605	0.8	1.43%	696	15	103	119.2
0006 254606	0.5	8.22%	34	27	532	743.1
0007 254607	0.7	8.78%	12	149	386	567.5
0008 254608	0.1	6.14%	139	32	115	368.6
0009 254609	0.6	5.61%	183	406	197	245.8
0010 254610	0.6	6880	416	95	260	7.4
0011 254611	0.4	1075	872	19	65	6.8
0012 254612	0.9	4.04%	40	2	X	323.3
0013 254613	0.4	5.95%	45	14	176	742.6
0014 254614	0.1	6.67%	37	11	286	1089.7
0015 254615	0.1	5.59%	106	14	113	2293.6
0016 254616	0.6	6.73%	45	18	368	1056.5
0017 254617	0.9	3.67%	124	12	128	48.2
0018 254618	0.2	2729	1002	6	X	4.2
0019 254619	0.9	1.70%	108	53	X	47.4
0020 254620	0.3	11.93%	4	53	161	203.7
0021 254621	1.8	9.33%	64	7	50	399.5
0022 254622	0.7	4532	9	13	X	36.0
0023 254623	1.5	3128	16	36	X	168.3
0024 254624	1.4	6.72%	49	8	66	1288.6
0025 254625	1.0	4.28%	103	61	X	40.4
0026 254626	0.9	4.00%	64	35	X	493.1
0027 254627	0.6	2540	16	82	X	40.8
0028 254628	0.4	7.92%	63	377	X	644.0
0029 254629	0.1	8.41%	70	31	581	907.5
0030 254630	X	10.21%	2	690	233	147.7
0031 254631	0.3	8.71%	53	21	136	964.6
0032 254632	X	1357	790	439	303	1.5
0033 254633	X	702	613	211	312	6.4
0034 254634	9.1	8.40%	46	92	106	1337.2
0035 254635	0.4	4.38%	201	888	X	70.7
0036 254636	0.5	11.38%	12	15	X	545.6
0037 254637	0.3	7.57%	90	16	185	783.1
0038 254638	0.4	3.97%	151	28	160	40.7
0039 254639	16.8	8.52%	4	67	116	112.3
0040 254640	0.2	8.52%	8	137	141	389.6

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 254601	0.2	1.23	0.10	1256	0.2	X
0002 254602	3.6	5.36	0.90	4482	2.0	X
0003 254603	2.9	0.30	0.62	7.55%	0.1	X
0004 254604	2.4	0.40	0.15	6571	X	0.03
0005 254605	0.8	0.13	3.55	12.33%	0.2	X
0006 254606	4.7	1.34	0.20	5765	0.1	0.02
0007 254607	3.9	31.20	0.57	723	0.4	X
0008 254608	2.6	1.16	0.06	2.32%	1.2	X
0009 254609	3.8	9.70	0.05	7.52%	0.2	X
0010 254610	1.9	9.16	0.64	7.51%	0.6	0.03
0011 254611	X	0.55	10.54	16.72%	11.1	0.03
0012 254612	6.7	1.11	0.29	5.67%	X	X
0013 254613	2.2	1.18	0.12	3.08%	0.2	X
0014 254614	1.6	0.77	X	4362	0.2	X
0015 254615	2.1	0.44	0.03	2.44%	0.2	X
0016 254616	2.0	0.73	0.10	1.70%	0.2	X
0017 254617	2.3	0.26	0.05	10.30%	0.3	X
0018 254618	0.1	0.02	10.92	18.74%	X	X
0019 254619	0.8	5.15	0.18	4.97%	0.2	0.06
0020 254620	2.2	7.97	0.08	1038	X	X
0021 254621	4.3	27.72	0.02	4.66%	0.2	X
0022 254622	0.7	3.61	0.06	1519	0.1	X
0023 254623	3.6	5.07	0.11	6209	1.1	X
0024 254624	2.6	0.60	0.03	1016	0.2	X
0025 254625	4.3	4.30	0.05	10.72%	2.0	X
0026 254626	2.1	3.81	1.39	1.30%	5.2	X
0027 254627	2.5	2.06	0.04	4.86%	1.8	X
0028 254628	3.3	2.04	0.63	5449	9.5	0.02
0029 254629	2.9	1.32	0.02	2.61%	0.4	X
0030 254630	2.1	5.53	0.07	189	X	X
0031 254631	3.2	0.32	0.04	2.44%	0.3	X
0032 254632	0.5	6.73	0.04	713	X	X
0033 254633	1.5	5.15	0.15	754	X	X
0034 254634	7.0	10.43	0.18	3.32%	14.4	X
0035 254635	4.0	1.99	0.06	7.55%	0.5	X
0036 254636	3.1	1.67	0.02	6.77%	1.9	X
0037 254637	2.8	3.32	0.01	6.55%	0.5	0.03
0038 254638	2.2	1.49	0.03	5.87%	7.2	X
0039 254639	1.4	701.29	0.28	748	X	0.03
0040 254640	1.3	2.46	0.09	1003	0.1	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 254601	26.1	Yes	12	359	200	640
0002 254602	26.8	No	85	109	760	1319
0003 254603	4.2	Yes	99	11	120	325
0004 254604	10.7	Yes	41	60	120	1005
0005 254605	7.2	Yes	15	19	320	994
0006 254606	18.6	Yes	59	42	530	1173
0007 254607	21.0	No	111	86	700	1415
0008 254608	40.5	Yes	58	188	370	1137
0009 254609	9.4	Yes	70	66	180	879
0010 254610	12.6	Yes	7	77	140	1464
0011 254611	1.6	Yes	X	35	410	180
0012 254612	14.8	Yes	28	4	160	1630
0013 254613	13.3	Yes	92	61	1490	771
0014 254614	13.1	Yes	56	26	260	594
0015 254615	13.7	Yes	50	20	360	1658
0016 254616	26.3	Yes	47	304	260	1398
0017 254617	10.4	Yes	39	62	220	729
0018 254618	1.1	Yes	X	14	250	195
0019 254619	236.7	Yes	19	2049	8250	1079
0020 254620	3.6	No	69	43	200	496
0021 254621	20.9	Yes	74	15	240	996
0022 254622	3.7	No	6	13	240	148
0023 254623	18.1	No	6	36	350	2808
0024 254624	9.2	Yes	40	15	100	1391
0025 254625	12.1	Yes	43	47	120	647
0026 254626	27.6	Yes	33	20	680	1011
0027 254627	11.4	No	X	10	190	812
0028 254628	137.1	Yes	65	80	5230	1361
0029 254629	13.8	Yes	93	22	120	1230
0030 254630	6.4	No	101	204	100	567
0031 254631	7.7	Yes	65	31	290	914
0032 254632	18.2	No	X	5	160	808
0033 254633	10.7	Yes	X	2	130	684
0034 254634	26.1	Yes	69	66	270	923
0035 254635	20.4	Yes	50	131	200	1480
0036 254636	44.2	No	41	300	120	228
0037 254637	10.6	No	53	57	210	277
0038 254638	14.4	Yes	26	105	310	635
0039 254639	8.1	No	64	49	150	437
0040 254640	1.4	No	65	101	80	724

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 254601	12.03	0.9	X	0.02	51	19.48%
0002 254602	3.39	1.4	X	X	2.89%	1.43%
0003 254603	2.37	1.4	2	X	8503	2.84%
0004 254604	2.19	1.1	X	X	3.38%	1.32%
0005 254605	3.91	0.7	3	0.01	6426	13.00%
0006 254606	2.98	1.1	X	X	3.37%	1.32%
0007 254607	2.11	1.7	X	0.04	4.31%	7493
0008 254608	5.74	2.0	X	0.01	9209	6.84%
0009 254609	4.15	1.9	X	X	9376	9.88%
0010 254610	9.50	0.6	1	0.01	330	13.27%
0011 254611	8.33	1.0	3	0.01	78	10.56%
0012 254612	7.58	1.9	1	X	1.46%	4.30%
0013 254613	3.05	1.3	1	0.01	2.44%	2.56%
0014 254614	2.71	1.3	X	X	3.70%	1.54%
0015 254615	6.17	1.7	X	X	2.92%	9.22%
0016 254616	2.41	1.3	X	X	3.44%	3.09%
0017 254617	4.03	1.6	3	0.01	3675	11.96%
0018 254618	1.01	1.1	X	X	128	11.16%
0019 254619	19.95	1.7	X	0.01	3316	6.98%
0020 254620	4.41	1.6	X	X	2.19%	3936
0021 254621	7.30	1.5	X	X	1.50%	4.98%
0022 254622	9.09	1.5	X	0.03	1147	1.34%
0023 254623	17.97	1.5	X	0.05	153	8.52%
0024 254624	4.39	1.4	X	X	2.67%	2.97%
0025 254625	8.88	1.6	X	X	2221	7.82%
0026 254626	19.56	1.7	X	0.01	1.14%	6.04%
0027 254627	27.75	1.6	X	0.02	554	7.52%
0028 254628	11.72	1.5	X	0.01	2.24%	9.14%
0029 254629	3.34	1.5	X	X	4.08%	3.43%
0030 254630	8.77	1.7	X	0.02	1.56%	5354
0031 254631	3.35	1.3	X	X	2.53%	3.80%
0032 254632	12.77	0.8	X	0.01	93	19.52%
0033 254633	19.68	0.6	X	0.01	186	15.25%
0034 254634	6.44	1.4	X	0.01	4.42%	1.70%
0035 254635	6.08	0.6	X	X	5056	11.81%
0036 254636	7.03	1.8	X	0.02	7047	1.18%
0037 254637	3.70	1.4	X	X	2.48%	3.87%
0038 254638	16.14	1.8	X	0.01	1525	11.17%
0039 254639	17.50	1.7	X	0.02	1.83%	3803
0040 254640	4.56	1.7	X	0.01	3.56%	6738

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 254601	2423	0.5	54	0	6.0	0
0002 254602	2069	13.0	3654	4	3.8	1
0003 254603	1866	4.7	2.02%	0	9.7	0
0004 254604	323	1.4	2232	0	9.0	0
0005 254605	2331	1.9	158	0	8.8	0
0006 254606	1480	10.3	9991	1	4.7	0
0007 254607	952	7.1	726	1	5.0	0
0008 254608	1906	6.3	1.86%	17	3.2	5
0009 254609	4612	4.9	1.07%	0	8.2	0
0010 254610	3415	0.4	261	0	8.6	0
0011 254611	4178	0.6	73	0	8.2	0
0012 254612	3465	0.5	1.00%	0	10.1	0
0013 254613	653	1.6	4582	0	7.3	0
0014 254614	350	1.2	3970	0	6.7	0
0015 254615	799	1.0	6098	0	7.1	0
0016 254616	444	2.0	8576	2	4.8	0
0017 254617	3070	0.7	463	0	6.6	0
0018 254618	1078	0.3	54	0	9.0	0
0019 254619	937	0.7	181	290	2.2	253
0020 254620	183	15.8	316	0	6.0	0
0021 254621	5885	1.0	823	0	7.3	0
0022 254622	1077	1.4	119	0	7.6	0
0023 254623	6604	2.1	381	0	7.6	0
0024 254624	5623	1.8	384	0	7.4	0
0025 254625	5274	1.0	1197	0	7.3	0
0026 254626	5964	0.8	1068	0	7.2	0
0027 254627	5500	1.6	416	0	8.1	0
0028 254628	5310	27.7	163	5	3.6	2
0029 254629	1656	7.8	8390	0	7.9	0
0030 254630	265	11.4	329	0	5.1	0
0031 254631	1457	5.3	2.06%	0	7.5	0
0032 254632	2838	1.2	36	0	8.1	0
0033 254633	3375	1.5	101	0	7.6	0
0034 254634	2995	2.7	5916	1	4.5	0
0035 254635	5457	3.2	777	0	7.4	0
0036 254636	1.49%	1.7	669	0	6.6	0
0037 254637	3782	15.4	1.84%	0	6.0	0
0038 254638	3631	0.3	256	0	5.7	0
0039 254639	312	6.7	404	0	5.5	0
0040 254640	132	8.0	420	1	5.4	0

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 254601	19	X	14	9.0	2.7	2.58
0002 254602	68	435	225	7.3	3.2	0.66
0003 254603	24	448	25	9.1	3.8	0.05
0004 254604	25	390	5	9.1	3.5	0.16
0005 254605	18	177	19	8.6	3.6	0.97
0006 254606	36	465	25	7.9	3.4	0.39
0007 254607	39	271	33	5.4	3.8	0.20
0008 254608	50	339	40	7.7	3.2	2.07
0009 254609	34	301	12	9.1	3.8	0.04
0010 254610	7	60	75	9.0	3.1	0.14
0011 254611	5	316	57	9.0	2.8	2.33
0012 254612	26	205	146	9.1	3.4	0.03
0013 254613	31	404	20	7.0	3.2	0.32
0014 254614	26	375	13	7.4	3.3	0.10
0015 254615	32	454	10	7.4	3.4	0.19
0016 254616	100	369	36	8.5	3.7	0.48
0017 254617	15	343	16	9.3	3.5	0.51
0018 254618	3	X	X	9.6	3.9	0.04
0019 254619	164	225	29	4.3	3.0	13.67
0020 254620	18	512	164	4.9		0.08
0021 254621	42	505	154	7.6	3.4	0.06
0022 254622	6	X	124	7.2	3.5	0.02
0023 254623	19	483	1730	6.8		0.02
0024 254624	29	444	181	7.3	3.5	X
0025 254625	35	264	211	8.4	3.4	0.08
0026 254626	34	731	45	6.9	2.9	0.04
0027 254627	13	79	123	7.8		X
0028 254628	259	200	78	4.3	3.4	1.24
0029 254629	34	555	67	7.9	3.5	0.02
0030 254630	17	491	294	4.9		0.07
0031 254631	16	398	21	7.2		0.03
0032 254632	2	226	7	8.9		0.01
0033 254633	4	97	13	8.7	3.3	X
0034 254634	47	335	135	6.9	3.4	0.49
0035 254635	33	1846	7	8.5	3.9	0.57
0036 254636	38	407	99	5.3		0.03
0037 254637	31	297	28	7.5	3.8	0.43
0038 254638	27	225	91	8.6	3.5	0.81
0039 254639	18	145	87	5.1		0.05
0040 254640	5	174	217	4.9		0.07

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 254601	0.14	34.65	2.60	12.8	1.21	0.11
0002 254602	0.06	7.95	3.46	3.7	93.55	14.26
0003 254603	X	3.19	0.04	29.4	312.57	8.53
0004 254604	0.01	1.02	0.29	2.2	53.39	14.19
0005 254605	0.08	5.30	0.45	1.2	104.67	2.29
0006 254606	0.05	1.95	0.98	9.1	168.36	15.52
0007 254607	0.03	6.14	0.98	4.7	28.07	16.35
0008 254608	0.14	5.81	4.57	8.6	285.76	10.57
0009 254609	X	45.44	0.37	123.5	137.26	9.27
0010 254610	0.02	24.69	0.63	45.9	19.78	1.43
0011 254611	0.18	1.36	0.18	1.2	116.36	0.11
0012 254612	X	4.24	0.05	175.7	193.99	8.42
0013 254613	0.05	3.70	0.29	15.4	207.10	11.33
0014 254614	0.02	1.94	0.10	3.7	225.10	12.61
0015 254615	0.04	4.07	0.05	13.7	296.94	9.27
0016 254616	0.03	1.38	0.54	2.7	337.00	13.37
0017 254617	0.03	5.48	0.42	101.8	12.11	6.01
0018 254618	0.01	0.44	0.02	0.6	183.79	0.50
0019 254619	0.83	11.89	7.79	32.5	26.20	2.94
0020 254620	0.05	24.20	0.68	128.4	14.65	20.97
0021 254621	0.25	22.51	0.20	92.5	513.64	14.41
0022 254622	0.01	11.24	0.04	15.1	11.23	0.42
0023 254623	0.02	25.64	0.40	60.6	2.46	0.88
0024 254624	X	4.48	0.03	8.0	40.66	11.84
0025 254625	X	22.75	0.19	307.4	182.49	8.69
0026 254626	0.03	8.76	0.18	22.9	26.86	7.04
0027 254627	0.03	10.43	0.08	43.4	10.88	0.62
0028 254628	0.44	40.34	3.04	62.9	80.74	13.76
0029 254629	X	14.83	0.12	64.2	257.80	15.18
0030 254630	0.07	20.57	3.90	21.0	6.70	15.95
0031 254631	X	1.78	0.12	32.4	265.33	15.01
0032 254632	X	11.94	0.12	13.9	0.92	0.10
0033 254633	X	12.11	0.05	22.3	1.85	0.28
0034 254634	0.05	25.55	1.02	91.9	335.11	14.76
0035 254635	0.04	17.42	1.51	135.2	68.83	8.88
0036 254636	0.04	8.72	0.04	277.9	26.43	26.10
0037 254637	0.04	7.37	0.77	22.3	294.70	14.60
0038 254638	0.16	9.62	0.43	162.7	19.06	3.82
0039 254639	0.04	20.34	0.75	46.0	9.96	15.43
0040 254640	0.03	7.90	5.13	13.0	9.57	17.05

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 254601	0.03	0.10	8	248
0002 254602	X	6.87	288	574
0003 254603	0.61	2.05	111	62
0004 254604	0.13	3.34	73	17
0005 254605	3.50	2.01	58	73
0006 254606	0.18	5.59	183	52
0007 254607	0.02	6.37	289	168
0008 254608	X	5.85	165	701
0009 254609	0.02	5.23	106	331
0010 254610	0.63	2.01	54	261
0011 254611	10.54	0.23	4	2861
0012 254612	0.29	3.31	65	213
0013 254613	0.11	3.41	76	106
0014 254614	X	2.92	94	122
0015 254615	0.03	2.37	103	93
0016 254616	0.06	3.63	78	62
0017 254617	0.04	1.43	50	3262
0018 254618	10.91	0.47	14	26
0019 254619	0.18	2.17	68	77
0020 254620	0.05	7.50	154	121
0021 254621	X	7.60	177	911
0022 254622	0.04	0.50	8	206
0023 254623	0.07	2.13	22	1530
0024 254624	X	3.01	86	479
0025 254625	0.03	5.81	149	398
0026 254626	1.36	5.25	179	1383
0027 254627	0.02	0.44	29	591
0028 254628	X	14.18	244	5269
0029 254629	X	3.81	136	191
0030 254630	0.02	9.52	345	150
0031 254631	X	3.99	126	663
0032 254632	0.04	0.52	X	46
0033 254633	0.11	0.51	6	52
0034 254634	X	3.79	153	925
0035 254635	0.04	5.37	69	338
0036 254636	X	6.57	256	1072
0037 254637	X	4.69	133	245
0038 254638	0.02	1.72	97	4637
0039 254639	0.17	4.34	210	106
0040 254640	0.04	9.84	287	132

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						
0041 254641	0.6	8.62%	37	22	70	745.1
0042 254642	0.1	8.51%	48	10	116	678.0
0043 254643	0.3	4.84%	94	13	X	155.1
0044 254644	0.3	5574	27	73	X	20.5
0045 254645	0.2	7.21%	79	163	113	998.9
0046 254646	1.5	1.36%	33	77	X	24.5
0047 254647	0.2	1617	101	4	X	14.0
0048 254648	1.0	3.55%	461	746	304	20.4
CHECKS						
0001 254622	0.7	4387	9	12	X	35.0
STANDARDS						
0001 0.5%NaCl						
0002 GTS-2a						
0003 MPL-5					447	
0004 OREAS 928	5.7	6.20%		9		292.1
0005 OREAS 97.01						
0006 PD-1						
0007 STSD-1						
0008 STSD-3						
0009 TOC-1						
0010 0.5%NaCl						
0011 AMIS0170						
0012 AMIS0342						
0013 HgSTD-5						
0014 OREAS 185					X	
0015 OREAS 929	7.3	6.34%		16		307.5
0016 OREAS 97.01						
0017 PD-1						
0018 TOC-1						
BLANKS						
0001 Control Blank	X	72		X	X	0.5
0002 Control Blank	X	X		X	X	X

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						
0041 254641	2.8	8.63	0.05	1.29%	0.3	X
0042 254642	2.8	1.66	0.14	1.49%	X	X
0043 254643	3.7	2.26	0.20	10.96%	0.9	X
0044 254644	1.9	19.21	0.03	4.97%	0.4	X
0045 254645	2.6	2.55	0.18	1.25%	0.7	X
0046 254646	3.9	9.92	0.01	7.29%	0.9	X
0047 254647	2.0	0.92	0.36	13.48%	1.1	0.03
0048 254648	2.7	7.53	0.08	7.40%	1.0	0.03
CHECKS						
0001 254622	0.7	3.39	0.05	1546	0.2	X
STANDARDS						
0001 0.5%NaCl						0.30
0002 GTS-2a						
0003 MPL-5						
0004 OREAS 928	1.9	82.83		4390	0.6	
0005 OREAS 97.01						
0006 PD-1						
0007 STSD-1						
0008 STSD-3			8.55			
0009 TOC-1						
0010 0.5%NaCl						0.36
0011 AMIS0170			0.22			
0012 AMIS0342						
0013 HgSTD-5						
0014 OREAS 185						
0015 OREAS 929	1.9	111.10		4365	0.6	
0016 OREAS 97.01						
0017 PD-1						
0018 TOC-1						
BLANKS						
0001 Control Blank	X	X	0.01	56	X	X
0002 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						
0041 254641	10.4	Yes	62	33	100	928
0042 254642	10.8	Yes	60	35	190	1177
0043 254643	7.9	Yes	29	21	150	498
0044 254644	10.7	No	X	33	120	358
0045 254645	14.5	Yes	50	34	140	700
0046 254646	13.0	No	11	8	160	843
0047 254647	2.6	No	X	8	120	259
0048 254648	4.3	Yes	20	6	140	2663
CHECKS						
0001 254622	3.6	No	5	11	240	122
STANDARDS						
0001 0.5%NaCl						
0002 GTS-2a						
0003 MPL-5						
0004 OREAS 928	29.9		65	1.52%		
0005 OREAS 97.01						
0006 PD-1						
0007 STSD-1						1151
0008 STSD-3						
0009 TOC-1						
0010 0.5%NaCl						
0011 AMIS0170						
0012 AMIS0342						1145
0013 HgSTD-5						
0014 OREAS 185						
0015 OREAS 929	36.2		66	2.02%		
0016 OREAS 97.01						
0017 PD-1						
0018 TOC-1						
BLANKS						
0001 Control Blank	X		X	4	X	X
0002 Control Blank	X		X	2		60

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						
0041 254641	4.13	1.3	X	X	3.73%	2.37%
0042 254642	3.01	1.5	X	X	3.01%	2.00%
0043 254643	4.24	1.5	X	X	4301	8.76%
0044 254644	31.44	1.7	X	0.01	869	6.85%
0045 254645	8.80	1.5	X	X	3.48%	2.48%
0046 254646	9.32	1.8	X	0.01	558	11.55%
0047 254647	1.45	1.2	X	X	485	11.10%
0048 254648	5.96	0.6	1	X	581	13.58%
CHECKS						
0001 254622	8.85	1.6	X	0.03	1115	1.33%
STANDARDS						
0001 0.5%NaCl						
0002 GTS-2a				0.27		
0003 MPL-5						
0004 OREAS 928	8.64				1.91%	1.69%
0005 OREAS 97.01						
0006 PD-1						
0007 STSD-1						
0008 STSD-3						
0009 TOC-1						
0010 0.5%NaCl						
0011 AMIS0170						
0012 AMIS0342						
0013 HgSTD-5				0.86		
0014 OREAS 185						
0015 OREAS 929	8.84				2.10%	1.67%
0016 OREAS 97.01						
0017 PD-1						
0018 TOC-1						
BLANKS						
0001 Control Blank	0.01			X	25	75
0002 Control Blank	X		X	X	X	X

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						
0041 254641	1677	6.0	2861	0	7.3	0
0042 254642	455	3.6	3905	2	4.5	0
0043 254643	4021	0.8	2834	0	9.1	0
0044 254644	4559	0.3	268	0	7.8	0
0045 254645	2558	10.7	8130	0	7.6	0
0046 254646	3475	0.3	503	0	7.4	0
0047 254647	2378	0.5	249	0	9.8	0
0048 254648	2846	1.1	142	0	8.8	0
CHECKS						
0001 254622	1068	1.4	113	0	7.5	0
STANDARDS						
0001 0.5%NaCl						
0002 GTS-2a						
0003 MPL-5						
0004 OREAS 928	1069	1.3	1888			
0005 OREAS 97.01						
0006 PD-1						
0007 STSD-1						
0008 STSD-3						
0009 TOC-1						
0010 0.5%NaCl						
0011 AMIS0170						
0012 AMIS0342						
0013 HgSTD-5						
0014 OREAS 185						
0015 OREAS 929	1001	1.2	2137			
0016 OREAS 97.01						
0017 PD-1						
0018 TOC-1						
BLANKS						
0001 Control Blank	3	X	X	4	4.5	0
0002 Control Blank	X	X	X	4	4.5	0

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						
0041 254641	24	451	74	6.6		0.02
0042 254642	20	525	14	7.5	3.5	0.42
0043 254643	24	562	19	9.1	3.6	0.06
0044 254644	6	308	20	7.6		0.02
0045 254645	36	511	121	8.9	3.4	0.25
0046 254646	23	132	105	7.6		X
0047 254647	3	X	195	9.1	4.0	0.03
0048 254648	18	222	291	9.2	3.9	0.04
CHECKS						
0001 254622	4	X	120	7.3	3.3	0.02
STANDARDS						
0001 0.5%NaCl						
0002 GTS-2a						
0003 MPL-5						
0004 OREAS 928	30	546	130			
0005 OREAS 97.01						
0006 PD-1						
0007 STSD-1						
0008 STSD-3						0.15
0009 TOC-1						
0010 0.5%NaCl						
0011 AMIS0170						0.45
0012 AMIS0342						
0013 HgSTD-5						
0014 OREAS 185						
0015 OREAS 929	31	540	129			
0016 OREAS 97.01						
0017 PD-1						
0018 TOC-1						
BLANKS						
0001 Control Blank	2	X	2			X
0002 Control Blank	X	X	X			X

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						
0041 254641	X	5.31	0.18	25.1	107.42	15.24
0042 254642	0.03	1.44	0.63	5.7	155.74	13.69
0043 254643	X	6.11	0.24	128.6	111.23	7.90
0044 254644	X	4.67	0.10	116.7	8.68	1.56
0045 254645	0.07	3.38	0.97	19.3	157.43	13.25
0046 254646	X	12.13	0.07	54.0	11.97	2.37
0047 254647	0.01	8.74	0.03	18.9	14.45	0.51
0048 254648	X	53.16	0.20	85.7	139.08	6.35
CHECKS						
0001 254622	0.01	8.67	0.05	15.3	10.89	0.40
STANDARDS						
0001 0.5%NaCl						
0002 GTS-2a						
0003 MPL-5						
0004 OREAS 928		1.43		26.4	32.56	13.39
0005 OREAS 97.01			0.63			
0006 PD-1	4.11					
0007 STSD-1						
0008 STSD-3						
0009 TOC-1						
0010 0.5%NaCl						
0011 AMIS0170						
0012 AMIS0342						
0013 HgSTD-5						
0014 OREAS 185						
0015 OREAS 929		2.61		28.2	32.91	13.19
0016 OREAS 97.01			0.65			
0017 PD-1	4.52					
0018 TOC-1						
BLANKS						
0001 Control Blank	X	X	0.01	X	0.16	0.01
0002 Control Blank	X	X	X	X	X	X

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				
0041 254641	0.02	4.84	159	264
0042 254642	X	3.97	111	60
0043 254643	0.17	8.37	101	1075
0044 254644	X	1.70	22	482
0045 254645	0.07	8.77	244	307
0046 254646	X	2.02	59	702
0047 254647	0.32	0.27	7	964
0048 254648	0.07	5.54	70	210
CHECKS				
0001 254622	0.02	0.50	8	203
STANDARDS				
0001 0.5%NaCl				
0002 GTS-2a				
0003 MPL-5				
0004 OREAS 928		2.67	77	431
0005 OREAS 97.01				
0006 PD-1				
0007 STSD-1				
0008 STSD-3				
0009 TOC-1	1.33			
0010 0.5%NaCl				
0011 AMIS0170				
0012 AMIS0342				
0013 HgSTD-5				
0014 OREAS 185				
0015 OREAS 929		2.68	80	469
0016 OREAS 97.01				
0017 PD-1				
0018 TOC-1	1.37			
BLANKS				
0001 Control Blank	X	X	X	3
0002 Control Blank	X	X	X	1

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation

/CSA Intertek Genalysis Perth

Induction Furnace Analysed by Infrared Spectrometry

4AB/MS Intertek Genalysis Perth **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 **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

Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement

ANCx/QUAL Intertek Genalysis Perth

Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection

ANCx/VOL Intertek Genalysis Perth

Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.

C72/CSA Intertek Genalysis Perth **ENV_W017, CSA : ENV_W017**

Digestion by hot acid(s) Analysed by Infrared Spectrometry

CL1/COL Intertek Genalysis Perth **ENV_W014, COL : ENV_W014**

Carbonate leach specific for Chlorine. Analysed by UV-Visible Spectrometry.

FC7/SIE Intertek Genalysis Perth **ENV_W012, SIE : ENV_W012**

Alkaline fusion (Nickel crucible) specific for Fluorine. Analysed by Specific Ion Electrode.

FP1/OE Intertek Genalysis Perth **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

Low temperature Perchloric acid digest specific for Mercury. Analysed by Cold Vapour Generation Atomic Absorption Spectrometry.

NAGx/MTR Intertek Genalysis Perth

Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement

NAGx/VOL Intertek Genalysis Perth

Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.

Paste/MTR Intertek Genalysis Perth

Water Extraction using a specific sample:water ratio. Analysed with Electronic Meter Measurement

S71/OE Intertek Genalysis Perth

Digestion to eliminate sulphides. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation
SE1/MS	Intertek Genalysis Perth	

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	:	752.0/1513650
No. of SAMPLES	:	4
No. of ELEMENTS	:	46
CLIENT O/N	:	ED TUPLIN (Job 1 of 1)
SAMPLE SUBMISSION No.	:	
PROJECT	:	TENTH LEGION MAGNETITE PROJEC
STATE	:	Various
DATE RECEIVED	:	01/10/2015
DATE COMPLETED	:	22/10/2015
DATE PRINTED	:	22/10/2015
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
15 Davison Street, Maddington 6109, Western Australia
PO Box 144, Gosnells 6990, Western Australia
Tel: +61 8 9251 8100 Fax: +61 8 9251 8110
Email: genalysis@intertek.com
Web Page: www.genalysis.com.au

KALGOORLIE SAMPLE PREPARATION DIVISION
12 Keogh Way, Kalgoorlie 6430, Western Australia
Tel: +61 8 9021 6057 Fax: +61 8 9021 3476

ADELAIDE LABORATORY
11 Senna Road, Wingfield, 5013, South Australia
Tel: +61 8 8162 9714 Fax: +61 8 8349 7444

JOHANNESBURG LABORATORY
43 Malcolm Moodie Crescent,
Jet Park, Gauteng, South Africa 1459
Tel: +27 11 552 8149 Fax: +27 11 552 8248

TOWNSVILLE LABORATORY
9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
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 C Sample Tailings	3.3	6087	706	1560	9919	31.5
0002 S Sample Tailings	0.2	2046	770	516	548	6.2
0003 C Sample Ore	0.3	336	70	115	910	3.0
0004 S Sample Ore	0.1	609	119	90	149	2.3
CHECKS						
0001 S Sample Ore	X	599	119	87	147	2.1
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0341						
0003 HgSTD-7						
0004 OREAS 45e						
0005 OREAS 97.01						
0006 PD-1						
0007 SARM4					X	
0008 SY-4	X	8.68%		1		338.8
0009 TOC-1						
BLANKS						
0001 Control Blank	X	X	0	X	X	X

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 C Sample Tailings	2.5	8771.78	5.72	7.81%	3.5	X
0002 S Sample Tailings	0.7	45.82	0.18	2889	0.2	X
0003 C Sample Ore	0.2	535.31	0.58	6995	X	X
0004 S Sample Ore	0.6	75.96	0.08	888	0.2	X
CHECKS						
0001 S Sample Ore	0.5	70.89	0.08	886	0.2	X
STANDARDS						
0001 0.5%NaCl						0.34
0002 AMIS0341						
0003 HgSTD-7						
0004 OREAS 45e			0.55			
0005 OREAS 97.01						
0006 PD-1						
0007 SARM4						
0008 SY-4	3.0	3.15		5.75%	X	
0009 TOC-1						
BLANKS						
0001 Control Blank	X	X	X	60	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 C Sample Tailings	1029.5	Yes	7	66	583	3948
0002 S Sample Tailings	7.6	No	7	12	402	1092
0003 C Sample Ore	172.1	Yes	15	8	330	384
0004 S Sample Ore	37.4	No	10	8	418	225
CHECKS						
0001 S Sample Ore	36.2	No	8	5	405	206
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0341						3688
0003 HgSTD-7						
0004 OREAS 45e						
0005 OREAS 97.01						
0006 PD-1						
0007 SARM4						
0008 SY-4	2.6		7	9		
0009 TOC-1						
BLANKS						
0001 Control Blank	X		X	2		X

ANALYSIS

ELEMENTS	Fe	Fe	Final-pH	Fizz-Rate	Hg	K
UNITS	%	%	NONE	NONE	ppm	ppm
DETECTION LIMIT	0.01	0.01	0.1	0.1	0.01	20
DIGEST	4AB/	FP1/	ANCx/	ANCx/	HG1/	4AB/
ANALYTICAL FINISH	OE	OE	MTR	QUAL	CV	OE
SAMPLE NUMBERS						
0001 C Sample Tailings	6.59		1.2	3.0	0.05	391
0002 S Sample Tailings	2.22		1.2	1.0	0.01	192
0003 C Sample Ore	>50.00	64.56	1.3	1.0	0.04	42
0004 S Sample Ore	>50.00	58.16	1.4	X	0.02	55
CHECKS						
0001 S Sample Ore	>50.00	59.56	1.4	X	0.01	46
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0341						
0003 HgSTD-7					1.61	
0004 OREAS 45e						
0005 OREAS 97.01						
0006 PD-1						
0007 SARM4		6.59				
0008 SY-4	4.25					1.34%
0009 TOC-1						
BLANKS						
0001 Control Blank	X	X	1.1		X	X

ANALYSIS

ELEMENTS	Mg	Mn	Mo	Na	NAG	NAGpH
UNITS	ppm	ppm	ppm	ppm	kgH2SO4/t	NONE
DETECTION LIMIT	20	1	0.1	100	1	0.1
DIGEST	4AB/	4AB/	4AB/	4AB/	NAGx/	NAGx/
ANALYTICAL FINISH	OE	OE	MS	OE	VOL	MTR
SAMPLE NUMBERS						
0001 C Sample Tailings	16.29%	2569	2.7	420	0	8.9
0002 S Sample Tailings	25.02%	1904	0.9	145	0	9.1
0003 C Sample Ore	2.25%	1855	1.8	304	0	9.0
0004 S Sample Ore	3.58%	4894	2.1	324	0	9.0
CHECKS						
0001 S Sample Ore	3.56%	4897	1.8	306	0	8.9
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0341						
0003 HgSTD-7						
0004 OREAS 45e						
0005 OREAS 97.01						
0006 PD-1						
0007 SARM4						
0008 SY-4	2664	794	0.2	5.13%		
0009 TOC-1						
BLANKS						
0001 Control Blank	X	X	X	X	5	4.6

ANALYSIS

ELEMENTS	NAG(4.5)	Ni	P	Pb	pH	pH Drop
UNITS	kgH2SO4/t	ppm	ppm	ppm	NONE	NONE
DETECTION LIMIT	1	1	10	2	0.1	0.1
DIGEST	NAGx/	4AB/	4AB/	4AB/	Paste/	ANCx/
ANALYTICAL FINISH	VOL	OE	OE	MS	MTR	MTR
SAMPLE NUMBERS						
0001 C Sample Tailings	0	41	181	342	8.5	2.8
0002 S Sample Tailings	0	6	123	26	8.3	
0003 C Sample Ore	0	10	18	30	9.0	3.0
0004 S Sample Ore	0	7	22	13	8.5	3.3
CHECKS						
0001 S Sample Ore	0	9	17	11	8.5	3.3
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0341						
0003 HgSTD-7						
0004 OREAS 45e						
0005 OREAS 97.01						
0006 PD-1						
0007 SARM4						
0008 SY-4		15	537	10		
0009 TOC-1						
BLANKS						
0001 Control Blank	0	3	X	X		

ANALYSIS

ELEMENTS	S	S-SO4	Sb	Se	Sn	Sr
UNITS	%	%	ppm	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.01	0.05	0.01	0.1	0.05
DIGEST		S71/	4AB/	SE1/	4AB/	4AB/
ANALYTICAL FINISH	/CSA	OE	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 C Sample Tailings	0.23	0.02	51.11	9.77	408.8	134.67
0002 S Sample Tailings	0.04	0.03	16.40	0.16	18.8	8.21
0003 C Sample Ore	0.03	X	14.52	0.17	137.9	12.77
0004 S Sample Ore	0.02	0.01	5.74	0.13	40.3	1.82
CHECKS						
0001 S Sample Ore	0.02	X	5.50	0.13	38.8	2.08
STANDARDS						
0001 0.5%NaCl						
0002 AMIS0341						
0003 HgSTD-7						
0004 OREAS 45e	0.03					
0005 OREAS 97.01				0.67		
0006 PD-1		4.28				
0007 SARM4						
0008 SY-4			0.06		7.6	1176.17
0009 TOC-1						
BLANKS						
0001 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Th	TIC	U	V	Zn
UNITS	ppm	%	ppm	ppm	ppm
DETECTION LIMIT	0.01	0.01	0.01	1	1
DIGEST	4AB/	C72/	4AB/	4AB/	4AB/
ANALYTICAL FINISH	MS	CSA	MS	OE	OE
SAMPLE NUMBERS					
0001 C Sample Tailings	0.43	5.65	4.20	3	1379
0002 S Sample Tailings	0.40	0.16	0.73	3	119
0003 C Sample Ore	0.08	0.54	1.05	6	280
0004 S Sample Ore	0.14	0.06	0.40	20	113
CHECKS					
0001 S Sample Ore	0.16	0.06	0.38	21	111
STANDARDS					
0001 0.5%NaCl					
0002 AMIS0341					
0003 HgSTD-7					
0004 OREAS 45e					
0005 OREAS 97.01					
0006 PD-1					
0007 SARM4					
0008 SY-4	0.93		0.38	5	96
0009 TOC-1		1.25			
BLANKS					
0001 Control Blank	X	X	X	X	5

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation
/CSA	Intertek Genalysis Perth	**MPL_W043, CSA : MPL_W043**

Induction Furnace Analysed by Infrared Spectrometry

4AB/MS	Intertek Genalysis Perth	**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	**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

Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement

ANCx/QUAL Intertek Genalysis Perth

Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection

ANCx/VOL Intertek Genalysis Perth

Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.

C72/CSA	Intertek Genalysis Perth	**ENV_W017, CSA : ENV_W017**

Digestion by hot acid(s) Analysed by Infrared Spectrometry

CL1/COL	Intertek Genalysis Perth	**ENV_W014, COL : ENV_W014**

Carbonate leach specific for Chlorine. Analysed by UV-Visible Spectrometry.

FC7/SIE	Intertek Genalysis Perth	**ENV_W012, SIE : ENV_W012**

Alkaline fusion (Nickel crucible) specific for Fluorine. Analysed by Specific Ion Electrode.

FP1/OE	Intertek Genalysis Perth	**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

Low temperature Perchloric acid digest specific for Mercury. Analysed by Cold Vapour Generation Atomic Absorption Spectrometry.

NAGx/MTR Intertek Genalysis Perth

Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement

NAGx/VOL Intertek Genalysis Perth

Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.

Paste/MTR Intertek Genalysis Perth

Water Extraction using a specific sample:water ratio. Analysed with Electronic Meter Measurement

S71/OE Intertek Genalysis Perth

Digestion to eliminate sulphides. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation
SE1/MS	Intertek Genalysis Perth	

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	:	752.0/1513638
No. of SAMPLES	:	13
No. of ELEMENTS	:	37
CLIENT O/N	:	P14027 (Job 1 of 2)
SAMPLE SUBMISSION No.	:	BR801-00283 SS15001
PROJECT	:	10TH LEGION
STATE	:	Ex-Pulp
DATE RECEIVED	:	01/10/2015
DATE COMPLETED	:	29/10/2015
DATE PRINTED	:	29/10/2015
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
15 Davison Street, Maddington 6109, Western Australia
PO Box 144, Gosnells 6990, Western Australia
Tel: +61 8 9251 8100 Fax: +61 8 9251 8110
Email: genalysis@intertek.com
Web Page: www.genalysis.com.au

KALGOORLIE SAMPLE PREPARATION DIVISION
12 Keogh Way, Kalgoorlie 6430, Western Australia
Tel: +61 8 9021 6057 Fax: +61 8 9021 3476

ADELAIDE LABORATORY
11 Senna Road, Wingfield, 5013, South Australia
Tel: +61 8 8162 9714 Fax: +61 8 8349 7444

JOHANNESBURG LABORATORY
43 Malcolm Moodie Crescent,
Jet Park, Gauteng, South Africa 1459
Tel: +27 11 552 8149 Fax: +27 11 552 8248

TOWNSVILLE LABORATORY
9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
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	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	0.02	2
DIGEST										
ANALYTICAL FINISH	/MS	/OE	/MS	/OE	/MS	/MS	/MS	/OE	/MS	/COL
SAMPLE NUMBERS										
0001 254601	0.01	0.01	4.1	0.60	24.71	X	X	5.98	X	23
0002 254604	X	2.86	15.5	0.03	44.45	0.3	0.088	8.85	X	2
0003 254616	0.04	0.66	57.9	0.06	8.32	X	0.045	13.14	0.03	4
0004 254619	0.63	10.23	2.1	0.47	15.39	7.7	0.023	373.27	26.62	X
0005 254624	0.02	0.52	0.4	0.01	18.18	X	0.037	0.55	0.07	2
0006 254626	X	0.07	0.7	0.01	50.62	X	0.025	12.50	2.32	5
0007 254627	X	0.02	22.9	0.02	0.22	X	0.059	3.20	0.17	3
0008 254628	X	1.03	20.4	0.04	74.35	3.1	0.020	23.12	1470.20	12
0009 254630	X	0.07	0.3	X	13.68	X	X	0.12	0.04	14
0010 254635	0.02	0.15	102.0	0.09	1.08	X	0.065	7.30	0.07	3
0011 254637	0.10	2.73	17.2	0.01	27.37	0.2	2.282	1.90	0.40	2
0012 254642	X	1.24	4.5	0.01	14.86	0.2	0.076	4.33	X	X
0013 254643	X	0.33	17.9	0.10	9.96	0.2	0.203	6.16	0.06	6
0014 C Sample Tailings	0.09	X	23.0	6.24	33.39	X	71.420	19.93	X	12
0015 S Sample Tailings	0.22	0.02	14.4	0.38	55.48	X	0.124	20.28	X	7
0016 C Sample Ore	2.89	X	5.7	0.62	1.70	X	20.296	7.33	X	2
0017 S Sample Ore	X	0.01	5.6	0.11	0.89	X	0.302	11.24	X	3
CHECKS										
0001 254635	0.05	0.15	93.6	0.08	1.15	X	0.070	6.86	0.06	3
STANDARDS										
0001 SOLN-001										
0002 TMDW	2.01		80.4		50.23	19.7	10.018		10.25	
0003 UNI 1		25.31		5.15				25.68		
BLANKS										
0001 Control Blank	X	0.03	X	X	0.09	X	0.008	0.01	X	X

ANALYSIS

ELEMENTS	Co	Cr	Cu	EC	F	Fe-Sol	Hg	K	Mg	Mn
UNITS	ug/l	mg/l	mg/l	mS/cm	mg/l	mg/l	ug/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.1	0.01	0.01	0.01	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 254601	X	X	X	0.15	0.8	X	X	0.5	12.64	0.01
0002 254604	1.6	X	X	0.10	1.6	1.76	X	9.4	2.82	0.09
0003 254616	0.8	X	X	0.15	1.3	0.41	X	6.0	5.57	0.04
0004 254619	4699.4	X	82.68	4.55	0.4	126.99	0.1	9.6	732.89	17.08
0005 254624	0.5	X	X	0.05	0.5	0.54	X	4.2	1.85	0.29
0006 254626	2.6	X	X	0.41	0.4	0.11	X	14.9	35.88	1.53
0007 254627	0.5	X	X	0.10	0.4	0.37	X	0.5	4.95	0.02
0008 254628	17104.9	0.03	0.27	2.62	0.3	X	X	34.2	252.83	172.44
0009 254630	3.0	X	X	0.07	X	X	X	1.8	0.81	0.11
0010 254635	0.7	X	X	0.15	0.9	0.35	X	5.4	8.83	0.04
0011 254637	3.6	X	0.06	0.08	0.1	3.23	X	1.1	12.16	0.68
0012 254642	0.9	X	X	0.09	1.2	1.09	X	7.8	4.15	0.06
0013 254643	0.5	X	X	0.12	0.3	0.49	X	3.9	7.80	0.07
0014 C Sample Tailings	1.0	X	X	0.27	2.1	0.16	X	2.4	23.43	X
0015 S Sample Tailings	X	X	X	0.25	1.0	X	X	1.8	20.57	0.01
0016 C Sample Ore	0.3	X	X	0.10	1.1	0.26	X	0.6	7.64	X
0017 S Sample Ore	X	X	X	0.11	0.5	0.14	X	0.6	6.92	X
CHECKS										
0001 254635	1.0	X	X	0.14	0.8	0.38	X	4.9	8.72	0.07
STANDARDS										
0001 SOLN-001					1.1					
0002 TMDW	25.6						X			
0003 UNI 1		25.15	10.28			251.99		24.3	24.70	10.19
BLANKS										
0001 Control Blank	X	X	X		X	X	X	X	X	X

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	0.5	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 254601	0.60	1.0	X	X	0.7	8.9	30.7	8.00	1.1	X
0002 254604	1.69	2.2	X	X	1.7	9.1	2.2	1.81	X	X
0003 254616	5.20	5.0	X	X	5.3	8.7	12.1	6.08	1.7	X
0004 254619	0.08	2.2	3.25	0.1	X	3.7	1364.4	0.21	18.5	X
0005 254624	0.36	4.3	X	X	5.6	7.0	1.8	0.58	X	X
0006 254626	0.07	6.9	X	X	X	7.1	45.7	0.74	6.9	X
0007 254627	17.30	10.9	0.03	X	1.1	7.8	3.2	4.29	X	0.2
0008 254628	0.11	6.2	31.79	X	2.3	4.8	692.1	2.38	93.1	X
0009 254630	X	8.2	X	X	40.6	4.8	0.3	X	X	X
0010 254635	5.46	4.4	X	X	0.6	7.8	13.3	3.40	4.2	0.1
0011 254637	11.49	5.4	0.01	X	27.0	7.8	7.4	2.69	12.1	0.5
0012 254642	12.33	3.1	X	X	1.3	7.3	10.8	0.95	1.1	X
0013 254643	4.58	5.6	X	X	4.9	8.9	2.5	5.51	X	0.1
0014 C Sample Tailings	36.44	3.0	X	X	1.9	8.7	22.8	44.34	62.7	1.6
0015 S Sample Tailings	0.85	2.2	X	X	X	8.4	2.0	5.36	1.2	0.9
0016 C Sample Ore	21.38	0.6	X	X	0.7	9.3	4.1	17.29	11.3	1.3
0017 S Sample Ore	4.14	1.0	X	X	X	8.9	5.5	1.49	1.2	0.5
CHECKS										
0001 254635	4.91	4.4	X	X	0.5	8.0	12.1	3.22	4.3	0.1
STANDARDS										
0001 SOLN-001										
0002 TMDW	101.13				39.9			9.94	9.9	X
0003 UNI 1		25.8	10.14	25.1			24.9			
BLANKS										
0001 Control Blank	X	X	X	X	0.5		X	X	X	X

ANALYSIS

ELEMENTS	Sr	TDSCon	TDSEva	Th	U	V	Zn
UNITS	ug/l	mg/l	mg/Kg	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.02	20	20	0.005	0.005	0.01	0.01
DIGEST							
ANALYTICAL FINISH	/MS	/CALC	/GR	/MS	/MS	/OE	/OE
SAMPLE NUMBERS							
0001 254601	7.05	90		X	X	X	X
0002 254604	17.88	60		2.912	0.733	X	X
0003 254616	71.08	90		0.310	0.207	X	X
0004 254619	338.13		6465	1.221	54.007	X	3.20
0005 254624	3.62	30		0.090	0.030	X	0.03
0006 254626	29.17	246		0.066	0.061	X	0.04
0007 254627	2.26	60		0.022	0.025	X	0.10
0008 254628	105.04		3517	0.101	4.153	X	415.32
0009 254630	2.43	42		0.010	0.069	X	0.02
0010 254635	7.92	90		0.122	0.115	X	0.01
0011 254637	6.04	48		0.453	0.052	X	0.27
0012 254642	42.19	54		1.360	0.159	X	X
0013 254643	12.07	72		0.083	0.184	X	0.04
0014 C Sample Tailings	67.80		184	X	0.125	X	X
0015 S Sample Tailings	98.68		99	X	X	X	X
0016 C Sample Ore	13.54	60		0.005	0.020	X	X
0017 S Sample Ore	11.84	66		X	X	X	X
CHECKS							
0001 254635	7.57	84		0.125	0.120	X	X
STANDARDS							
0001 SOLN-001							
0002 TMDW	254.36			X	10.025		
0003 UNI 1						10.08	10.09
BLANKS							
0001 Control Blank	0.04			X	X	X	X

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory	NATA Scope of Accreditation

/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.

/GR Intertek Genalysis Perth

Analysed by Gravimetric Technique.

/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.

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Quantitative X-Ray Diffraction Analysis

REPORT PREPARED FOR	ED TUPLIN KNIGHT PIESOLD PTY. LTD.
CLIENT CODE	752.0
JOB CODE	1513639
No. of SAMPLES	10
CLIENT O/N	P14027
SAMPLE SUBMISSION No.	N/A
PROJECT	10TH LEGION
STATE	PULPS
DATE RECEIVED	5-Oct-15
DATE COMPLETED	28-Oct-15
DATE WRITTEN	29-Oct-15
WRITTEN BY	Dr Sharon Ness Dr Evgenia Lebedeva
ANALYSING LABORATORY	Perth

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Sample Details

DISCLAIMER

This report relates specifically to the sample(s) that were drawn and/or provided by the client or their nominated third party. The reported results(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 is prepared solely for the use of the client named in this report. Intertek accepts no responsibility for any loss, damage or laibility 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

The method detection limit is 1 wt%.

Uncertainty in the software analyses should reflect errors (absolute) of no greater than: +/- 10% for phases 50-95%, +/- 5% for phases 10-50% and +/- 2% for phases 3-10%. Phases of < 3% are approaching detection limit and normally no refinements are made on these.

Please note that results are rounded off to integer values

LEGEND

ND	Not Detected

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Job Information

Preparation

XRD15 (dry 50C, mill < 60um, micronise)

Analytical Method

XRDQUANT01 - Quantitative analysis, crystalline and amorphous content

Sampling

Sample(s) coned and quartered, then grab(s) taken

Amorphous content determination

Internal standard single scan

Additions

	Sample
Internal standard CaF2 (fluorite)	254601
	254602
	254617
	254619
	254628
	254635
	254638

	Sample
Internal standard ZnO (zincite)	254608
	254616
	254642

Method

Sample(s) packed and presented as unoriented powder mount(s) of the total sample

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Job Information

Instrumentation and Parameters

Instrument:

PANalytical Cubix^3 XRD
Copper radiation (operating at 45 kV and 40 mA)
Graphite monochromator (diffracted beam)

Parameters:

Parameter	Setting
Start angle (deg 2θ)	4
End angle (deg 2θ)	65
Step size (deg 2θ)	0.02
Time/active length (secs)	150
Active length (deg 2θ)	4.01

Software

Qualitative analysis: Bruker Diffrac.EVA 4.0 Search/Match (ICDD PDF-2 (2011) database)

Quantitative analysis: SIROQUANT Version 4

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Results

The quantitative analysis of the crystalline and amorphous content of each sample is given in the file, 752.0_1513639 XRD results, attached to the report email.

Calculation of the phase abundances has been based on the Brindley contrast corrections using a particle diameter of 4 µm.

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Notes

1

For confirmation of the clay mineralogy, a clay separation followed by analysis on oriented clay mounts (glycol and heat treated) would be required.

2

The mixed layer clay may be a mixture of poorly ordered transitional minerals such as illite/smectites and/or chlorite/smectites.

3

The amorphous content may contain some of the more poorly crystalline clay phases and conversely the clay phase content may contain some poorly crystalline or amorphous material. Where there is a significant presence of clay material, the distinction between poorly crystalline material and amorphous content can be imprecise.

4

The XRD cannot distinguish the form of the serpentine mineral. Further classification would require analysis by either optical or scanning electron microscopy.

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Quality Control

NIST Standard Reference Material (SRM) 656

This standard is used for quality control on the instrument and software.

The standard reference material is a powder which consists of sub-micrometer, equi-axial, non-aggregated grains that do not display the effects of absorption contrast, extinction or preferred orientation.

An aliquot of this SRM, spiked with 10% Al2O3 (SRM 676a) for the amorphous content determination, was prepared as un-oriented powder mount of the total sample and the pattern analysed with SIROQUANT™

Sample ID **β 656 (High β Phase Powder)**

		1513639	method std dev	SRM certified	SRM uncert
Phase	Formula	wt%	wt%	wt%	wt%
Amorphous content		9.2	0.6	8.6	0.60
Si3N4, alpha	SiN4	15.3	0.4	16.3	0.81
Si3N4, beta	SiN4	75.6	0.5	75.1	2.54

Each interval defined by the certified value and its uncertainty is a 95% confidence interval for the true value of the mean in the absence of systematic error.

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Method Description

Quantification is determined from the chosen software package: this uses the full-profile Rietveld method of refining the profile of the calculated XRD pattern against the profile of the measured XRD pattern. The total calculated pattern is the sum of the calculated patterns of the individual phases.

Results are given as weight % of the total crystalline phases and amorphous content.

The amorphous content quantifies the amorphous material and unknown minerals or known minerals for which there is not a suitable crystal structure.

Corrections are incorporated into the process that allows for a more accurate description of the mineral's contribution to the measured pattern and to allow for variation due to atomic substitution, layer disordering, preferred orientation, and other factors that affect the acquisition of the XRD scan.

The limitations of qualitative XRD analysis are as follows:

1. There is a limit of detection of approximately 1 wt% on the crystalline phases.
2. The detection of a phase may be dependent on its crystallinity.
3. Where there exist multiple phases, overlap of diffracted reflections can occur, thus rendering some ambiguity into the interpretation.
4. Overlapping reflections of a major phase can mask the presence of minor or trace phases.
5. Some phases cannot be unambiguously identified as they are present in minor or trace amounts

The limitations of quantitative XRD analysis by a full-profile Rietveld method are as follows:

1. The limitations for qualitative XRD analysis apply
2. The method as described is standardless: it relies solely on the published crystallographic data available for each phase. Some data may not exactly describe the phases present.
3. Particle size is important with respect to the absorption of the X-rays by the sample. Micronising reduces the particle size to that more suitable for quantitative analysis.

The accuracy of the analysis is dependent on sampling and sample preparation in addition to the calculated profiles being exactly representative of the chemistry of the component phases and their crystallinity. Some preferred orientation effects and reflection overlaps may occur which cannot be adequately resolved.

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

Amorphous Content

Internal standard method

Single scan (SIROQUANT™ and TOPAS)

The amorphous content is determined from the addition of a known spike of a well-crystalline internal standard to each sample.

When amorphous material is present, the weight percentage of the spike found is larger than actually weighed out. The amount of amorphous material that causes the difference in the spike weight percentages is then calculated and all weight percentages are normalised to include the amorphous content.

Double scan (SIROQUANT only)

SIROQUANT™ also allows the choice of using the spiked pattern completely, or combining the run with a previous unspiked pattern result. This choice is given because the weight percentages from an unspiked pattern are more accurate since the intensities are not diluted by the spike addition. The percentages from the unspiked sample are normalised to the amorphous content calculated from the spiked sample pattern.

External standard method

The amorphous content is determined from the external standard method[1]

The normalisation constant is determined from the external standard which allows the calculated weight fractions to be placed on an absolute scale.

Reference:

1. O'Connor, B.H., and Raven, M.D., "Application of the Rietveld Refinement Procedure in Assaying Powdered Mixtures", Powder Diffraction 3(1), (1988), 2-6.

15 Davison Street, Maddington
Western Australia 6109
Telephone: +61 8 9251 8100
Facsimile: +61 8 9251 8110
www.intertek.com
ABN: 32 008 787 237

XRD Analysis Standard Report Conditions

1. The work for and preparation of this report are governed by the Standard Report Conditions listed below and Intertek Minerals Terms and Conditions 2010, a copy of which is available online at www.intertek.com. The Standard Report Conditions also govern use and reproduction of this report and any extract of it. This endorsement highlights some of the Standard Report Conditions but does not override or vary them.

2. The analytical methods and procedures used in carrying out the work are summarised in the report. Any interpretations of data are also identified as such in the report. Intertek accepts no responsibility for any further or other interpretations. Any questions relating to the work or the report or about inferences to be drawn from them, should be referred to the author of the report.

3. The report must not be disseminated in any way which is likely to mislead or deceive any person, including by disseminating an extract of the report without including relevant qualifications contained in the report without limitation.

4. Subject to condition 17, the Client indemnifies Intertek against all Claims arising in any way of or in connection with:

a) the use, investigation, analysis, deterioration or destruction of the samples or other Client Property;

b) any breach of intellectual property rights of any person in any sample;

c) the use of any part of the Works or Report by any person other than the Client; and

d) any breach of any of these conditions by the client

5. Notwithstanding anything to the contrary, Intertek's liability for any Claim arising in any way out of

a) the supplying of services again; or

b) the cost of having those services supplied again.

6. The work and this report are subject to indemnity, exclusion and liability limiting provisions set out

7. Every copy of this report which is made must include this Standard Report Conditions XRD Analysis in a clearly legible form.

Phase	Amorphous content***	Amphibole	Ankerite	Apatite
Formula		e.g.(Na,Ca)2(Fe,Mg,Al)5(Si,Al)8O22(OH)2	Ca(Fe,Mg)(CO3)2	Ca5(PO4)3(OH,F,Cl)
Sample/Units	wt%	wt%	wt%	wt%
254601	10			
254601 DUPLICATE	10			
254602	14			
254608	9	3		
254616	18	7		
254617	22	7		
254619	19	2		
254628	24			
254635	23	7		1
254638	29			
254642	11	5	1	

*see Note 1 in main report
**see Note 2 in main report
***see Note 3 in main report
#possibly present
see Note 4 in main report

Phase	Calcium sodium plagioclase	Chlorite*	Epidote	Expanding clay*
Formula	(Ca,Na)(Si,Al)4O8	(Fe,Al,Mg)6(Si,Al)4O10(OH)8	Ca2(Fe,Al)Al2(SiO4)(Si2O7)O(OH)	
Sample/Units	wt%	wt%	wt%	wt%
254601		<1		
254601 DUPLICATE		<1		
254602		6		
254608		6		
254616	11	7		
254617		11		
254619		12	2	6
254628		27		2
254635		20	1	
254638		14		1
254642	12	5		

*see Note 1 in main report
**see Note 2 in main repor
***see Note 3 in main repo
#possibly present
see Note 4 in main repo

Phase	Forsterite	Goethite	Grossular	Hematite	Illite/Muscovite
Formula	(Mg,Fe)2SiO4	FeO(OH)	$Ca_3Al_2(SiO_4)_3$	Fe2O3	Na)(Al,Mg,Fe)2(Si,Al)4O1
Sample/Units	wt%	wt%	wt%	wt%	wt%
254601					
254601 DUPLICATE					
254602					28
254608					2
254616					8
254617	2			1	10
254619	6			1	2
254628		9	2		24
254635			4	1	4
254638			4		
254642					25

*see Note 1 in main report
**see Note 2 in main repor
***see Note 3 in main repo
#possibly present
see Note 4 in main repo

Phase	Jarosite	Kaolin*	Magnetite	Manganese sulphide#	Marcasite
Formula	KFe3(SO4)2(OH)6	e.g. Al2Si2O5(OH)4	Fe3O4	MnS	FeS2
Sample/Units	wt%	wt%	wt%	wt%	wt%
254601			13		
254601 DUPLICATE			13		
254602	1				
254608			1		
254616					
254617			2		
254619			5		5
254628		2		<1	
254635					
254638			17		
254642					

*see Note 1 in main report
**see Note 2 in main repor
***see Note 3 in main repo
#possibly present
see Note 4 in main repo

Phase	Mixed layer clay**	Potassium feldspar	Pyrite	Pyroxene	Pyrrhotite
Formula		KAlSi3O8	FeS2	$(Mg,Fe)CaSi_2O_6$	Fe(1-x)Sx (x=0-0.2)
Sample/Units	wt%	wt%	wt%	wt%	wt%
254601			2		3
254601 DUPLICATE			2		3
254602		15	1		
254608			4		
254616		11	1		
254617			<1	43	
254619			17	19	
254628		3	1		
254635			1	21	
254638			1	24	
254642	7	3	1		

*see Note 1 in main report
**see Note 2 in main repor
***see Note 3 in main repo
#possibly present
see Note 4 in main repo

Phase	Quartz	Serpentine##	Siderite	Sodium plagioclase	Sphalerite
Formula	SiO2	e.g. Mg3(Si2O5)(OH)4	FeCO3	NaAlSi3O8	ZnS
Sample/Units	wt%	wt%	wt%	wt%	wt%
254601		72			
254601 DUPLICATE		72			
254602	29			6	
254608	13	30		32	
254616	32			5	
254617			<1		1
254619	<1	5			
254628		1			<1
254635		1			
254638		11			
254642	32				

*see Note 1 in main report
**see Note 2 in main repor
***see Note 3 in main repc
#possibly present
see Note 4 in main repc

Phase	Spinel	Talc
Formula	$MgAl_2O_4$	Mg3Si4O10(OH)2
Sample/Units	wt%	wt%
254601		
254601 DUPLICATE		
254602		
254608		1
254616		
254617	2	
254619		<1
254628		4
254635		16
254638		
254642		

*see Note 1 in main report
**see Note 2 in main repor
***see Note 3 in main repc
#possibly present
see Note 4 in main repc

16-18 Hayden Court, Myaree, Western Australia 6154
PO Box 4023 Myaree BC, Western Australia 6950
tel: +61 8 9317 2505
email: lab@mpl.com.au
envirolab.com.au
Envirolab Services (WA) Pty Ltd trading as
MPL Laboratories | ABN 53 140 099 207

CERTIFICATE OF ANALYSIS 175325

Client:
Knight Piesold Pty Ltd
Level 1 36 Cordelia St
South Brisbane
QLD

Attention: E Tuplin

Sample log in details:

Your Reference:	**Tenth Legion Mineral Samples**
No. of samples:	6x bulk
Date samples received:	4/01/2016
Date completed instructions received:	4/01/2016
Location:	

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.

Please refer to the last pages of this report for any comments relating to the results.

Report Details:

Date results requested by:	12/01/16
Date of Preliminary Report:	Not issued
Issue Date:	11/01/16

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025.
Tests not covered by NATA are denoted with *.

Results Approved By:

Tom Edwards
Occupational Hygiene and Microbiology Supervisor

Fibre ID by SEM - Material*							
Our Reference:	UNITS	PQL	175325-1	175325-2	175325-3	175325-4	175325-5
Your Reference	--	--	254601	254608	254619	254628	254635
Type of sample	--	--	bulk	bulk	bulk	bulk	bulk
Fibre Mineral Type*	-		Chrysotile	Actinolite Chlorite Mica Inorganic	Actinolite Amosite	Actinolite	Actinolite

Fibre ID by SEM - Material*			
Our Reference:	UNITS	PQL	175325-6
Your Reference	--	--	254638
Type of sample	--	--	bulk
Fibre Mineral Type*	-		Actinolite Smectite

Method ID	Methodology Summary
Ext-073	Analysis conducted by FibreLab

Report Comments:

Asbestos Signatories:

Asbestos was analysed by Approved Identifier: Not applicable for this job
Airborne Fibres were analysed by Approved Counter: Not applicable for this job

Definitions:

DOL: Sample rejected due to particulate overload RPF: Sample rejected due to Pump Failure.
RFD: Sample rejected due to Filter Damage. RUD: Sample rejected due to uneven deposition.
PQL: Practical Quantitation Limit

APPENDIX B

Waste Rock Global Abundance Indices

Knight Piésold CONSULTING

APPENDIX B - GAI TABLES

ELEMENTS	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Cl	Co	Cr	Cu	F	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Se	Sn	Sr	Th	U	V	Zn
UNITS	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
ACA	0.07	82000	1.5	10	500	2.6	0.048	41000	0.11	130	20	100	50	950	41000	0.05	21000	23000	950	1.5	23000	80	1000	14	260	0.2	0.05	2.2	370	12	2.4	160	75
254601	0	0	6	5	0	0	4	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	6	6	5	1	0	0	0	0	1
254602	3	0	5	4	0	0	6	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	3	4	4	5	0	0	0	0	0	2
254603	0	0	1	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	3	0	0	0	0	0
254604	1	0	1	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0
254605	2	0	2	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4	4	2	0	0	0	0	0	0
254606	2	0	3	5	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	2	3	1	0	0	0	0	0
254607	2	0	6	4	0	0	6	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	4	3	0	0	0	0	0	0
254608	0	0	3	2	0	0	4	0	2	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	5	4	5	1	0	0	0	0	2
254609	2	0	6	3	0	0	6	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	6	2	5	0	0	0	0	1
254610	2	0	5	4	0	0	6	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	6	3	3	0	0	0	0	1
254611	1	0	3	2	0	0	2	1	6	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	5	2	1	0	0	0	0	0	4
254612	3	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	3	0	5	0	0	0	0	0
254613	1	0	2	3	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	1	2	0	0	0	0	0
254614	0	0	2	4	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0
254615	0	0	2	2	1	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	3	0	2	0	0	0	0	0
254616	2	0	3	4	0	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	2	2	0	0	0	0	0	0
254617	3	0	2	3	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	3	4	2	4	0	0	0	0	4
254618	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
254619	3	0	4	1	0	0	6	0	0	1	2	0	4	0	1	0	0	1	0	0	0	0	0	0	6	5	6	3	0	0	0	0	0
254620	1	0	4	3	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	1	6	3	5	0	0	1	0	0
254621	4	0	1	1	0	0	6	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	6	1	4	0	0	1	0	3
254622	2	0	2	1	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	0	2	0	0	0	0	0
254623	3	0	4	1	0	0	6	0	2	0	0	0	0	0	1	0	0	1	2	0	0	0	0	6	0	6	2	4	0	0	0	0	3
254624	3	0	1	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	3	0	1	0	0	0	0	2
254625	3	0	4	1	0	0	5	0	3	0	0	0	0	0	0	0	0	1	1	0	0	0	0	3	1	6	1	6	0	0	0	0	1
254626	3	0	3	1	0	0	5	0	4	0	0	0	0	0	1	0	0	0	2	0	0	0	0	1	0	4	1	2	0	0	0	0	3
254627	2	0	5	1	0	0	4	0	3	0	0	0	0	0	2	0	0	1	1	0	0	0	0	2	0	5	0	3	0	0	0	0	2
254628	1	0	6	1	0	0	4	0	5	0	2	0	0	0	0	0	0	1	1	3	0	1	0	1	4	6	5	4	0	0	1	0	5
254629	0	0	3	5	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	5	0	4	0	0	0	0	0
254630	0	0	6	3	0	0	6	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	3	0	6	5	2	0	0	1	0	0
254631	1	0	3	3	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	3	0	0	0	0	2
254632	0	0	6	4	0	0	6	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	5	0	2	0	0	0	0	0
254633	0	0	6	4	0	0	6	0	0	0	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	5	0	2	0	0	0	0	0
254634	6	0	5	2	0	0	6	0	6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	3	6	3	4	0	0	0	0	3
254635	1	0	6	1	0	0	4	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	3	5	4	5	0	0	0	0	1
254636	2	0	2	1	0	0	4	0	3	0	0	0	2	0	0	0	0	0	3	0	0	0	0	2	0	4	0	6	0	0	0	0	3
254637	1	0	2	3	0	0	5	0	1	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	3	4	3	2	0	0	0	0	1
254638	1	0	3	3	0	0	4	0	5	0	0	0	0	0	1	0	0	1	1	0	0	0	0	2	4	5	2	5	0	0	0	0	5
254639	6	0	4	2	0	0	6	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	6	3	3	0	0	0	0	0
254640	0	0	5	3	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	4	6	1	0	0	1	0	0
254641	2	0	3	2	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	4	1	2	0	0	0	0	1
254642	0	0	2	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	0	0	0	0	0	0
254643	1	0	2	1	0	0	4	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	4	1	5	0	0	1	0	3
254644	1	0	5	1	0	0	6	0	1	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	3	0	5	0	0	0	0	2
254645	0	0	6	2	0	0	5	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	2	3	3	2	0	0	1	0	1
254646	3	0	5	1	0	0	6	0	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	0	5	0	4	0	0	0	0	2
254647	0	0	0	1	0	0	3	1	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	4	0	2	0	0	0	0	3
254648	3	0	6	4	0	0	6	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	6	1	4	0	0	0	0	0

APPENDIX C

Waste Rock Soil Quality Screening Tables

Knight Piésold
CONSULTING

APPENDIX C - SOIL QUALITY SCREENING RESULTS

Knight Piésold CONSULTING

Element	Human Health-Based Investigation Levels [1]	254601	254602	254603	254604	254605	254606	254607	254608	254609	254610	254611	254612	254613	254614	254615	254616	254617
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	N/G	34.65	7.95	3.19	1.02	5.3	1.95	6.14	5.81	45.44	24.69	1.36	4.24	3.7	1.94	4.07	1.38	5.48
Arsenic	300	315	100	5	7	15	27	149	32	406	95	19	2	14	11	14	18	12
Barium	N/G	2.4	**887.5**	**430.6**	**463.3**	119.2	**743.1**	**567.5**	**368.6**	245.8	7.4	6.8	**323.3**	**742.6**	**1089.7**	**2293.6**	**1056.5**	48.2
Beryllium	90	0.2	3.6	2.9	2.4	0.8	4.7	3.9	2.6	3.8	1.9	0.1	6.7	2.2	1.6	2.1	2	2.3
Boron	20000	**715**	**263**	**93**	**186**	**103**	**532**	**386**	**115**	**197**	**260**	65	50	**176**	**286**	**113**	**368**	**128**
Cadmium	90	0.2	2	0.1	0.1	0.2	0.1	0.4	1.2	0.2	0.6	11.1	0.1	0.2	0.2	0.2	0.2	0.3
Chromium	N/G	12	85	**99**	41	15	59	**111**	58	70	7	5	28	**92**	56	50	47	39
Cobalt	300	26.1	26.8	4.2	10.7	7.2	18.6	21	40.5	9.4	12.6	1.6	14.8	13.3	13.1	13.7	26.3	10.4
Copper	17000	**359**	109	11	60	19	42	86	188	66	77	35	4	61	26	20	**304**	62
Lead	600	14	225	25	5	19	25	33	40	12	75	57	146	20	13	10	36	16
Manganese	19000	**2423**	**2069**	**1866**	323	**2331**	**1480**	**952**	**1906**	**4612**	**3415**	**4178**	**3465**	**653**	350	**799**	444	**3070**
Mercury	80	0.02	0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Molybdenum	N/G	0.5	13	4.7	1.4	1.9	10.3	7.1	6.3	4.9	0.4	0.6	0.5	1.6	1.2	1	2	0.7
Nickel	1200	19	68	24	25	18	36	39	50	34	7	5	26	31	26	32	100	15
Phosphorus	N/G	50	435	448	390	177	465	271	339	301	60	316	205	404	375	454	369	343
Selenium	700	2.6	3.46	0.04	0.29	0.45	0.98	0.98	4.57	0.37	0.63	0.18	0.05	0.29	0.1	0.05	0.54	0.42
Silver	N/G	0.2	1.5	0.2	0.4	0.8	0.5	0.7	0.1	0.6	0.6	0.4	0.9	0.4	0.1	0.1	0.6	0.9
Sulfur	N/G	25800	6600	500	1600	9700	3900	2000	20700	400	1400	23300	300	3200	1000	1900	4800	5100
Sulfate	N/G	1400	600	100	100	800	500	300	1400	100	200	1800	100	500	200	400	300	300
Tin	N/G	12.8	3.7	29.4	2.2	1.2	9.1	4.7	8.6	123.5	45.9	1.2	175.7	15.4	3.7	13.7	2.7	101.8
Vanadium	N/G	8	288	111	73	58	183	289	165	106	54	4	65	76	94	103	78	50
Zinc	30000	248	574	62	17	73	52	168	701	331	261	2861	213	106	122	93	62	3262

Element	Ecological Soil Screening Levels [2]	254601	254602	254603	254604	254605	254606	254607	254608	254609	254610	254611	254612	254613	254614	254615	254616	254617
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	0.27	34.65	7.95	3.19	1.02	5.3	1.95	6.14	5.81	45.44	24.69	1.36	4.24	3.7	1.94	4.07	1.38	5.48
Arsenic	46	**315**	**100**	**5**	**7**	**15**	**27**	**149**	**32**	**406**	**95**	**19**	**2**	**14**	**11**	**14**	**18**	**12**
Barium	2000	2.4	**887.5**	**430.6**	**463.3**	**119.2**	**743.1**	**567.5**	**368.6**	**245.8**	7.4	6.8	**323.3**	**742.6**	**1089.7**	**2293.6**	**1056.5**	**48.2**
Beryllium	21	0.2	3.6	2.9	2.4	0.8	4.7	3.9	2.6	3.8	1.9	0.1	6.7	2.2	1.6	2.1	2	2.3
Boron	N/G	**715**	**263**	**93**	**186**	**103**	**532**	**386**	**115**	**197**	**260**	**65**	**50**	**176**	**286**	**113**	**368**	**128**
Cadmium	0.36	0.2	2	0.1	0.1	0.2	0.1	0.4	1.2	0.2	0.6	11.1	0.1	0.2	0.2	0.2	0.2	0.3
Chromium	34	**12**	**85**	**99**	**41**	**15**	**59**	**111**	**58**	**70**	**7**	**5**	**28**	**92**	**56**	**50**	**47**	**39**
Cobalt	230	26.1	26.8	4.2	10.7	7.2	18.6	21	**40.5**	9.4	12.6	1.6	14.8	13.3	13.1	13.7	26.3	10.4
Copper	49	**359**	109	11	60	19	42	86	188	66	77	35	4	61	26	20	**304**	62
Lead	56	14	**225**	25	5	19	25	33	40	12	**75**	**57**	**146**	20	13	10	36	16
Manganese	4000	**2423**	**2069**	**1866**	**323**	**2331**	**1480**	**952**	**1906**	**4612**	**3415**	**4178**	**3465**	**653**	**350**	**799**	**444**	**3070**
Mercury	N/G	0.02	0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Molybdenum	N/G	0.5	13	4.7	1.4	1.9	10.3	7.1	6.3	4.9	0.4	0.6	0.5	1.6	1.2	1	2	0.7
Nickel	130	19	68	24	25	18	36	39	50	34	7	5	26	31	26	32	100	15
Phosphorus	2000	50	**435**	**448**	**390**	**177**	**465**	**271**	**339**	**301**	60	**316**	**205**	**404**	**375**	**454**	**369**	**343**
Selenium	0.63	2.6	3.46	0.04	0.29	0.45	0.98	0.98	4.57	0.37	0.63	0.18	0.05	0.29	0.1	0.05	0.54	0.42
Silver	14	0.2	**1.5**	0.2	0.4	**0.8**	0.5	**0.7**	0.1	0.6	0.6	0.4	**0.9**	0.4	0.1	0.1	0.6	**0.9**
Sulfur	600	**25800**	**6600**	**500**	**1600**	**9700**	**3900**	**2000**	**20700**	**400**	**1400**	**23300**	**300**	**3200**	**1000**	**1900**	**4800**	**5100**
Sulfate	2000	**1400**	600	100	100	**800**	500	300	**1400**	100	200	**1800**	100	500	200	400	300	300
Tin	N/G	12.8	3.7	29.4	2.2	1.2	9.1	4.7	8.6	123.5	45.9	1.2	175.7	15.4	3.7	13.7	2.7	101.8
Vanadium	280	8	288	111	73	58	183	289	165	106	54	4	65	76	94	103	78	50
Zinc	79	248	**574**	62	17	73	52	168	**701**	**331**	261	**2861**	213	106	122	93	62	**3262**

Element	Soil Remediation Intervention Values [3]	254601	254602	254603	254604	254605	254606	254607	254608	254609	254610	254611	254612	254613	254614	254615	254616	254617
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	15	34.65	7.95	3.19	1.02	5.3	1.95	6.14	5.81	45.44	24.69	1.36	4.24	3.7	1.94	4.07	1.38	5.48
Arsenic	55	**315**	**100**	5	7	15	**27**	**149**	**32**	**406**	**95**	**19**	2	14	11	14	**18**	12
Barium	625	2.4	**887.5**	**430.6**	**463.3**	**119.2**	**743.1**	**567.5**	**368.6**	**245.8**	7.4	6.8	**323.3**	**742.6**	**1089.7**	**2293.6**	**1056.5**	48.2
Beryllium	30	0.2	3.6	2.9	2.4	0.8	4.7	3.9	2.6	3.8	1.9	0.1	6.7	2.2	1.6	2.1	2	2.3
Boron	N/G	**715**	**263**	**93**	**186**	**103**	**532**	**386**	**115**	**197**	**260**	**65**	**50**	**176**	**286**	**113**	**368**	**128**
Cadmium	12	0.2	2	0.1	0.1	0.2	0.1	0.4	1.2	0.2	0.6	11.1	0.1	0.2	0.2	0.2	0.2	0.3
Chromium	380	12	**85**	**99**	**41**	**15**	**59**	**111**	**58**	**70**	7	5	**28**	**92**	**56**	**50**	**47**	**39**
Cobalt	240	26.1	26.8	4.2	10.7	7.2	18.6	21	40.5	9.4	12.6	1.6	14.8	13.3	13.1	13.7	26.3	10.4
Copper	190	**359**	109	11	60	19	42	86	188	66	77	35	4	61	26	20	**304**	62
Lead	530	14	**225**	25	5	19	25	33	40	12	75	57	146	20	13	10	36	16
Manganese	N/G	**2423**	**2069**	**1866**	323	**2331**	**1480**	**952**	**1906**	**4612**	**3415**	**4178**	**3465**	**653**	350	**799**	444	**3070**
Mercury	10	0.02	0.01	0.01	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Molybdenum	200	0.5	**13**	4.7	1.4	1.9	**10.3**	7.1	6.3	4.9	0.4	0.6	0.5	1.6	1.2	1	2	0.7
Nickel	210	19	68	24	25	18	36	39	50	34	7	5	26	31	26	32	100	15
Phosphorus	N/G	50	**435**	**448**	**390**	177	**465**	**271**	**339**	**301**	60	**316**	205	**404**	**375**	**454**	**369**	**343**
Selenium	100	2.6	3.46	0.04	0.29	0.45	0.98	0.98	4.57	0.37	0.63	0.18	0.05	0.29	0.1	0.05	0.54	0.42
Silver	15	0.2	1.5	0.2	0.4	0.8	0.5	0.7	0.1	0.6	0.6	0.4	0.9	0.4	0.1	0.1	0.6	0.9
Sulfur	N/G	**25800**	**6600**	**500**	**1600**	**9700**	**3900**	**2000**	**20700**	**400**	**1400**	**23300**	**300**	**3200**	**1000**	**1900**	**4800**	**5100**
Sulfate	N/G	1400	600	100	100	800	500	300	1400	100	200	1800	100	500	200	400	300	300
Tin	900	12.8	3.7	29.4	2.2	1.2	9.1	4.7	8.6	123.5	45.9	1.2	175.7	15.4	3.7	13.7	2.7	101.8
Vanadium	250	8	288	111	73	58	183	289	165	106	54	4	65	76	94	103	78	50
Zinc	720	248	**574**	62	17	73	52	168	**701**	**261**	**2861**	213	106	122	93	62	**3262**

[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.

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

[3] VROM 2000, Circular on Target Values and Intervention Values for Soil Remediation, Reference DBO/1999226863, Ministry of Housing, Spatial Planning and the Environment, Bilthoven, Netherlands. Soil remediation intervention values and indicative levels for serious soil contamination. Applies to Be, Se, Ag, Sn and Va.

[4] National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999). Former Australian ecological investigation levels for urban areas included for reference purposes in the absence of other more applicable ecological assessment criteria. Applies to P, S and SO_4

APPENDIX C - SOIL QUALITY SCREENING RESULTS

Knight Piésold CONSULTING

Element	Human Health-Based Investigation Levels [1]	254618	254619	254620	254621	254622	254623	254624	254625	254626	254627	254628	254629	254630	254631	254632	254633	254634
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	N/G	0.44	11.89	24.2	22.51	9.955	25.64	4.48	22.75	8.76	10.43	40.34	14.83	20.57	1.78	11.94	12.11	25.55
Arsenic	300	6	53	53	7	12.5	36	8	61	35	82	377	31	690	21	439	211	92
Barium	N/G	4.2	47.4	203.7	**399.5**	35.5	168.3	**1288.6**	40.4	**493.1**	40.8	**644**	**907.5**	147.7	**964.6**	1.5	6.4	**1337.2**
Beryllium	90	0.1	0.8	2.2	4.3	0.7	3.6	2.6	4.3	2.1	2.5	3.3	2.9	2.1	3.2	0.5	1.5	7
Boron	20000	50	50	**161**	50	50	50	66	50	50	50	50	**581**	**233**	**136**	**303**	**312**	**106**
Cadmium	90	0.1	0.2	0.1	0.2	0.15	1.1	0.2	2	5.2	1.8	9.5	0.4	0.1	0.3	0.1	0.1	14.4
Chromium	N/G	5	19	69	74	5.5	6	40	43	33	5	65	**93**	**101**	65	5	5	69
Cobalt	300	1.1	236.7	3.6	20.9	3.65	18.1	9.2	12.1	27.6	11.4	137.1	13.8	6.4	7.7	18.2	10.7	26.1
Copper	17000	14	**2049**	43	15	12	36	15	47	20	10	80	22	204	31	5	2	66
Lead	600	2	29	164	154	122	1730	181	211	45	123	78	67	294	21	7	13	135
Manganese	19000	**1078**	**937**	183	**5885**	**1072.5**	**6604**	**5623**	**5274**	**5964**	**5500**	**5310**	**1656**	265	**1457**	**2838**	**3375**	**2995**
Mercury	80	0.01	0.01	0.01	0.01	0.03	0.05	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Molybdenum	N/G	0.3	0.7	15.8	1	1.4	2.1	1.8	1	0.8	1.6	27.7	7.8	11.4	5.3	1.2	1.5	2.7
Nickel	1200	3	164	18	42	5	19	29	35	34	13	259	34	17	16	2	4	47
Phosphorus	N/G	50	225	512	505	50	483	444	264	731	79	200	555	491	398	226	97	335
Selenium	700	0.02	7.79	0.68	0.2	0.045	0.4	0.03	0.19	0.18	0.08	3.04	0.12	3.9	0.12	0.12	0.05	1.02
Silver	N/G	0.2	0.9	0.3	1.8	0.7	1.5	1.4	1	0.9	0.6	0.4	0.1	0.1	0.3	0.1	0.1	9.1
Sulfur	N/G	400	136700	800	600	200	200	100	800	400	100	12400	200	700	300	100	100	4900
Sulfate	N/G	100	8300	500	2500	100	200	100	100	300	300	4400	100	700	100	100	100	500
Tin	N/G	0.6	32.5	128.4	92.5	15.2	60.6	8	307.4	22.9	43.4	62.9	64.2	21	32.4	13.9	22.3	91.9
Vanadium	N/G	14	68	154	177	8	22	86	149	179	29	244	136	345	126	2	6	153
Zinc	30000	26	77	121	911	204.5	1530	479	398	1383	591	5269	191	150	663	46	52	925

Element	Ecological Soil Screening Levels [2]	254618	254619	254620	254621	254622	254623	254624	254625	254626	254627	254628	254629	254630	254631	254632	254633	254634
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	0.27	0.44	11.89	24.2	22.51	9.955	25.64	4.48	22.75	8.76	10.43	40.34	14.83	20.57	1.78	11.94	12.11	25.55
Arsenic	46	**6**	**53**	**53**	**7**	**12.5**	**36**	**8**	**61**	**35**	**82**	**377**	**31**	**690**	**21**	**439**	**211**	**92**
Barium	2000	4.2	**47.4**	**203.7**	**399.5**	35.5	**168.3**	**1288.6**	40.4	**493.1**	40.8	**644**	**907.5**	**147.7**	**964.6**	1.5	6.4	**1337.2**
Beryllium	21	0.1	0.8	2.2	4.3	0.7	3.6	2.6	4.3	2.1	2.5	3.3	2.9	2.1	3.2	0.5	1.5	7
Boron	N/G	**50**	**50**	**161**	**50**	**50**	**50**	**66**	**50**	**50**	**50**	**50**	**581**	**233**	**136**	**303**	**312**	**106**
Cadmium	0.36	0.1	0.2	0.1	0.2	0.15	1.1	0.2	2	5.2	1.8	9.5	0.4	0.1	0.3	0.1	0.1	14.4
Chromium	34	**5**	**19**	**69**	**74**	**5.5**	**6**	**40**	**43**	**33**	**5**	**65**	**93**	**101**	**65**	**5**	**5**	**69**
Cobalt	230	1.1	**236.7**	3.6	20.9	3.65	18.1	9.2	12.1	27.6	11.4	**137.1**	13.8	6.4	7.7	18.2	10.7	26.1
Copper	49	14	**2049**	43	15	12	36	15	47	20	10	80	22	204	31	5	2	66
Lead	56	2	29	**164**	**154**	**122**	**1730**	**181**	**211**	45	**123**	**78**	**67**	**294**	21	7	13	**135**
Manganese	4000	**1078**	**937**	**183**	**5885**	**1072.5**	**6604**	**5623**	**5274**	**5964**	**5500**	**5310**	**1656**	**265**	**1457**	**2838**	**3375**	**2995**
Mercury	N/G	0.01	0.01	0.01	0.01	0.03	0.05	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Molybdenum	N/G	0.3	0.7	15.8	1	1.4	2.1	1.8	1	0.8	1.6	27.7	7.8	11.4	5.3	1.2	1.5	2.7
Nickel	130	3	164	18	42	5	19	29	35	34	13	259	34	17	16	2	4	47
Phosphorus	2000	50	**225**	**512**	**505**	50	**483**	**444**	**264**	**731**	79	**200**	**555**	**491**	**398**	**226**	97	**335**
Selenium	0.63	0.02	7.79	0.68	0.2	0.045	0.4	0.03	0.19	0.18	0.08	3.04	0.12	3.9	0.12	0.12	0.05	1.02
Silver	14	0.2	**0.9**	0.3	**1.8**	**0.7**	**1.5**	**1.4**	**1**	**0.9**	0.6	0.4	0.1	0.1	0.3	0.1	0.1	**9.1**
Sulfur	600	**400**	**136700**	**800**	**600**	**200**	**200**	**100**	**800**	**400**	**100**	**12400**	**200**	**700**	**300**	**100**	**100**	**4900**
Sulfate	2000	100	**8300**	500	**2500**	100	200	100	100	300	300	**4400**	100	**700**	100	100	100	500
Tin	N/G	0.6	32.5	128.4	92.5	15.2	60.6	8	307.4	22.9	43.4	62.9	64.2	21	32.4	13.9	22.3	91.9
Vanadium	280	14	68	154	177	8	22	86	149	179	29	244	136	345	126	2	6	153
Zinc	79	26	77	121	**911**	204.5	**1530**	**479**	**398**	**1383**	**591**	**5269**	191	150	**663**	46	52	**925**

Element	Soil Remediation Intervention Values [3]	254618	254619	254620	254621	254622	254623	254624	254625	254626	254627	254628	254629	254630	254631	254632	254633	254634
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	15	0.44	11.89	24.2	22.51	9.955	25.64	4.48	22.75	8.76	10.43	40.34	14.83	20.57	1.78	11.94	12.11	25.55
Arsenic	55	6	**53**	**53**	7	12.5	**36**	8	**61**	**35**	**82**	**377**	**31**	**690**	**21**	**439**	**211**	**92**
Barium	625	4.2	47.4	**203.7**	**399.5**	35.5	**168.3**	**1288.6**	40.4	**493.1**	40.8	**644**	**907.5**	**147.7**	**964.6**	1.5	6.4	**1337.2**
Beryllium	30	0.1	0.8	2.2	4.3	0.7	3.6	2.6	4.3	2.1	2.5	3.3	2.9	2.1	3.2	0.5	1.5	7
Boron	N/G	**50**	**50**	**161**	**50**	**50**	**50**	**66**	**50**	**50**	**50**	**50**	**581**	**233**	**136**	**303**	**312**	**106**
Cadmium	12	0.1	0.2	0.1	0.2	0.15	1.1	0.2	2	5.2	1.8	9.5	0.4	0.1	0.3	0.1	0.1	14.4
Chromium	380	5	**19**	**69**	**74**	5.5	6	**40**	**43**	**33**	5	**65**	**93**	**101**	**65**	5	5	**69**
Cobalt	240	1.1	236.7	3.6	20.9	3.65	18.1	9.2	12.1	27.6	11.4	137.1	13.8	6.4	7.7	18.2	10.7	26.1
Copper	190	14	**2049**	43	15	12	36	15	47	20	10	80	22	204	31	5	2	66
Lead	530	2	29	164	154	122	**1730**	181	**211**	45	123	78	67	**294**	21	7	13	135
Manganese	N/G	**1078**	**937**	183	**5885**	**1072.5**	**6604**	**5623**	**5274**	**5964**	**5500**	**5310**	**1656**	265	**1457**	**2838**	**3375**	**2995**
Mercury	10	0.01	0.01	0.01	0.01	0.03	0.05	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01
Molybdenum	200	0.3	0.7	**15.8**	1	1.4	2.1	1.8	1	0.8	1.6	**27.7**	7.8	**11.4**	5.3	1.2	1.5	2.7
Nickel	210	3	164	18	42	5	19	29	35	34	13	**259**	34	17	16	2	4	47
Phosphorus	N/G	50	**225**	**512**	**505**	50	**483**	**444**	**264**	**731**	79	200	**555**	**491**	**398**	**226**	97	**335**
Selenium	100	0.02	7.79	0.68	0.2	0.045	0.4	0.03	0.19	0.18	0.08	3.04	0.12	3.9	0.12	0.12	0.05	1.02
Silver	15	0.2	0.9	0.3	1.8	0.7	1.5	1.4	1	0.9	0.6	0.4	0.1	0.1	0.3	0.1	0.1	9.1
Sulfur	N/G	**400**	**136700**	**800**	**600**	**200**	**200**	**100**	**800**	**400**	**100**	**12400**	**200**	**700**	**300**	**100**	**100**	**4900**
Sulfate	N/G	100	8300	500	2500	100	200	100	100	300	300	4400	100	700	100	100	100	500
Tin	900	0.6	32.5	128.4	92.5	15.2	60.6	8	307.4	22.9	43.4	62.9	64.2	21	32.4	13.9	22.3	91.9
Vanadium	250	14	68	154	177	8	22	86	149	179	29	244	136	345	126	2	6	153
Zinc	720	26	77	121	**911**	204.5	**1530**	**479**	**398**	**1383**	**591**	**5269**	191	150	**663**	46	52	**925**

[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.
[2] United States Environmental Protection Agency (U.S. EPA) Ecological Soil Screening Levels (Eco-SSLs), http://www.epa.gov/ecotox/ecossl/ (mammalian wildlife).
[3] VROM 2000, Circular on Target Values and Intervention Values for Soil Remediation, Reference DBO/1999226863, Ministry of Housing, Spatial Planning and the Environment, Bilthoven, Netherlands. Soil remediation intervention values and indicative levels for serious soil contamination. Applies to Be, Se, Ag, Sn and Va.
[4] National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999). Former Australian ecological investigation levels for urban areas included for reference purposes in the absence of other more applicable ecological assessment criteria. Applies to P, S and SO_4

APPENDIX C - SOIL QUALITY SCREENING RESULTS

Knight Piésold CONSULTING

Element	Human Health-Based Investigation Levels [1]	254635	254636	254637	254638	254639	254640	254641	254642	254643	254644	254645	254646	254647	254648
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	N/G	17.42	8.72	7.37	9.62	20.34	7.9	5.31	1.44	6.11	4.67	3.38	12.13	8.74	0.47
Arsenic	300	888	15	16	28	67	137	22	10	13	73	163	77	4	539
Barium	N/G	70.7	**545.6**	**783.1**	40.7	112.3	**389.6**	**745.1**	**678**	155.1	20.5	**998.9**	24.5	14	**552.5**
Beryllium	90	4	3.1	2.8	2.2	1.4	1.3	2.8	2.8	3.7	1.9	2.6	3.9	2	0.9
Boron	20000	50	50	**185**	**160**	**116**	**141**	70	**116**	50	50	**113**	50	50	82
Cadmium	90	0.5	1.9	0.5	7.2	0.1	0.1	0.3	0.1	0.9	0.4	0.7	0.9	1.1	0.1
Chromium	N/G	50	41	53	26	64	65	62	60	29	5	50	11	5	5
Cobalt	300	20.4	44.2	10.6	14.4	8.1	1.4	10.4	10.8	7.9	10.7	14.5	13	2.6	5.9
Copper	17000	131	300	57	105	49	101	33	35	21	33	34	8	8	16
Lead	600	7	99	28	91	87	217	74	14	19	20	121	105	195	6
Manganese	19000	**5457**	**14894**	**3782**	**3631**	312	132	**1677**	455	**4021**	**4559**	**2558**	**3475**	**2378**	480
Mercury	80	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.07
Molybdenum	N/G	3.2	1.7	15.4	0.3	6.7	8	6	3.6	0.8	0.3	10.7	0.3	0.5	1.1
Nickel	1200	33	38	31	27	18	5	24	20	24	6	36	23	3	3
Phosphorus	N/G	**1846**	407	297	225	145	174	451	525	562	308	511	132	50	388
Selenium	700	1.51	0.04	0.77	0.43	0.75	5.13	0.18	0.63	0.24	0.1	0.97	0.07	0.03	0.18
Silver	N/G	0.4	0.5	0.3	0.4	16.8	0.2	0.6	0.1	0.3	0.3	0.2	1.5	0.2	0.1
Sulfur	N/G	5700	300	4300	8100	500	700	200	4200	600	200	2500	100	300	2900
Sulfate	N/G	400	400	400	1600	400	300	100	300	100	100	700	100	100	100
Tin	N/G	135.2	277.9	22.3	162.7	46	13	25.1	5.7	128.6	116.7	19.3	54	18.9	0.5
Vanadium	N/G	69	256	133	97	210	287	159	111	101	22	244	59	7	21
Zinc	30000	338	1072	245	4637	106	132	264	60	1075	482	307	702	964	39

Element	Ecological Soil Screening Levels [2]	254635	254636	254637	254638	254639	254640	254641	254642	254643	254644	254645	254646	254647	254648
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	0.27	17.42	8.72	7.37	9.62	20.34	7.9	5.31	1.44	6.11	4.67	3.38	12.13	8.74	0.47
Arsenic	46	**888**	**15**	**16**	**28**	**67**	**137**	**22**	**10**	**13**	**73**	**163**	**77**	**4**	**539**
Barium	2000	**70.7**	**545.6**	**783.1**	40.7	**112.3**	**389.6**	**745.1**	**678**	**155.1**	20.5	**998.9**	24.5	14	**552.5**
Beryllium	21	4	3.1	2.8	2.2	1.4	1.3	2.8	2.8	3.7	1.9	2.6	3.9	2	0.9
Boron	N/G	**50**	**50**	**185**	**160**	**116**	**141**	**70**	**116**	**50**	**50**	**113**	**50**	**50**	**82**
Cadmium	0.36	0.5	1.9	0.5	7.2	0.1	0.1	0.3	0.1	0.9	0.4	0.7	0.9	1.1	0.1
Chromium	34	**50**	**41**	**53**	**26**	**64**	**65**	**62**	**60**	**29**	**5**	**50**	**11**	**5**	**5**
Cobalt	230	20.4	**44.2**	10.6	14.4	8.1	1.4	10.4	10.8	7.9	10.7	14.5	13	2.6	5.9
Copper	49	131	**300**	57	105	49	101	33	35	21	33	34	8	8	16
Lead	56	7	**99**	28	**91**	**87**	**217**	**74**	14	19	20	**121**	**105**	**195**	6
Manganese	4000	**5457**	**14894**	**3782**	**3631**	**312**	**132**	**1677**	**455**	**4021**	**4559**	**2558**	**3475**	**2378**	**480**
Mercury	N/G	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.07
Molybdenum	N/G	3.2	1.7	15.4	0.3	6.7	8	6	3.6	0.8	0.3	10.7	0.3	0.5	1.1
Nickel	130	33	38	31	27	18	5	24	20	24	6	36	23	3	3
Phosphorus	2000	**1846**	**407**	**297**	**225**	**145**	**174**	**451**	**525**	**562**	**308**	**511**	**132**	50	**388**
Selenium	0.63	1.51	0.04	0.77	0.43	0.75	5.13	0.18	0.63	0.24	0.1	0.97	0.07	0.03	0.18
Silver	14	0.4	0.5	0.3	0.4	**16.8**	0.2	0.6	0.1	0.3	0.3	0.2	**1.5**	0.2	0.1
Sulfur	600	**5700**	**300**	**4300**	**8100**	**500**	**700**	**200**	**4200**	**600**	**200**	**2500**	**100**	**300**	**2900**
Sulfate	2000	400	400	400	**1600**	400	300	100	300	100	100	**700**	100	100	100
Tin	N/G	135.2	277.9	22.3	162.7	46	13	25.1	5.7	128.6	116.7	19.3	54	18.9	0.5
Vanadium	280	69	256	133	97	210	287	159	111	101	22	244	59	7	21
Zinc	79	**338**	**1072**	245	**4637**	106	132	264	60	**1075**	**482**	**307**	**702**	**964**	39

Element	Soil Remediation Intervention Values [3]	254635	254636	254637	254638	254639	254640	254641	254642	254643	254644	254645	254646	254647	254648
	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Antimony	15	17.42	8.72	7.37	9.62	20.34	7.9	5.31	1.44	6.11	4.67	3.38	12.13	8.74	0.47
Arsenic	55	**888**	15	**16**	**28**	**67**	**137**	**22**	10	13	**73**	**163**	**77**	4	**539**
Barium	625	**70.7**	**545.6**	**783.1**	40.7	**112.3**	**389.6**	**745.1**	**678**	**155.1**	20.5	**998.9**	24.5	14	**552.5**
Beryllium	30	4	3.1	2.8	2.2	1.4	1.3	2.8	2.8	3.7	1.9	2.6	3.9	2	0.9
Boron	N/G	**50**	**50**	**185**	**160**	**116**	**141**	**70**	**116**	**50**	**50**	**113**	**50**	**50**	**82**
Cadmium	12	0.5	1.9	0.5	7.2	0.1	0.1	0.3	0.1	0.9	0.4	0.7	0.9	1.1	0.1
Chromium	380	**50**	**41**	**53**	**26**	**64**	**65**	**62**	**60**	**29**	5	**50**	11	5	5
Cobalt	240	20.4	44.2	10.6	14.4	8.1	1.4	10.4	10.8	7.9	10.7	14.5	13	2.6	5.9
Copper	190	131	**300**	57	105	49	101	33	35	21	33	34	8	8	16
Lead	530	7	99	28	91	87	**217**	74	14	19	20	121	105	**195**	6
Manganese	N/G	**5457**	**14894**	**3782**	**3631**	312	132	**1677**	455	**4021**	**4559**	**2558**	**3475**	**2378**	480
Mercury	10	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.07
Molybdenum	200	3.2	1.7	**15.4**	0.3	6.7	8	6	3.6	0.8	0.3	**10.7**	0.3	0.5	1.1
Nickel	210	33	38	31	27	18	5	24	20	24	6	36	23	3	3
Phosphorus	N/G	**1846**	**407**	**297**	**225**	145	174	**451**	**525**	**562**	**308**	**511**	132	50	**388**
Selenium	100	1.51	0.04	0.77	0.43	0.75	5.13	0.18	0.63	0.24	0.1	0.97	0.07	0.03	0.18
Silver	15	0.4	0.5	0.3	0.4	16.8	0.2	0.6	0.1	0.3	0.3	0.2	1.5	0.2	0.1
Sulfur	N/G	**5700**	**300**	**4300**	**8100**	**500**	**700**	**200**	**4200**	**600**	**200**	**2500**	**100**	**300**	**2900**
Sulfate	N/G	400	400	400	1600	400	300	100	300	100	100	700	100	100	100
Tin	900	135.2	277.9	22.3	162.7	46	13	25.1	5.7	128.6	116.7	19.3	54	18.9	0.5
Vanadium	250	69	256	133	97	210	287	159	111	101	22	244	59	7	21
Zinc	720	**338**	**1072**	245	**4637**	106	132	**264**	60	**1075**	**482**	**307**	**702**	**964**	39

[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.
[2] United States Environmental Protection Agency (U.S. EPA) Ecological Soil Screening Levels (Eco-SSLs), http://www.epa.gov/ecotox/ecossl/ (mammalian wildlife).
[3] VROM 2000, Circular on Target Values and Intervention Values for Soil Remediation, Reference DBO/1999226863, Ministry of Housing, Spatial Planning and the Environment, Bilthoven, Netherlands. Soil remediation intervention values and indicative levels for serious soil contamination. Applies
[4] National Environment Protection (Assessment of Site Contamination) Measure (NEPC, 1999). Former Australian ecological investigation levels for urban areas included for reference purposes in the absence of other more applicable ecological assessment criteria. Applies to P, S and SO_4

APPENDIX D

Waste Rock Distilled Water Extract Tables

Knight Piésold
CONSULTING

APPENDIX D - DISTILLED WATER EXTRACT RESULTS

Knight Piésold CONSULTING

Parameter	Reference Release Value (mg/L)	Assay Results (mg/L)												
		254601 (mg/L)	254604 (mg/L)	254616 (mg/L)	254619 (mg/L)	254624 (mg/L)	254626 (mg/L)	254627 (mg/L)	254628 (mg/L)	254630 (mg/L)	254635 (mg/L)	254637 (mg/L)	254642 (mg/L)	254643 (mg/L)
pH	9	8.9	**9.1**	8.7	**3.7**	7	7.1	7.8	**4.8**	**4.8**	7.9	7.8	7.3	8.9
TDS	2000	90	60	90	**6465**	30	246	60	**3517**	42	87	48	54	72
Aluminum	5	0.01	2.86	0.66	**10.23**	0.52	0.07	0.02	1.03	0.07	0.15	2.73	1.24	0.33
Antimony	N/G	0.008	0.00181	0.00608	0.00021	0.00058	0.00074	0.00429	0.00238	0.00001	0.00331	0.00269	0.00095	0.00551
Arsenic	0.1	0.0041	0.0155	0.0579	0.0021	0.0004	0.0007	0.0229	0.0204	0.0003	0.0978	0.0172	0.0045	0.0179
Barium	N/G	0.02471	0.04445	0.00832	0.01539	0.01818	0.05062	0.00022	0.07435	0.01368	0.001115	0.02737	0.01486	0.00996
Boron	5	0.6	0.03	0.06	0.47	0.01	0.01	0.02	0.04	0.01	0.085	0.01	0.01	0.1
Cadmium	0.01	0.00002	0.00002	0.00003	**0.02662**	0.00007	0.00232	0.00017	**1.4702**	0.00004	0.000065	0.0004	0.00002	0.00006
Calcium	1000	5.98	8.85	13.14	373.27	0.55	12.5	3.2	23.12	0.12	7.08	1.9	4.33	6.16
Chloride	N/G	23	2	4	2	2	5	3	12	14	3	2	2	6
Chromium	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.01
Cobalt	1	0.0001	0.0016	0.0008	**4.6994**	0.0005	0.0026	0.0005	**17.1049**	0.003	0.00085	0.0036	0.0009	0.0005
Copper	0.3	0.01	0.01	0.01	**82.68**	0.01	0.01	0.01	0.27	0.01	0.01	0.06	0.01	0.01
Fluoride	2	0.8	1.6	1.3	0.4	0.5	0.4	0.4	0.3	0.1	0.85	0.1	1.2	0.3
Iron	2	0.01	1.76	0.41	**126.99**	0.54	0.11	0.37	0.01	0.01	0.365	**3.23**	1.09	0.49
Lead	0.1	0.0007	0.0017	0.0053	0.0005	0.0056	0.0005	0.0011	0.0023	0.0406	0.00055	0.027	0.0013	0.0049
Magnesium	2000	12.64	2.82	5.57	732.89	1.85	35.88	4.95	252.83	0.81	8.775	12.16	4.15	7.8
Manganese	N/G	0.01	0.09	0.04	17.08	0.29	1.53	0.02	172.44	0.11	0.055	0.68	0.06	0.07
Mercury	0.002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Molybdenum	0.15	0.0006	0.00169	0.0052	0.00008	0.00036	0.00007	0.0173	0.00011	0.00005	0.005185	0.01149	0.01233	0.00458
Nickel	0.5	0.01	0.01	0.01	**3.25**	0.01	0.01	0.03	**31.79**	0.01	0.01	0.01	0.01	0.01
Phosphorus	N/G	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Selenium	0.02	0.0011	0.0005	0.0017	0.0185	0.0005	0.0069	0.0005	**0.0931**	0.0005	0.00425	0.0121	0.0011	0.0005
Silver	0.5	0.00001	0.00001	0.00004	0.00063	0.00002	0.00001	0.00001	0.00001	0.00001	0.000035	0.0001	0.00001	0.00001
Sodium	N/G	1	2.2	5	2.2	4.3	6.9	10.9	6.2	8.2	4.4	5.4	3.1	5.6
Sulfate	1000	92.0	6.6	36.2	**4087.5**	5.4	136.9	9.6	**2073.4**	0.9	38.0	22.2	32.4	7.5
Tin	N/G	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0005	0.0001	0.0001
Uranium	0.2	0.000005	0.000733	0.000207	0.054007	0.00003	0.000061	0.000025	0.004153	0.000069	0.0001175	0.000052	0.000159	0.000184
Vanadium	N/G	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zinc	0.5	0.01	0.01	0.01	**3.2**	0.03	0.04	0.1	**415.32**	0.02	0.01	0.27	0.01	0.04

Parameter	Reference Drinking Water Value (mg/L)	Assay Results (mg/L)												
		254601 (mg/L)	254604 (mg/L)	254616 (mg/L)	254619 (mg/L)	254624 (mg/L)	254626 (mg/L)	254627 (mg/L)	254628 (mg/L)	254630 (mg/L)	254635 (mg/L)	254637 (mg/L)	254642 (mg/L)	254643 (mg/L)
pH	8.5	**8.9**	**9.1**	**8.7**	**3.7**	7	7.1	7.8	**4.8**	**4.8**	7.9	7.8	7.3	**8.9**
TDS	600	90	60	90	**6465**	30	246	60	**3517**	42	87	48	54	72
Aluminum	0.2	0.01	**2.86**	**0.66**	**10.23**	**0.52**	0.07	0.02	**1.03**	0.07	0.15	**2.73**	**1.24**	**0.33**
Antimony	0.003	**0.008**	0.00181	**0.00608**	0.00021	0.00058	0.00074	**0.00429**	0.00238	0.00001	**0.00331**	0.00269	0.00095	**0.00551**
Arsenic	0.01	0.0041	**0.0155**	**0.0579**	0.0021	0.0004	0.0007	**0.0229**	**0.0204**	0.0003	**0.0978**	**0.0172**	0.0045	**0.0179**
Barium	2	0.02471	0.04445	0.00832	0.01539	0.01818	0.05062	0.00022	0.07435	0.01368	0.001115	0.02737	0.01486	0.00996
Boron	4	0.6	0.03	0.06	0.47	0.01	0.01	0.02	0.04	0.01	0.085	0.01	0.01	0.1
Cadmium	0.002	0.00002	0.00002	0.00003	**0.02662**	0.00007	**0.00232**	0.00017	**1.4702**	0.00004	0.000065	0.0004	0.00002	0.00006
Calcium	N/G	5.98	8.85	13.14	373.27	0.55	12.5	3.2	23.12	0.12	7.08	1.9	4.33	6.16
Chloride	250	23	2	4	2	2	5	3	12	14	3	2	2	6
Chromium	N/G	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.01
Cobalt	N/G	0.0001	0.0016	0.0008	4.6994	0.0005	0.0026	0.0005	17.1049	0.003	0.00085	0.0036	0.0009	0.0005
Copper	1	0.01	0.01	0.01	**82.68**	0.01	0.01	0.01	0.27	0.01	0.01	0.06	0.01	0.01
Fluoride	1.5	0.8	**1.6**	1.3	0.4	0.5	0.4	0.4	0.3	0.1	0.85	0.1	1.2	0.3
Iron	0.3	0.01	**1.76**	**0.41**	**126.99**	**0.54**	0.11	**0.37**	0.01	0.01	**0.365**	**3.23**	**1.09**	**0.49**
Lead	0.01	0.0007	0.0017	0.0053	0.0005	0.0056	0.0005	0.0011	0.0023	**0.0406**	0.00055	**0.027**	0.0013	0.0049
Magnesium	N/G	12.64	2.82	5.57	732.89	1.85	35.88	4.95	252.83	0.81	8.775	12.16	4.15	7.8
Manganese	0.1	0.01	0.09	0.04	**17.08**	**0.29**	**1.53**	0.02	**172.44**	**0.11**	0.055	**0.68**	0.06	0.07
Mercury	0.001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Molybdenum	0.05	0.0006	0.00169	0.0052	0.00008	0.00036	0.00007	0.0173	0.00011	0.00005	0.005185	0.01149	0.01233	0.00458
Nickel	0.02	0.01	0.01	0.01	**3.25**	0.01	0.01	**0.03**	**31.79**	0.01	0.01	0.01	0.01	0.01
Phosphorus	N/G	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Selenium	0.01	0.0011	0.0005	0.0017	**0.0185**	0.0005	0.0069	0.0005	**0.0931**	0.0005	0.00425	**0.0121**	0.0011	0.0005
Silver	0.1	0.00001	0.00001	0.00004	0.00063	0.00002	0.00001	0.00001	0.00001	0.00001	0.000035	0.0001	0.00001	0.00001
Sodium	180	1	2.2	5	2.2	4.3	6.9	10.9	6.2	8.2	4.4	5.4	3.1	5.6
Sulfate	250	92.0	6.6	36.2	**4087.5**	5.4	136.9	9.6	**2073.4**	0.9	38.0	22.2	32.4	7.5
Tin	N/G	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0005	0.0001	0.0001
Uranium	0.017	0.000005	0.000733	0.000207	**0.054007**	0.00003	0.000061	0.000025	0.004153	0.000069	0.0001175	0.000052	0.000159	0.000184
Vanadium	N/G	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Zinc	3	0.01	0.01	0.01	**3.2**	0.03	0.04	0.1	**415.32**	0.02	0.01	0.27	0.01	0.04