MT MORGANS GOLD PROJECT
TAILINGS GEOCHEMICAL CHARACTERISATION

PREPARED FOR:

DACIAN GOLD LIMITED

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AUGUST 2016

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1. INTRODUCTION

1.1 PROJECT BACKGROUND

Dacian Gold Limited (Dacian) has been exploring its tenements in the Laverton Greenstone Belt, a gold region in the Yilgarn Craton of Western Australia.

Dacian is now investigating development opportunities for the Mt Morgans Gold Project (MMGP) located approximately 30 km west of Laverton (Figure 1) following the discovery of significant areas of gold mineralisation at the Westralia and Jupiter prospects.

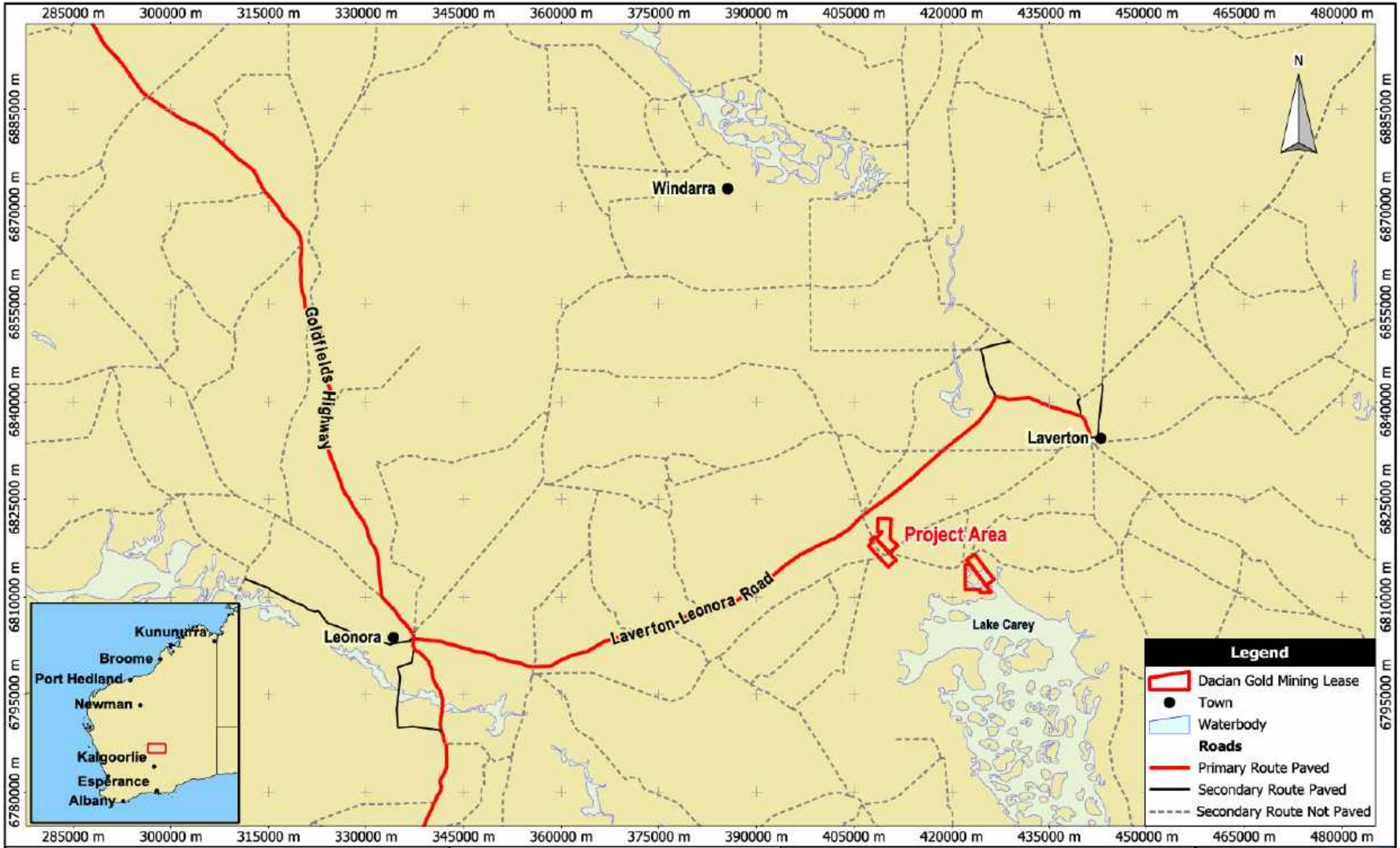
A geochemical assessment, including an assessment of the potential generation of acid and metalliferous drainage (AMD) from tailings generated from proposed mining at Westralia and Jupiter, is a key component in the process of gaining environmental approvals for development of the MMGP.

1.2 OBJECTIVE AND SCOPE OF WORK

The objective of the study was to determine the potential for AMD, neutral or saline drainage to occur from tailings produced from processing of ore at the MMGP and if these materials are likely to pose a significant risk to the surrounding environment. Geochemical characteristics of waste rock are presented in a separate report.

Specifically, the scope of work comprised:

- Desktop review and gap analysis of any earlier geochemical ore and tailings characterisation studies.
- Selection of representative samples of process tailings from metallurgical testwork residues as surrogates for process tailings materials.
- Classification of tailings based on their potential to generate AMD according to the procedures published by the Federal Department of Industry, Tourism and Resources (DITR, 2007) and the International Network for Acid Prevention (INAP).
- Preparation of a geochemical characterisation report with respect to the process tailings predicted to be produced at the MMGP outlining the likely properties and any significant risks to the environment posed by these materials.



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0 20 km

Dacian Gold Limited
Mt Morgans Gold Project

Figure 1

Location Plan

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W:\Dacian\Drawings\Location Plan.map 17/05/2016 F1 Location Plan Layout

2. PROJECT DESCRIPTION

Dacian is currently completing a Definitive Feasibility Study (DFS) contemplating the development of open cut and underground gold mines and construction of ore processing facilities and site support infrastructure at the MMGP. The MMGP is an historic mining operation centred on the Westralia open pit, developed in the late 1980s with subsequent development of a number of open pits and underground mines (including Jupiter), that produced over one million ounces of gold. The MMGP was owned by a number of companies prior to Dacian acquiring it in 2012, following it being placed on care and maintenance in 2011.

The DFS is investigating the potential economic viability of mining and on-site treatment of gold deposits at Westralia and Jupiter (Figure 2 and Figure 3).

Westralia contains four potential mines, comprising:

- Beresford Underground, accessed from the existing Westralia pit and containing approximately 3.1 million tonnes for ore.
- Allanson Underground, accessed from the existing Morgans North pit, containing approximately 1.2 million tonnes of ore.
- Morgans North pit cut-back, containing approximately 100,000 tonnes of ore.
- Transvaal Underground, accessed from the existing Transvaal pit and containing approximately 510,000 tonnes of ore.

Jupiter is situated 15 km east of Westralia and contains a potential open pit mining complex, comprising:

- Heffernans deposit, containing 6.8 million tonnes of ore.
- Doublejay deposit, containing 3.8 million tonnes of ore.
- Ganymede deposit, containing 600,000 tonnes of ore.

Based on current estimates, approximately 16 million tonnes of ore and 103 million tonnes of waste rock will be mined over a six year period. It is proposed that ore will be processed at a rate of approximately 2.5 million tonnes per annum through a purpose built carbon-in-leach (CIL) processing plant located at Jupiter. Approximately 16 million tonnes of tailings will be discharged to tailings storage facility (TSF) proposed to be constructed approximately 500 m north of the processing plant (Figure 2).

The expected composition of mine ore and hence tailings waste material is summarised in Table 1.

Table 1: Estimated Composition of Mine Ore Material (6 Year projection)

Ore Source	Estimated Ore Volume (Mt)	Estimated % of Tailings
Beresford (U/G from Westralia Pit)	3.1	19.2
Allanson (U/G)	1.2	7.45
Morgans North (Cutback)	0.101	0.63
Transvaal (U/G from Transvaal Pit)	0.507	3.14
Heffernans (Open Pit)	6.8	42.2
Doublejay (Open Pit)	3.8	23.6
Ganymede (Open Pit)	0.6	3.72
Total	**16.1**	

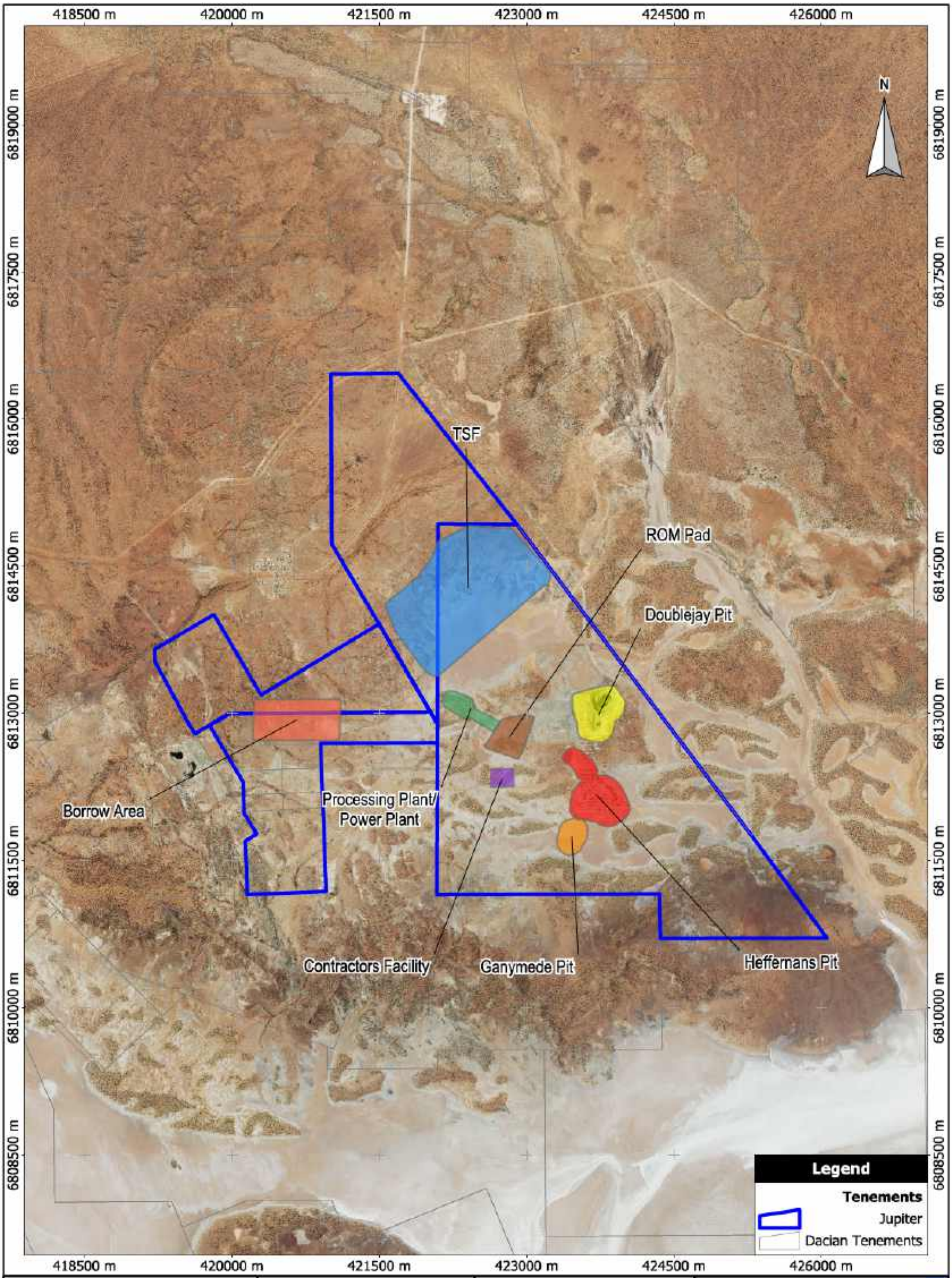

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Figure 2

Jupiter Site Layout

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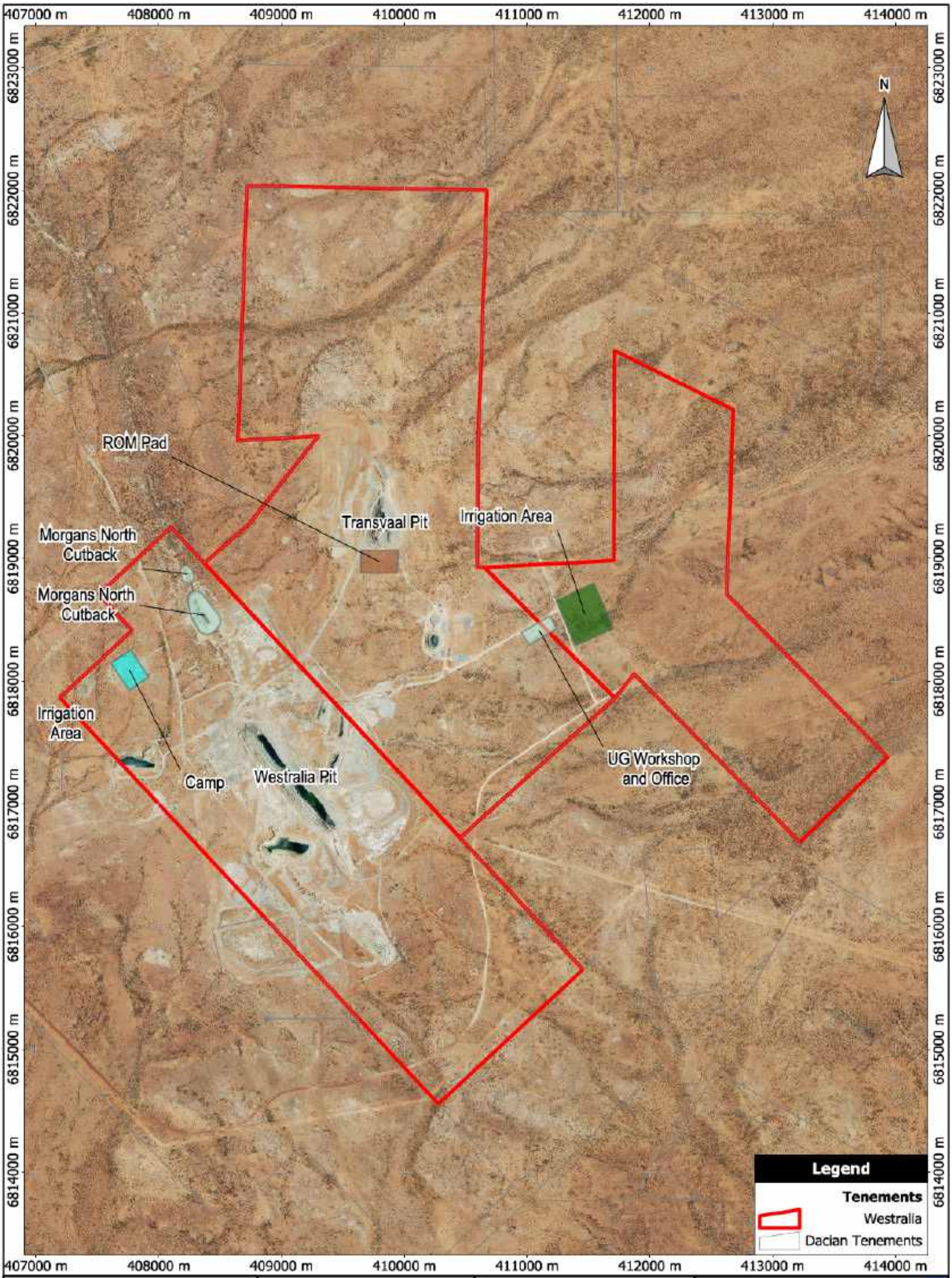

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0 1 km

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Figure 3

Westralia Site Layout

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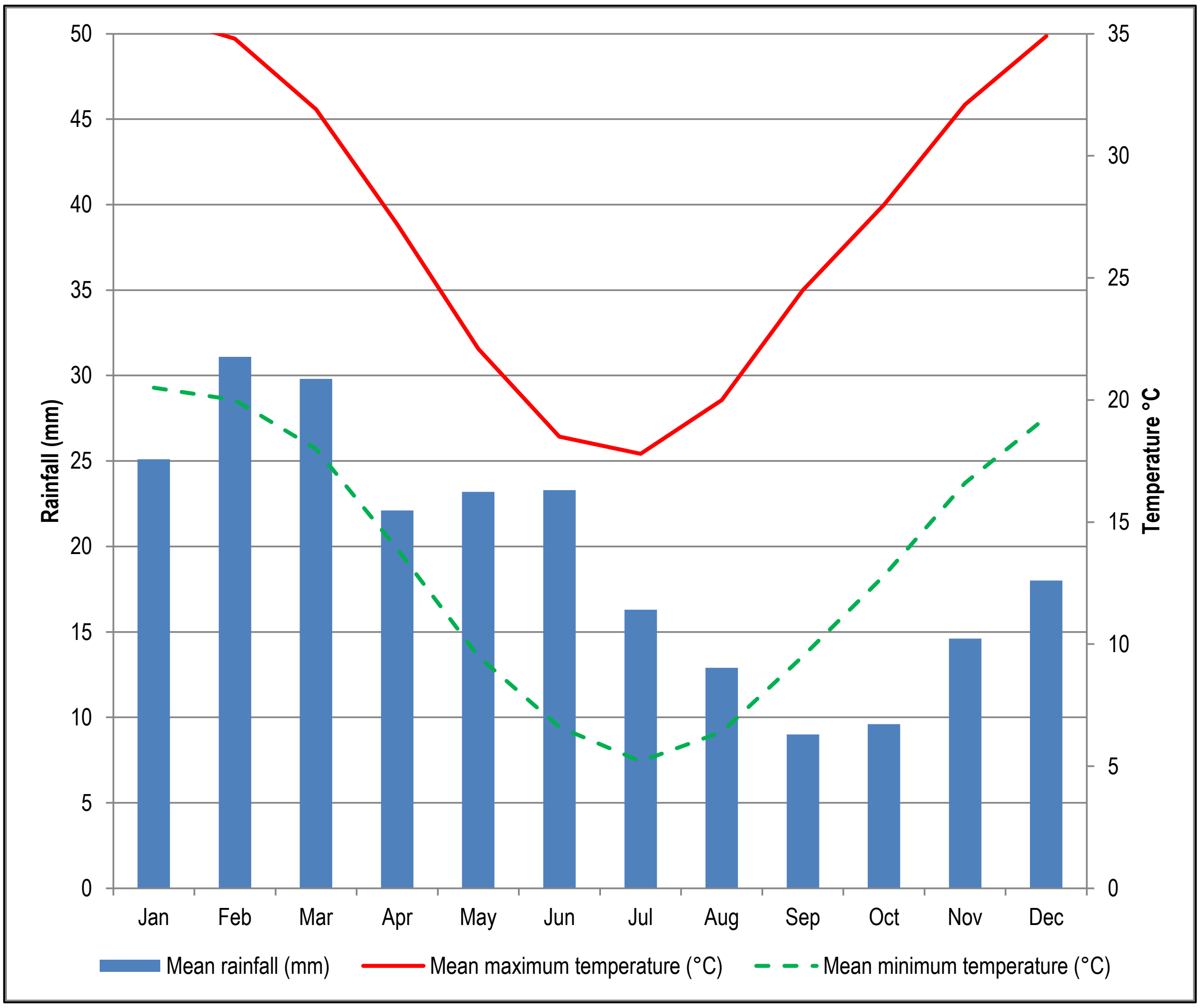
W:\Dacian\Waste Characterisation\Drawings\Site Layout.map 9/08/2016 F3 Westralia Site Layout

3. ENVIRONMENTAL SETTING

3.1 CLIMATE

The MMGP is within the semi-arid zone of Western Australia, with mild winters and hot summers. The annual temperature regime is characterised by marked diurnal and seasonal fluctuations. A representative Bureau of Meteorology (BoM) weather station for the project is located at Laverton (25 km to the northeast). Mean maximum summer temperatures recorded a range of between 31.9 and 35.8ºC, whilst the mean minimum winter temperature ranges between 5.2 and 6.6ºC (BoM 2016) (Chart 1).

Annual rainfall in the semi-arid zone is highly variable and subject to drought periods (Chart 1). The average annual rainfall is 233.5 mm, gauged by the Laverton weather station, with the months of May through July showing the greatest number of rain days (BoM 2016). Rainfall is unreliable, but tends to fall predominantly over the winter months. Occasional thunderstorms in summer bring heavy rainfall and resultant flooding.



Laverton (Site 012305)

Chart 1: Monthly Mean Rainfall and Temperature Data for Laverton (1899-2016) (BoM 2016)

3.2 GEOLOGY

3.2.1 Regional Geology

The MMGP lies within the Laverton Greenstone Belt, which forms the north eastern part of the Eastern Goldfields Province of the Yilgarn Craton of Western Australia. It consists of belts of greenstone, intruded by granitic rocks of Archean age and areas of sedimentary banded iron rocks associated with the greenstone (Pringle *et al.* 1994). The granites are generally expressed as low, rounded tors surrounded by plains, while the greenstones may be either low, rounded hills or steeper, less weathered hills with narrow drainages (Outback Ecology 2009). Figure 4 illustrates the subsurface regional geology of the Westralia and Jupiter deposits.

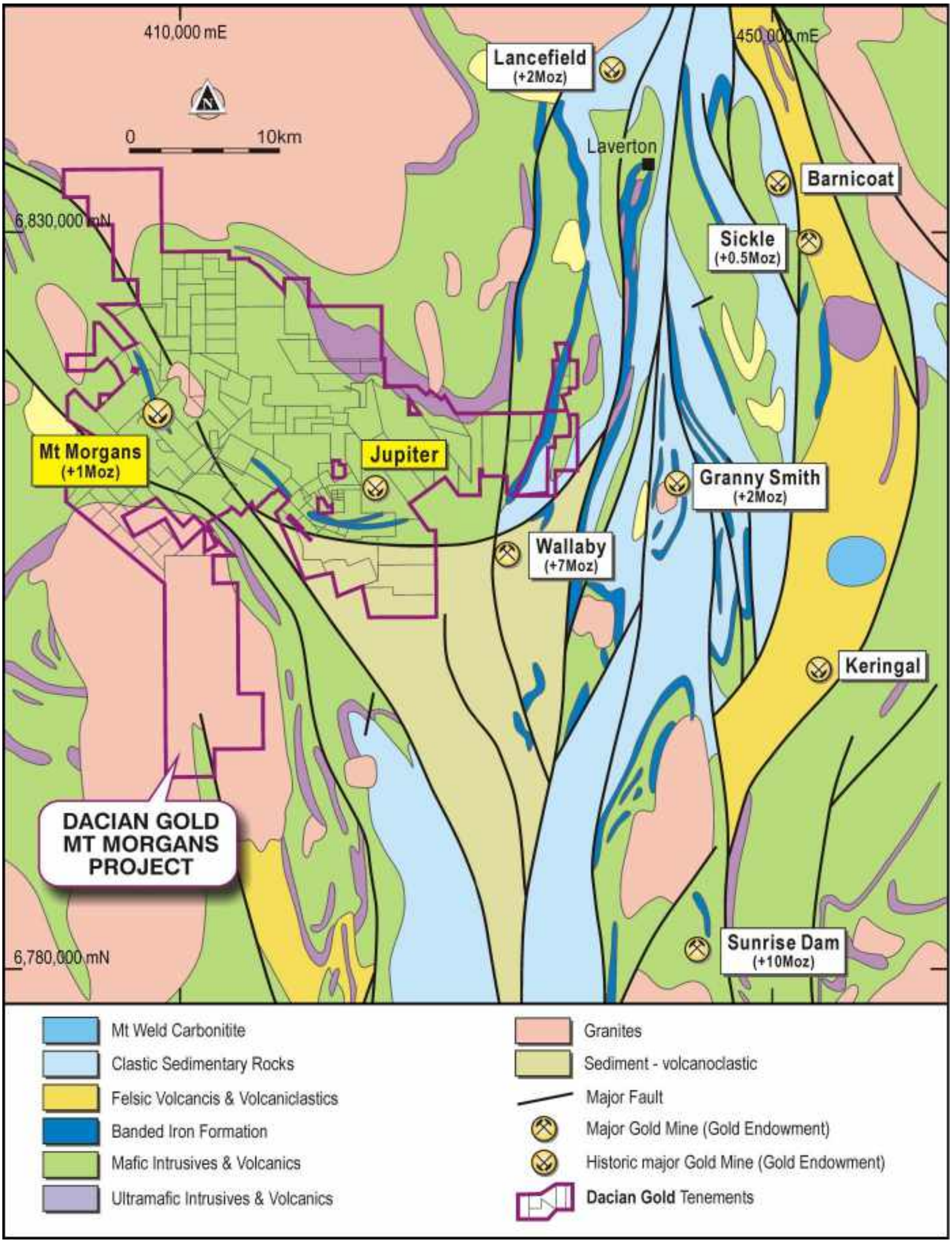
3.2.2 Project Geology

The MMGP lies in the overturned western limb of the Mt Margaret anticline which plunges moderately to the south and has a north north west trending folding axis (Dacian 2016). Lithologies are dominated by mafic volcanics and intrusives, metasediments and a narrow band of banded iron formation (BIF). These primary lithologies have been intruded by concordant and discordant felsic porphyry dykes and sills as well as local thin lamprophyre dykes. All rocks have undergone regional metamorphism and large granite intrusions form the core of the Mt Margaret anticline (Dacian 2016).

The project area comprises four styles of mineralisation (Dacian 2016) as follows:

- BIF hosted replacement style mineralisation (Westralia deposits).
- Basalt hosted shear zone quartz lodes. These deposits typically contain narrow, high grade veins of sericite-silica-carbonate-sulfide alteration zones and breccia veins within broader mineralised alteration haloes (Transvaal deposit).
- Splay shear hosted vein arrays in mafic and ultramafic rocks. These deposits occur in multiple orientations and are generally limited in scale (Recreation, King Street deposits).
- Syenite and some basalt hosted gold mineralisation along the Cornwall Shear Zone (CSZ) (Jupiter deposits).

Figure 4: Regional Geology



3.3 LANDFORM AND SOILS

The MMGP overlays the Salinaland Plateau within the Yilgarn Plateau Province (Pringle *et al.* 1994). The Salinaland Plateau is typically characterised by sandplains, laterite breakaways, granitic and alluvial plains, ridges of metamorphic rocks, granitic hills and, along valleys, calcretes, large salt lakes and dunes (Pringle *et al.* 1994). The MMGP is situated on a sandplain with scattered quartz mantles, north of the Lake Carey salt lake system (Outback Ecology 2009).

The MMGP area predominately encompasses four land systems (Pringle at al. 1994) including:

- Gundockerata Land System. Extensive gently undulating, calcareous, stony plains.
- Jundee Land System. Hardpan plains with ironstone gravel mantles.
- Nubev Land System. Gently undulating stony plains, minor limonitic low rises and drainage floors.
- Carnegie Land System. Salt lakes with fringing saline alluvial plains, kopi dunes and sandy banks

Major soil types within these systems are described (Pringle at al. 1994) as:

- Salt lake sediments.
- Red deep sandy duplex soil.
- Deep red sand.
- Red shallow loam.
- Calcareous loamy earth.
- Stony soil.

3.4 SURFACE WATER DRAINAGE AND QUALITY

The north eastern part of the Eastern Goldfields Province is crossed by two major surface water divides, separating the Carey, Minigwal and Raeside Palaeodrainages (DoE 2004). These palaeodrainages once carried water east to the Eucla Basin, but are now occupied by chains of playa lakes (DoE 2004). The MMGP lies within the Carey Palaeodrainage and has no permanent rivers or streams. Intermittent streamflow occurs only after major rainfall and the water runs into playa lakes including Lake Carey located about 2 km south west of the Jupiter.

Water ponding in the playa lakes is hypersaline, particularly when levels are low (DoE 2004). Salinity decreases following significant rainfall events, but the salt levels rapidly increase as water levels drop from evaporation.

3.5 REGIONAL HYDROGEOLOGY AND GROUNDWATER QUALITY

The MMGP is located within groundwater area (GWA) 21, which covers the entire goldfields district (Sandstone 2014). Groundwater in the region typically occurs in the following units (from deepest to shallowest) (GRM 2015):

- **Fresh and weathered Archaean basement fractured rock aquifers**: Associated with discrete interconnected fractures. Fractured bedrock aquifers occur more commonly in mafic, ultramafic and granitic rocks than in sedimentary, felsic volcanic and volcanoclastic units. In contrast the mafic and ultramafic dykes which are prevalent in the region can form hydraulic barriers to groundwater flow.
- **Tertiary palaeochannel sands**: Typically infilled with a basal palaeochannel sand, which is overlain by low permeability clay. The palaeochannel sands form a major aquifer in the region and provide the largest reliable source of groundwater in the area. This water resource is used extensively for ore processing across the Goldfields. The sands tend to have high permeability, but limited storage. Therefore in the

longer term most of abstraction is supported by leakage from the overlying clays and surrounding basement rocks.

- **Surficial deposits including lacustrine sediments, alluvium/colluvium and calcrete**: Groundwater occurrences are found in the surficial sediments, where they extend below the water table. Lacustrine sediments are generally fine grained and provide low yields. Alluvium/colluvium tends to be more variable and can provide higher yields of up to 4 to 5 L/s in areas where deposits comprise predominantly sand and gravel. However, long-term abstraction is not always sustainable, because of the aquifers limited extent.

Groundwater is recharged by direct rainfall infiltration or by stream flow during episodic rainfall events. Although difficult to quantify, recharge only constitutes a small proportion of rainfall. Most rainfall is lost to evaporation and evapo-transpiration. The rainfall recharge mainly occurs around outcropping basement, on sandplains and sinkholes in the calcrete. Regional groundwater flows are generally towards the palaeodrainages away from catchment divides. The palaeodrainages discharge into salt lakes. In the salt lakes the groundwater is evaporated and concentrated to brine, which then descends and moves downstream eventually discharge into the Eucla Basin.

Groundwater salinities are extremely variable ranging from about 1,000 to 250,000 mg/L Total Dissolved Solids (TDS). Lower salinity groundwater, i.e. from 1,000 to 5,000 mg/L TDS occurs in areas most affected by direct rainfall recharge, e.g. near catchment divides and within shallow alluvium and calcrete units. The highest salinity groundwater occurs low down in the catchments within palaeochannel sands, salt lake sediments and in deeper fractured rock aquifers.

4. GEOCHEMICAL CHARACTERISATION METHODS

4.1 ACID FORMING WASTE CLASSIFICATION METHODOLOGY

There is no simple method to define whether mine waste containing small quantities of sulfur will produce sulfuric acid. Sulfide minerals are variable in their behaviour under oxidising conditions and not all forms will produce sulfuric acid (H_2SO_4). Instead, a combination of approaches is often applied to more accurately classify mine waste. These approaches are listed below in order of increasing data requirements (and therefore increased reliability):

- The "Analysis Concept", which only requires data for total sulfur content. Its adoption is based on long term experience of wastes from Western Australian mine sites in arid and semi-arid conditions. Experience has shown that waste rock and tailings containing very low sulfur contents (less than 0.2 to 0.3%) rarely produces significant amounts of acidic seepage.
- The "Ratio Concept", which compares the relative proportions of acid neutralising minerals (measured by the Acid Neutralising Capacity (ANC)) to acid generating minerals (measured by the Maximum Potential Acidity (MPA)). Experience has shown that the risk of generating acidic seepage is generally low when this ratio (the Neutralisation Potential Ration – NPR) is above a value of two.
- Acid-Base Accounting, in which the calculated value for Net Acid Producing Potential (NAPP) is used to classify the acid generating potential of mine waste. NAPP is equal to the MPA minus the ANC.
- Procedures recommended by AMIRA (2002), which take into consideration measured values provided by the Net Acid Generation (NAG) test and calculated NAPP values.
- Kinetic leaching column test data, which provides information for the relative rates of acid generation under controlled laboratory conditions, intended to simulate those within a waste rock stockpile or tailings storage facility over time.

A sound knowledge of geological and geochemical processes must also be employed in the application of the above methods. The methods are described in greater detail in Appendix 1. Non pyrite (FeS_2) sulfides and non-sulfide minerals that contribute to acid drainage are also discussed in Appendix 1.

Classification of wastes in this report uses procedures recommended by AMIRA (2002) based on NAPP and NAGpH results. However results are also compared to the Analysis Concept (total sulfur) and Ratio Concept models and a modification of the AMIRA procedure by determination of the following:

- Analysis for total sulfur (Tot_S).
- Analysis for ANC (quoted in kg H_2SO_4/t).
- Calculation of Maximum Potential Acidity (MPA) = [Tot_S * 30.6] kg H_2SO_4/t.
- Calculation of NAPP = [MPA – ANC] kg H_2SO_4/t.
- Analysis for NAG (quoted in kg H_2SO_4/t).
- Analysis for NAG pH.
- Calculation of NPR = ANC/MPA.

This AMIRA approach is more conservative than either the Analysis Concept or the Ratio Concept alone, but assumes the absence of insoluble sulfates such as barium sulfate which if present leads to overestimation of oxidisable sulfur. The AMIRA approach of using NAG testing is particularly useful for Potentially Acid Forming – Low Capacity materials or where there is very low ANC in the host rock. A combined acid generation classification scheme based on NAPP and NAG determinations is presented in Table 2 (see also Appendix 1).

Table 2: Waste Classification Criteria

Primary Geochemical Waste Type Class	NAPP Value kg H_2SO_4/t	NAGpH	Sulfide S Content
Potentially Acid Forming (PAF)	≥10	< 4.5	≥ 0.3%
Potentially Acid Forming – Low Capacity (PAF-LC)	0 to 10	< 4.5	0.16 to 0.3%
Uncertain (UC)	0 to 5	> 4.5	Not important
Uncertain (UC)	-10 to 0	< 4.5	Not important
Non Acid Forming (NAF)	-100 to 0	> 4.5	Not important
Acid Consuming (AC)	< -100	>4.5	Not important

Table 2 is based on the Australian Government's Guidelines on Managing Acidic and Metalliferous Drainage (DITR 2007) and is in turn based on an earlier classification system included within the AMIRA Acid Rock Drainage (ARD) Test Handbook (AMIRA 2002), which is advocated by the Global Acid Rock Drainage Guidelines (GARD) published by the International Network for Acid Prevention (INAP 2009). This classification system, based on static acid base accounting procedures and used in conjunction with geological, geochemical and mineralogical analysis can still leave materials classified as 'uncertain' where there is conflicting NAGpH and NAPP results. Uncertain materials demonstrating a NAG pH above 4.5 may be tentatively assigned as potentially NAF and those below pH 4.5 as potentially PAF, however in such cases, further assessment, such as the use of kinetic leaching columns may be required to provide a definitive classification.

4.2 LABORATORY METHODS

4.2.1 Acid Base Accounting

Sample analysis was performed by a NATA accredited laboratory (Intertek Genalysis). Preliminary analysis included selected acid base accounting (ABA) parameters.

Total sulfur was measured by combustion analysis. ANC was measured by a modified Sobek procedure (AMIRA 2002), which involves addition of dilute hydrochloric acid to the sample, followed by gentle simmering (two hours) to complete the reaction. The concentration of acid used for this procedure is first determined by testing the vigour of the reaction of the sample with hydrochloric acid, as assessed by the rate evolution of carbon dioxide gas and any colour change (a 'fizz rating'). ANC was then measured by titrating the amount of excess acid after addition and reaction using standardised sodium hydroxide solution.

When assessing data for the MPA and NAPP, it must be noted that both parameters are based on the assumption that all sulfur other than soluble sulfate-sulfur in the sample is acid producing (and sourced from pyrite (FeS_2) and other iron sulfide minerals). However, this represents a worst case scenario as not all minerals containing sulfur will result in acid production. Conversely, the NAPP calculation also assumes that the acid neutralising material measured in ANC is rapid-acting. In practice, some neutralising capacity is supplied by silicate and aluminosilicate minerals, which can be much slower to react (termed 'silicate ANC'). Furthermore, iron carbonate minerals such as siderite ($FeCO_3$) have limited or no capacity to neutralise acidity due to acid producing reactions resulting from oxidation of the dissolved ferrous iron component. Despite these assumptions, NAPP remains a suitable conservative prediction of potential acid generation when used in conjunction with mineralogical data.

The NAG test involves the addition of hydrogen peroxide, a strong oxidising agent, to a sample of mine waste to oxidise reactive sulfides. An aliquot of hydrogen peroxide is added to a sample, allowed to react overnight and heated. After cooling the sample solution pH was measured (NAGpH) and any acidity generated was measured by back titrating with sodium hydroxide solution to a pH of 4.5 (NAG to pH 4.5) and pH 7 (NAG to pH 7). NAG is expressed in units of kg H_2SO_4/t. A significant NAG result (i.e. final NAG pH less than 4.5) generally indicates that the sample is PAF (Table 2) and the test provides a direct measure of the NAG potential. A NAG pH of 4.5 or more generally indicates that the sample is NAF, but may still be capable of generating metalliferous drainage following oxidation of the sulfide minerals. Results for titrations of aliquots of the NAG solution to endpoint pH values of 4.5 and 7.0 allow estimation by the difference between these results of the relative amounts of non-acid producing base metal (such as copper) and iron sulfides in the sample. This is explained in more detail in Appendix 1.

4.2.2 Elemental Composition

Major and trace metals/metalloids were measured following digestion of a finely ground sample with a four acid mixture of nitric, hydrochloric, perchloric and hydrofluoric acids, which is a total determination for the elements measured.

Digest solutions were analysed using inductively coupled plasma - mass spectrometry (ICP-MS) or ICP- optical emission spectrometry (ICP-OES). Samples were analysed for a 28 element suite of metals and metalloids (Table A2-2, Appendix 2).

From this data, the global abundance index (GAI) for each element was calculated by comparison to the average earth crustal abundance (Bowen 1999 and AIMM 2001). The main purpose of the GAI is to provide an indication of any elemental enrichment that could be of environmental significance. The GAI (based on a log-2 scale) is expressed in integer increments from 0 to 6 (GARD Guide). A GAI of 0 indicates that the content of the element is less than or up to three times the average crustal abundance; a GAI of 1 corresponds to a three to six fold enrichment; a GAI of 2 corresponds to a 6 to 12 fold enrichment and so forth, up to a GAI of 6, which corresponds to a 96-fold, or greater, enrichment above average crustal abundances. A GAI of 3 or more is generally considered significant and may warrant further investigation.

4.2.3 Water Leachable Characterisation

Samples examined during this investigation were subject to a water leach similar to the Australian Standards Leaching Procedure (ASLP) 4439.3 Class 1 specification, except that the dilution used was 1:5 weight/weight, sample to water, instead of a 1:20 weight/weight, sample to water. Analytical finish of the filtered (0.45 µm) extract was via ICP-OES or ICP-MS finish, as necessary, for a range of elements based on the total concentrations determined from four acid digestion. This included sodium, potassium, calcium, magnesium, water soluble sulfur (sulfate) and 23 other environmentally significant metals and metalloids.

Water extracts of samples were simultaneously tested for Electrical Conductivity (EC), pH, alkalinity (bicarbonate, carbonate and hydroxide forms) and chloride.

Water extracts of fresh metallurgical trial samples were also analysed for total, free and weak-acid dissociable (WAD) forms of cyanide.

5. EARLIER STUDIES

An acid base accounting (ABA) assessment of nine ore samples from the (then) Westralia and Jupiter deposits was reported by Graeme Campbell and Associates in February 1996 (GCA 1996). The stated aim of this study was to provide geochemical information relevant to the management of process tailings at Mt Morgans. These samples were analysed for pH, EC and ABA parameters (Total S, sulfate-sulfur, ANC, NAPP, NAG and acid base characteristics curve). Elemental composition, mineralogy or leachability testing was not conducted.

A summary of findings for samples from this report is as follows:

- Six samples of different lithologies of underground ore from the Westralia deposit were examined.
- Acid formation through sulfide oxidation was considered not to be a problem for process tailings derived from magnetite, pyritic chert-chlorite and mixed BIF/magnetite/chert ore from the Westralia underground mine. Sulfur content ranged from 0.98 to 1.6% in these samples.
- Acid formation was predicted for process tailings derived from sulfidic massive magnetite, pyritic magnetite and pyritic magnetite/BIF ore from the Westralia underground mine. Sulfur content ranged from 5.6 to 18% for these three samples, which is significantly higher than composite samples assessed in this report (Section 7.1.1).
- Three samples of ore from the Jupiter deposit were classified as follows:
    - Basalt-syenite-contact and oxidised basalt ores were classified as NAF
    - Pyritic syenite ore was classified as either Barren or PAF (Low Risk)
- Continued blending of PAF Westralia ores with NAF ores would be required to prevent acidification of process tailings stored at Mt Morgans.

6. SAMPLE DESCRIPTIONS

Samples of materials expected to be similar to tailings resulting from processing of ore produced by the project were sourced from metallurgical trials managed by GR Engineering Services Limited (GRES). Materials provided for this assessment compromised:

- Four samples (BK7875 to BK7877 and BK8791) of archived cyanide leach residues from trials of ore sourced from the Heffernans deposit.
- Three fresh samples of cyanide leach residues from trials of ore sourced from the Beresford deposit (BK8295, BK8296 and BK8783).
- Three fresh samples of cyanide leach residues from trials of ore sourced from the Allanson deposit (BK8298, BK 8299 and BK8784).
- One sample of archived cyanide leach residue from trials sourced from the Doublejay deposit (BK8790).

Sample descriptions are presented in Table 3.

Table 3: Sample Descriptions

Sample ID	Deposit	Ore Lithology
BK7875	Heffernans	Fresh syenite.
BK7876	Heffernans	Fresh Cornwall Shear Zone syenite.
BK7877	Heffernans	Fresh Cornwall Shear Zone basalt.
BK8791	Heffernans	Composite of fresh rock zone syenite and basalt.
BK8295	Beresford	Composite residues from blended Beresford ores derived from mainly BIF and minor mafic and other igneous host rock lithologies.
BK8296	Beresford	
BK8783	Beresford	
BK8298	Allanson	Composite residues from blended Allanson ores derived from BIF, chert, mafic volcanics, metasediments and felsic porphyry intrusives.
BK8299	Allanson	
BK8784	Allanson	
BK8790	Doublejay	Composite of fresh rock zone syenite and basalt.

7. RESULTS AND DISCUSSION

7.1 ACID BASE ACCOUNTING

Laboratory results for total sulfur, ANC, and NAG tests of tailings samples are collated in Table A2-1 of Appendix 2. Calculated MPA and NAPP are also included. The original laboratory reports are presented in Appendix 3.

7.1.1 Sulfur Forms and Distribution

A summary of results for total sulfur is given in Table 4.

Table 4: Total Sulfur Summary by Ore Location

Ore Location	No. Samples	Minimum (%)	Maximum (%)	Mean (%)
Heffernans	4	0.72	1.09	0.93
Beresford	3	2.31	2.39	2.34
Allanson	3	4.64	4.86	4.78
Doublejay	1	0.74	0.74	0.74

Sulfur content was found to increase in the following order:

- Doublejay (mean total sulfur concentration 0.74%).
- Heffernans (mean total sulfur concentration 0.93%).
- Beresford (mean total sulfur concentration 2.34%).
- Allanson (mean total sulfur concentration 4.78%).

Acid drainage classification is improved by using non sulfate sulfur (Appendix 1), rather than total sulfur, to predict acid production potential from oxidation of iron sulfide minerals. However, relatively low values of soluble sulfate in water leachates (Section 7.3.2), is consistent with the expectation that most of the sulfur in ore from all project deposits is predicted to be in the sulfide form.

7.1.2 Acid Neutralisation Capacity

All samples had substantial ANC, with laboratory values ranging from 64 to 206 kg/t H_2SO_4. A summary of ANC analysis by ore location is presented in Table 5. Although the mean values by ore location were similar, ranging from 99 (Allanson) to 116 (Heffernans), there was considerable variation with ore lithology. Two samples of tailings from ore hosted by syenite from Heffernans (samples BK7875 and BK 7876 both syenite) recorded the lowest ANC values of 64 and 67 kg H_2SO_4/t, respectively. By comparison, tailings from ore hosted by basalt in the same CSZ deposit recorded a much higher ANC of 206 kg H_2SO_4/t.

Table 5: ANC Summary by Ore Location

Ore Location	No. Samples	Minimum	Maximum	Mean
Heffernans	4	64	206	116
Beresford	3	102	122	112
Allanson	3	91	109	99
Doublejay	1	107	107	107

Units for ANC are kg H_2SO_4/t

7.1.3 Acid Drainage Classification

Based upon calculated NAPP values, NAG values and NAG pH results and the resulting classifications (Table A2-1, Appendix 2), the following aspects were evident:

- All samples derived from Heffernans and Doublejay ore were classified as NAF with NAGpH values of more than 4.5 and negative NAPP values. Two samples of Heffernans tailings (basalt, BK7877 and composite, BK8791) were further classed as acid consuming as they had NAPP values below -100 kg H_2SO_4/t. The basalt lithology in Jupiter deposits possesses significant ANC as calcite.
- Composite samples derived from Beresford ore were classified as NAF with NAGpH values of more than 4.5 and negative NAPP values.
- All three composite samples derived from Allanson ore were classified as PAF with NAGpH values of less than 4.5 and positive NAPP values.

A plot of AMD classification for tailings samples by ore location is given in Chart 2. The four quadrants are labelled as NAF, PAF and two UC (uncertain). Note in Chart 2 two samples of Allanson plot as one data point (BK8299 and BK8784 as they differ by only 0.1 kg H_2SO_4/t in the NAPP).

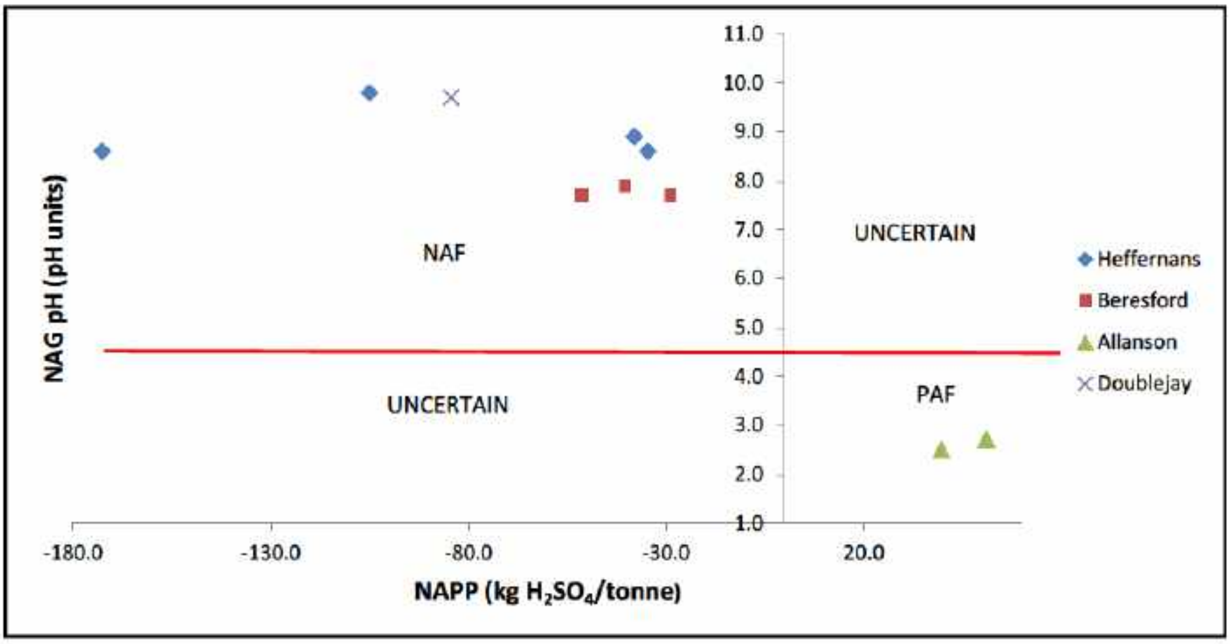


Chart 2: AMD Classification of Waste Rock NAPP vs NAGpH

A secondary consideration for AMD classification relates to NPR. As the effectiveness of acid consuming carbonate and silicate minerals varies considerably with mineral type, experience (DITR 2007, INAP 2009) indicates greater confidence in acid drainage predictions for mine wastes classified as NAF by ABA procedures if

NPR is greater than 2. NPR of all samples derived from Heffernans and Doublejay ore were greater than 2, with calculated values ranging from 2.1 (syenite ore) to 6.2 (basalt ore). Samples derived from Beresford ore were classified as NAF by the adopted classification procedure, but recorded NPR values of 1.4 to 1.7 (i.e. less than the 'ratio' criteria of 2). Beresford NAGpH values however were all consistently alkaline (7.7 to 7.9). Consistency of NAPP and NAG (pH7) values (Table A2-1 of Appendix 2) for Allanson samples also confirms the basic assumptions used in the adopted ABA, which are:

- Acid formation is based on oxidation of sulfur in iron sulfide minerals such as pyrite.
- Reactive calcium and magnesium carbonate minerals are responsible for measured ANC.

These observations suggest that the overall acid formation potential of tailings produced by processing blended ore from all three deposits is expected to be NAF as Allanson underground ore represented in the current samples comprises only 7.45% of the total (Table 1). Final processing and deposition of (in particular) Heffernans tailings above Allanson tailings will further reduce any potential for acid formation from Allanson ore tailings post closure.

7.2 ELEMENTAL COMPOSITION

Table A2-2 of Appendix 2 presents metal and metalloid compositions for the seven tailings samples. Table A2-3 of Appendix 2 presents calculated GAI values for selected elements where the GAI was 3 or more, as outlined in Section 4.2.2.

Mineral deposits by their nature are anticipated to have some elements present in concentrations above the average crustal abundance. The GAI does, however, provide a useful screening tool for identifying elements requiring further assessment by more specific test methods. Examination of the total element concentrations and the corresponding GAI values for these samples indicates the following:

- None of the common rock-forming elements (aluminium, iron, calcium, magnesium, sodium and potassium) were greater than or equal to 3, which is consistent with the lithologies of hosted ore. GAI values for iron of 2 (corresponding to concentrations of 19.4% to 19.9%) were recorded for tailings from Beresford ore, which is consistent with the dominance of BIF as the host rock for gold mineralisation.
- Although several gold deposits in the Northern Goldfields region contain elevated arsenic, there was no evidence of significant arsenic enrichment in ore from these deposits. The highest arsenic concentration was 71 mg/kg in sample BK8299 for tailings from Allanson ore.
- Head assay (0.09 to 0.44 mg/kg mercury, METS 2014) and analysis of fresh composite samples from Heffernans (0.016 mg/kg, BK8791), Beresford (0.035 mg/kg, BK8783), Allanson (0.025 mg/kg, BK8784) and Doublejay (0.024 mg/kg, BK8790) indicated low concentrations and no evidence for geochemical enrichment in mercury.
- Significant (GAI values of 3 or more) were recorded for the following elements:
  - Molybdenum (36 to 114 mg/kg) in all samples (GAI 4 to 6) versus an average crustal abundance of 1.5 mg/kg.
  - Selenium in all samples from underground ore (Beresford and Allanson; 1.7 to 4 mg/kg, GAI 3 or 4) versus an average crustal abundance of 0.2 mg/kg.
  - Tellurium in all samples (0.6 to 5.3 mg/kg, GAI 6) versus an average crustal abundance of 0.001 mg/kg.
  - Bismuth in the Doublejay composite sample (2.5 mg/kg, GAI 3) versus an average crustal abundance of 0.17 mg/kg.

As molybdenum, selenium and tellurium form stable oxyanions that may be soluble in alkaline conditions, water leachate characterisation was undertaken to assess their solubility.

7.3 WATER LEACHATE CHARACTERISATION

The use of a tumbled water extract of a finely ground sample allows the laboratory water extraction test to mimic weathering conditions that may be expected in a temperate, semi-arid environment over a period of several years. Use of a 1:5 ratio extraction in the present work was a compromise between the higher solids to liquids ratio which may be experienced in saturated tailings storage conditions (typically 1:0.5-1), and the common 1:20 ratio DI water ASLP often used to simulate short term leaching by rainwater. A 1:5 soil:water ratio extraction is the normal ratio used for soil chemistry methodology. It is not suitable for predicting long term release rates, especially in the case of fresh tailings samples containing significant amounts of sulfide minerals, which are likely to undergo a very long and gradual period of reaction and release of solutes.

Observed concentrations of minerals and metalloids in the extract may not represent maximum potential concentrations. This test method can be limited by the rates of dissolution, desorption and solubility (especially for sparingly soluble minerals such as gypsum ($CaSO_4.2H_2O$), barite ($BaSO_4$) and fluorite (CaF_2)). Hence an understanding of mineral phases present is important.

7.3.1 pH and Soluble Alkalinity

Results for pH and alkalinity in the 1:5 extracts are given in Table A2-4 of Appendix 2. All samples recorded moderately alkaline pH values, ranging from 9.2 to 9.7. Alkalinity was distributed primarily between carbonate and hydroxide forms. The contribution of hydroxide alkalinity may indicate use of alkali (hydrated lime) in metallurgical tests to optimise the efficiency of gold extraction by cyanide.

Exposure of freshly deposited tailings in a TSF is predicted to result in neutralisation of hydroxide alkalinity with atmospheric carbon dioxide (CO_2), thereby converting hydroxide alkalinity to carbonate alkalinity. Prolonged exposure is predicted to result in further reaction with atmospheric or rainfall dissolved CO_2, resulting in conversion of carbonate alkalinity to bicarbonate alkalinity. Provided blended tailings remain NAF, leachate from weathered tailings is predicted to remain alkaline.

7.3.2 Soluble Salts and Salinity

Results of analysis for major ions on a 1:5 extract are presented in Table A2-5 of Appendix 2 (EC results are presented in Table A2-4).

EC values ranged from 132 to 230 µS/cm, indicating low salinity. Measured EC values and major ion chemistries suggest that low salinity water was used in the metallurgical trials and do not reflect the salinity and ionic composition of process water to be used by the project. This water is expected to be sourced from a calcrete aquifer to the north of Jupiter and be fresh to brackish and calcium dominant.

Sulfate concentrations were low, ranging from 17 to 40 mg/L. As discussed in Section 7.1.1, most of the total sulfur in the tailings in expected to be presented in the non-sulfate (sulfide) form.

Salinity of leachate from process tailings will primarily depend on the salinity of process water used but will also increase over time with exposed storage in a TSF. The additional salinity is predicted to be from dissolution of calcium and magnesium salts produced by oxidation of sulfide minerals in the presence of calcium and magnesium carbonates.

7.3.3 Soluble Metals and Metalloids

Results for water soluble metals and metalloids in the 1:5 extracts are given in Table A2-6 of Appendix 2. ANZECC livestock drinking water guidelines (cattle), ANZECC/DER freshwater guidelines, and Human Drinking Water Guidelines (NHMRC 2016) are provided for comparison. When comparing results, it needs to be kept in mind that as the analysis was performed on a 1:5 extract (which is an estimation of pore water quality), the higher solids to water ratio and higher metals concentrations may tend to overestimate the potential impact on groundwater versus a commonly used comparison ratio of 1:20 extraction (deionised water ASLP).

Key observations of soluble metals and metalloids data were:

- No metals or metalloids exceeded ANZECC livestock drinking water guidelines in samples tested.
- Despite all samples recording GAI values of 4 or more for molybdenum (Section 7.2), reported molybdenum concentrations in water leachates were below the livestock and human drinking water guideline values of 0.15 and 0.05 mg/L, respectively. Molybdenum is considered unlikely to pose a risk to the project environment.
- Despite all samples from underground (Beresford and Allanson) ore recording GAI values of 3 or more for selenium (Section 7.2), all selenium concentrations in water leachates were below the livestock and human drinking water guideline values of 0.02 and 0.01 mg/L, respectively. Selenium is considered unlikely to pose a risk to the project environment.
- Tellurium recorded GAI values of 6 for all samples, indicating substantial enrichment by comparison with average crustal concentrations (0.001 mg/kg). Water leachates of nine samples, comprising those with high mafic rock contributions to ore (e.g. basalt from Heffernans and all samples from Beresford and Allanson underground ore) contained tellurium concentrations below the laboratory limit of reporting (0.0001 mg/L in a 1:5 extract). Concentrations in water leachates for syenite samples BK7875 and BK7876 were 0.0005 mg/L and 0.0006 mg/L. Although there is very little published ecotoxicological data for tellurium, predicted concentrations in leachates of tailings from blended ore are unlikely to present a risk to the project environment.
- Bismuth although slightly enriched in Doublejay tailings (BK8790) was only soluble at ultratrace levels of less than 0.05 parts per billion (µg/L) and is not considered a risk to the project environment.

In summary, concentrations of soluble metals and metalloids were generally very low and if compared on a 1:5 or 1:20 extractable ratio, all results fall well below human and livestock health based drinking water guidelines. These results suggest that water soluble concentrations of metals and metalloids from tailings material under neutral mine drainage conditions are unlikely to pose any significant risk to the surrounding environment or water usage.

7.4 CYANIDE

Results for analysis of water leachate of tailings from underground deposits (Beresford and Allanson) for cyanide forms are presented in Table A2-7 of Appendix 2. Samples of tailings from Heffermans' ore deposits were not analysed as the samples had not been stored appropriately for cyanide analyses following metallurgical trials completed in 2015.

Concentrations of total cyanide were very low, with only two samples recording values above the laboratory method reporting limit of 1 mg/L. The highest concentration was 2 mg/L in sample BK8295 from Westralia ore. Concentrations of free and WAD forms were below the laboratory method reporting limit of 1 mg/L for all samples.

As the samples provided for this assessment were residues from small scale laboratory metallurgical trials, it is expected that procedures used in the trial to wash residues will be much more effective than process fluid recovery in an operational processing plant and TSF. However, these results do indicate that tailings are unlikely to contain significant amounts of sparingly soluble, stable metal cyanide complexes which may otherwise result in long term leaching of cyanide and metals long after drain-down of tailings stored in the TSF after mine closure.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 SUMMARY OF FINDINGS

Geochemical assessment of seven metallurgical trial residue samples, simulating tailings from processing ore from three MMGP ore deposits, indicated that:

- Total sulfur concentrations were variable and related to the ore location.
- ANC values were also variable, but were related more to ore lithology rather than deposit location. ANC values ranged from 64 (Heffernans syenite) to 206 kg H_2SO_4/t (Heffernans basalt), with an arithmetic mean of 111 kg H_2SO_4/t.
- Tailings samples assessed representing Heffernans (both syenite and basalt lithologies), Doublejay (composite syenite and basalt) and Beresford ore deposits were classified as NAF. Two Heffernans samples (basalt and a basalt/syenite composite) were further classified as acid consuming.
- All three samples prepared from processing composite Allanson underground ore samples, which were the most sulfidic, were classified as PAF. These samples may be further classified as PAF-Long Lag as a consequence of substantial ANC (mean value 99 kg H_2SO_4/t) effectively neutralising acid produced by oxidation of sulfides until most of the effective ANC has been consumed. Allanson underground ore comprises only 7.45% of the total ore volume of the project, which is otherwise NAF with significant ANC. Final processing and deposition of (in particular) Heffernans/Doublejay tailings with high ANC content above Allanson tailings will assist in minimising any potential for acid formation from exposure of Allanson ore tailings at the near-surface post closure.
- Leachate from freshly deposited tailings is predicted to be alkaline, regardless of proportions of NAF and PAF ore from various deposits.
- Salinity concentrations of leachate from freshly deposited tailings will depend on the salinity of raw water used in processing. Salinity concentrations in leachates from weathered tailings are predicted to increase with time due to formation of sparingly soluble calcium sulfate salts and soluble magnesium sulfate by oxidation of sulfide minerals in the presence of reactive calcium and magnesium carbonates.
- Despite substantial geochemical enrichment by molybdenum, selenium, tellurium and bismuth (one sample), leachate from fresh tailings were found to contain low to very low concentrations of these elements and all other environmentally significant metals and metalloids under neutral mine drainage conditions.
- Levels of cyanide in tailings samples assessed were low (due to rinsing and storage of samples). Cyanide levels during active mine life are expected to be primarily driven by decant water concentrations from processing. Post closure cyanide breakdown will occur both within the TSF and underlying regolith by processes including photodegradation of surficial tailings, volatilisation as HCN, biological degradation and conversion to less toxic thiocyanate by reaction with sulfide minerals.

8.2 TSF MONITORING REQUIREMENTS

It is recommended that groundwater samples from monitoring bores around the proposed TSF are sampled frequently and analysed for the following parameters to validate predictions from this assessment:

- pH and salinity (EC, TDS and major ions including calcium, magnesium, sodium, potassium, chloride and sulfate).
- Metals and metalloids including arsenic, copper, manganese, mercury, molybdenum, nickel, selenium and tellurium.
- Total cyanide.

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10. GLOSSARY OF TECHNICAL TERMS

Term	Explanation
AC	Acid consuming material. Defined as NAF material which has a NAPP value in excess of – 100 kg H_2SO_4/t
ANC	Acid Neutralising Capacity. A process where a sample is reacted with excess 0.5 m HCl at a pH of about 1.5, for 2-3 hours at 80-90°C followed by back-titration to pH=7 with sodium hydroxide. This determines the acid consumed by soluble materials in the sample.
AP	Acid Potential. Similar to MPA, but only is based on the amount of sulfide-sulfur (calculated at the difference between total sulfur and sulfate-sulfur (SO_4-S)) rather than total sulfur. AP (kg H_2SO_4/t) = (Total S – SO_4-S) x 30.6.
basalt	A dark coloured fine grained mafic extrusive igneous rock composed chiefly of calcium plagioclase and pyroxene. Extrusive equivalent of gabbro underlies the ocean basins and comprises oceanic crust.
BIF	Banded Iron Formation. Layered rock formed from banded deposits of iron rich sediment laid down at the bottom of primordial oceans.
dolerite	A mafic, holocrystalline, subvolcanic rock equivalent to volcanic basalt (but larger grained) or plutonic gabbro
dolomite	Calcium magnesium carbonate $CaMg(CO_3)_2$.
calcite	Calcium carbonate $CaCO_3$.
CIL	Carbon in Leach – the process of extracting gold from crushed rock by extraction with sodium cyanide solution and adsorption onto activated charcoal.
circum-neutral pH	pH value near 7.
EC	Electrical conductivity. A measurement of solution salinity. Conversion: 1,000 µS/cm = 1 dS/m = 1 mS/cm
felsic	Silicate minerals, magma, and rocks which are enriched in the lighter elements such as silicon, oxygen, aluminium, sodium, and potassium.
mafic	Descriptive of igneous rock containing a high content of ferromagnesian silicate minerals, but less than those present in ultramafic rocks. Common mafic rocks include basalt, dolerite and gabbro.
MPA	Maximum Potential Acidity. A calculation where the total sulfur in the sample is assumed to all be present as pyrite. This value is multiplied by 30.6 to produce a value known as the Maximum Potential Acidity reported in units of kg H_2SO_4/t.
NAF	Non Acid Forming.
NAG	Net Acid Generation. A process where a sample is reacted with 15% hydrogen peroxide solution at pH = 4.5 to oxidise all sulfides and then time allowed for the solution to react with acid soluble materials. This is a direct measure of the acid generating capacity of the sample but can be affected by the presence of organic materials.
NAG pH	The pH after the NAG test with hydrogen peroxide and heating is completed i.e. oxidation of all sulfides.
NAPP	Net Acid Producing Potential. NAPP (kg H_2SO_4/t) = MPA – ANC.
PAF	Potentially Acid Forming.
PAF-LC	Potentially Acid Forming – Low Capacity. Waste rock classification for samples with NAPP values less than or equal to 10 kg H_2SO_4/t.
PAF-HC	Potentially Acid Forming – High Capacity. Waste rock classification for samples with NAPP values greater than 10 kg H_2SO_4/t.
PAF-Long Lag	Potentially Acid Forming – Long Long. Waste rock classification for samples with positive NAPP values and substantial ANC (values greater than 10 kg H_2SO_4/t). Generation of acid drainage may be delayed (several years to decade) until most of the effective ANC has been consumed by

Term	Explanation
	reaction with acid released by oxidation of sulfide minerals.
pyrite	Iron (II) sulfide, FeS_2. Pyrite is the most common sulfide minerals and the major acid forming mineral oxidising to produce sulfuric acid.
syenite	A coarse-grained intrusive igneous rock with a general composition similar to that of granite, but deficient in quartz, which, if present at all, occurs in relatively small concentrations (<5%). Alkali metal (potassium and sodium) concentrations are elevated, as a result of abundant feldspar (typically orthoclase) minerals.
TSF	Tails Storage Facility.

APPENDICES

APPENDIX 1: ACID FORMING WASTE CLASSIFICATION METHODOLOGY

ACID FORMING WASTE CLASSIFICATION METHODOLOGY

1. OXIDATION OF SULFIDES

There is no simple method of defining whether mine waste containing small quantities of sulfur will produce sulfuric acid. Sulfide minerals containing ferrous iron such as pyrite (FeS_2), marcasite (FeS_2) and pyrrhotite ($Fe_{(1-x)}S$) normally oxidise to produce sulfuric acid and ferric oxy-hydroxide minerals (represented by the generic formula $Fe(OH)_3$) according to Equation 2.

Equation 1

$$4FeS_2 + 15O_2 + 14H_2O \rightarrow 4Fe(OH)_3 + 16H^+ + 8SO_4^{2-}$$

Whilst sulfur in pyrite will always form sulfuric acid, a portion of the sulfur in marcasite and pyrrhotite forms highly soluble sulfite, thiosulfate, more complex polythionate ions and elemental sulfur, some or all of which may never form acid (discussed in more details in Section 4). Similarly, sulfur in chalcopyrite and arsenopyrite rarely forms sulfuric acid due to simultaneous oxidation of copper and/or arsenic resulting in formation of non-acid forming copper sulfides and soluble sulfates (Section 4). Sulfur in galena (PbS), sphalerite (ZnS), stibnite (Sb_2S_3) and other iron-free sulfides is non-acid producing. Sulfur present as sulfate in minerals such as barite ($BaSO_4$), anhydrite ($CaSO_4$), gypsum ($CaSO_4.2H_2O$), epsomite ($MgSO_4.7H_2O$) and alkali sulfates is also non-acid producing.

There is a group of iron and aluminium sulfate minerals that fall into a special category. An example is the mineral jarosite ($KFe_3(OH)_6(SO_4)_2$), an oxidation product of pyrite formed under certain environmental conditions. Substitution of aluminium for iron results in the common aluminium sulfate mineral, alunite ($KAl_3(OH)_6(SO_4)_2$). Although sulfur in jarosite (and alunite) is fully oxidised and therefore cannot produce further acidity under oxidising conditions, it can release acidity by hydrolysis as indicated by the chemical Equation 2:

Equation 2

$$KFe_3(OH)_6(SO_4)_2 + 3H_2O \rightarrow 3Fe(OH)_3 + K^+ + 3H^+ + 2SO_4^{2-}$$

This form of acidity is commonly referred to as “stored acidity” or “residual acidity”. This aspect of acidity in discussed further in Section 5 of this Appendix. Potential for acid production relies on determination of total sulfur content (Tot_S), and non-sulfide sulfur content (commonly described as sulfate sulfur (SO_4_S)). Where necessary, determination of sulfur in the acid insoluble minerals barite (barium sulfate) and celestite (strontium sulfate) commonly described as barite sulfur, may be undertaken.

2. ACID NEUTRALISATION

Acid Neutralising Capacity (ANC) is a measure of the natural ability of the sample to neutralise acid. It is normally determined in the laboratory by measuring the amount of residual acidity following reaction of a finely ground sample of mine waste with an excess of dilute hydrochloric acid. This method captures all minerals, including carbonates, oxides, hydroxides, phosphates and some silicate minerals that are capable of neutralising hydrochloric acid.

The ANC results are based on the assumption that all acid-neutralising materials are rapid-acting. In practice, some neutralising capacity is supplied by silicate and alumino-silicate minerals which can have slow to very slow reaction kinetics. The most common and reactive group of acid-consuming minerals are calcite ($CaCO_3$) and dolomite ($CaMg(CO_3)_2$). Measurement of total carbon content (or total inorganic carbon) provides a rapid and usually accurate method of estimating the contribution of these carbonate minerals to the ANC.

3. WASTE CLASSIFICATION

Calculations are undertaken of Maximum Potential Acidity (MPA) and Net Acid Producing Potential (NAPP). MPA is based on the incorrect assumption that all sulfur present in the sample is acid producing (sourced from pyrite FeS_2). Measurement of sulfate sulfur which does not contribute to acidity will allow for correction of the MPA this to give Acid Production Potential (AP). As discussed in Section 2 of this appendix, NAPP calculations may also over value the ANC. Generally, NAPP tends to over-estimate potential acidity. However, with care and a good knowledge of the minerals present, it is suitable for conservative prediction of potential acid generation.

Due to the lack of reliability of uncorrected MPA calculations, geological and geochemical experience is required to classify the wastes. Two concepts have been developed to alleviate the degree of difficulty associated with evaluating MPA results:

1. ***The analysis concept*** refers to situations where Tot_S is less than 0.3% sulfur; Acid Rock Drainage (ARD) is unlikely to occur. This sulfur value corresponds to a maximum of 9.2 kg H_2SO_4/t. With weathered rocks in arid areas where there may be a substantial percentage of SO_4_S and the presence of some carbonate minerals, the analysis concept is often correct. It is, however, commonly inaccurate in humid climates where some sulfur may be present in organic forms and unsuitable for acid sulfate soils investigations.

2. ***The ratio concept*** compares the direct calculation of MPA from Tot_S and the ANC analytical measurement, then classifies samples as either Non Acid Forming (NAF), where the ratio of ANC/MPA is greater than or equal to two, or Potentially Acid Forming (PAF) where the same ratio is less than or equal to two.

The methodology of the ratio concept is unsatisfactory as it does not allow for SO_4_S, or sulfur associated with barium sulfate or organic materials. It therefore tends to overestimate the MPA, resulting in a lower ratio value. For oxide to fresh rock, transitional, supergene enriched sulfide samples, many iron ores, most manganese ores and most zinc-copper stratiform sulfide horizons in felsic volcanics, this methodology fails. Ratio concept classification can be incorrect due to SO_4_S and barium sulfate content, particularly in manganese ores and most zinc-copper stratiform sulfide horizons where barite is often a substantial rock forming mineral. The ratio concept often gives incorrect results when used with acid sulfate soils and in conditions of very high salinity. It will also give incorrect results if applied to waste dumps that have not been rehabilitated and where the dominant residual sulfides in the wastes are base metal sulfides. This includes the iron-bearing sulfides chalcopyrite, bornite and arsenopyrite which all have high sulfur content but generate little or no acid.

In arid areas where rainfall comes in short heavy showers, followed by long periods of low humidity, climatic conditions minimise sulfide alteration. Oxidation products are flushed with each rainfall period resulting in dispersal over large areas with little or no acidic build-up. This is the basis behind the Analysis Concept, which gives sound results in areas with seasonal rainfall and an arid climate.

The “analysis concept” methodology is suitable to characterise mine waste during the early stages of feasibility drilling to ensure potentially acid forming materials are not missed utilising inexpensive mixed acid analytical methods with ICP-OES finish for base metals and sulfur determination. It is preferable to reduce the total sulfur cut off to 0.2%. This mixed acid methodology does not include barium sulfate sulfur in the final result. The sulfur values obtained approximate sulfide sulfur plus sulfate sulfur required for calculation of NAPP.

Basic classification of wastes undertaken in this report utilises the following methodology:

- Analysis for total sulfur (Tot_S).
- Analysis for non-sulfide sulfur (SO_4_S), quoted as sulfur, not sulfate.
- Analysis for ANC (quoted in kg H_2SO_4/t).

- Calculation of AP (SO_4_S corrected MPA) = [(Tot_S - SO_4_S) multiplied by 30.6 kg] H_2SO_4/t.
- Calculation of NAPP = [((Tot_S - SO_4_S) multiplied by 30.6) - ANC] kg H_2SO_4/t.

The waste classifications are based directly on the difference between total and non-sulfide sulfur (Tot_S - SO_4_S) and the NAPP value. The classifications are substantially more conservative than the Analysis Concept and the Ratio Concept but assume the absence of barium sulfate sulfur. The PAF-LC and "Uncertain" Classes will record as NAF using either of the Analysis or the Ratio concepts. These classes are defined in Table A1-1.

Table A1-1: NAPP Classification of Acid Rock Drainage

Primary Geochemical Waste Type Class	Sulfide - Sulfur Content *	NAPP Value kg H_2SO_4/t *
Potentially Acid Forming (PAF)	≥ 0.33%	≥ 10
Potentially Acid Forming - Low Capacity (PAF-LC)	≥ 0.16 ≤ 0.33%	5 to 10
Uncertain, probably NAF	≥ 0.00 ≤ 0.16%	0 to 5
Non Acid Forming (NAF)	Not important	- 100 to 0
Acid Consuming Materials	Not important	< -100

* *The NAPP value, not the sulfur value, is used to define the Class.*

"Uncertain samples" can be reclassified by undertaking a NAG determination (oxidation of a subsample in the laboratory with hydrogen peroxide to oxidise all the sulfide minerals to sulfuric acid where possible followed by an acidity and pH determination). NAG testing is particularly useful for PAF-LC materials or where there is a very low ANC in the host rock. A combined acid generation classification scheme based on NAPP and NAG determinations is presented in Table A1-2.

Table A1-2: Combined NAPP and NAG Classification of Acid Rock Drainage

Primary Geochemical Waste Type Class	NAPP Value kg H_2SO_4/t	NAG pH	Sulfide S Content
Potentially Acid Forming (PAF)	≥ 10	< 4.5	≥ 0.3%
Potentially Acid Forming – Low Capacity (PAF-LC)	0 to 10	< 4.5	0.16 to 0.3%
Uncertain possibly NAF	0 to 5	> 4.5	Not important
Uncertain possibly PAF	-10 to 0	< 4.5	Not important
Non Acid Forming (NAF)	-100 to 0	> 4.5	Not important
Acid Consuming Materials (AC)	< -100	> 4.5	Not important

4. ACID GENERATION FROM OTHER SULFIDE MINERALS

The principle of Acid Base Accounting procedures described above is based on the acid generating properties of the iron sulfide mineral pyrite (FeS_2). Pyrite reacts with oxygen and water to produce acidity (H^+) according to Equation 3:

Equation 3

$$4FeS_2 + 15O_2 + 14H_2O \rightarrow 4Fe(OH)_3 + 16H^+ + 8SO_4^{2-}$$

The stoichiometry of this reaction indicates that oxidation of one mole of pyrite will produce two moles of sulfuric acid or alternatively, 30.6 kg of sulfuric acid will be produced by oxidation of one tonne of mine waste containing 1% by weight of sulfur.

Other iron sulfides, such as pyrrhotite ($Fe_{(1-x)}S$), marcasite (FeS_2) and mackinawite ($Fe_{(1+x)}S$) react by different mechanisms, but all result in production of a maximum of one mole of sulfuric acid per mole of sulfur (30.6 kg of sulfuric acidic will be produced by oxidation of one tonne of mine waste containing 1% by weight of sulfur).

Copper sulfide minerals also react with oxygen, but the amount of acid produced depends on the composition of the mineral, and in particular the iron content. Chemical equations for the oxidation of copper sulfide minerals such as chalcocite (Cu_2S), covellite (CuS), chalcopyrite ($CuFeS_2$) and bornite (Cu_5FeS_4) are presented in Equation 4 to Equation 7 (inclusive):

Equation 4

$$2Cu_2S + 2H_2O + 5O_2 \rightarrow 2Cu(OH)_2 + 2Cu^{2+} + 2SO_4^{2-}$$

Equation 5

$$CuS + 2O_2 \rightarrow Cu^{2+} + SO_4^{2-}$$

Equation 6

$$4CuFeS_2 + 17O_2 + 10H_2O \rightarrow 4Cu^{2+} + 4Fe(OH)_3 + 8SO_4^{2-} + 8H^+$$

Equation 7

$$4Cu_5FeS_4 + 18H_2O + 37O_2 \rightarrow 12Cu^{2+} + 8(Cu(OH)_2 + 4Fe(OH)_3 + 16SO_4^{2-} + 8H^+$$

Other base metal sulfides containing metals including cobalt, nickel, lead and zinc indicate similar behaviour to those of copper sulfides. Chemical equations for the oxidation of common nickel sulfide minerals such as millerite (NiS), pentlandite ($Fe_xNi_{(9-x)}S_8$), and violarite ($FeNi_2S_4$) are presented in Equation 8 to Equation 10 (inclusive):

Equation 8

$$NiS + 2O_2 \rightarrow Ni^{2+} + SO_4^{2-}$$

Equation 9

$$Fe_xNi_{(9-x)}S_8 + {}^{(5x-2)}/_2H_2O + {}^{(36-7x)}/_2O_2 \rightarrow (9-x)Ni^{2+} + xFe(OH)_3 + 8SO_4^{2-} + (2x-2)H^+$$

Equation 10

$$4FeNi_2S_4 + 14H_2O + 31O_2 \rightarrow 8Ni^{2+} + 4Fe(OH)_3 + 16SO_4^{2-} + 16H^+$$

The predicted maximum amounts of sulfuric acid that can be produced by complete oxidation of various iron, copper and nickel sulfide minerals are listed in Table A1-3. These values indicate that acid generation is only possible if the sulfide mineral contains iron. Chalcopyrite, a common iron-copper sulfide mineral, has potential to generate acidity upon complete oxidation, but the maximum amount of potential acidity per percentage unit of sulfur in the mine waste is only half that of pyrite (or marcasite or pyrrhotite).

Table A1-3: Predicted Sulfur Acid Generation Potential from Oxidation of Iron, Copper and Nickel Sulfide Minerals

Mineral Name	Formula	Acid Generation Potential (kg H_2SO_4/t)	
		Per tonne of Mineral	Per 1% Sulfur
Pyrite	FeS_2	1,633	30.6
Marcasite	FeS_2	1,633	30.6
Pyrrhotite	$Fe_{(1-x)}S$	1,115	30.6
Chalcocite	Cu_2S	Nil	Nil
Covellite	CuS	Nil	Nil
Chalcopyrite	$CuFeS_2$	267	15.3
Bornite	Cu_5FeS_4	49	7.6
Millerite	NiS	Nil	Nil
Pentlandite	$Fe_xNi_{(9-x)}S_8$	Variable, depending on the value of x.	
Violarite	$FeNi_2S_4$	650	15.3

It should also be noted that oxidation of copper and nickel sulfide minerals can form soluble copper (Cu^{2+}) and nickel (Ni^{2+}) ions. Both metals form slightly soluble hydroxides (($Cu(OH)_2$) and $Ni(OH)_2$)), which significantly reduces the concentration of free metal ions in solution if the pH remains above 6.5. However, oxidation of copper and nickel sulfide minerals containing iron (e.g. chalcopyrite and violarite) can result in very low pH values, typically below 4.5 if there are insufficient carbonate minerals present to consume the generated acidity. For this reason, it is recommended that NAG measurements for mine waste containing copper and/or nickel sulfides be conducted to endpoint pH values of 4.5 and 7.0:

- NAG acidity to pH 4.5 includes hydrogen (H^+), ferric (Fe^{3+}), manganese (Mn^{2+}) and aluminium (Al^{3+}) ion acidity, but not copper ions (Cu^{2+}) or nickel (Ni^{2+}) ions.
- NAG acidity to pH 7.0 also includes the amount of alkalinity required to precipitate all of the soluble copper ions as $Cu(OH)_2$ and nickel ions as $Ni(OH)_2$. The difference between NAG acidity to pH 4.5 and NAG acidity to pH 7.0 is a measure of the amount of oxidisable copper and nickel sulfides in the sample.

The potential for mixed element iron sulfides to generate variable amounts of acidity is further complicated by the presence of arsenic. Arsenopyrite (FeAsS) is a common sulfide mineral often associated with gold mineralisation in the Western Australian goldfields.

Oxidation of arsenopyrite may be described by Equation 11 and Equation 12:

Equation 11

$$4FeAsS + 21O_2 + 16H_2O \rightarrow 4Fe(OH)_3 + 4SO_4^{2-} + 4AsO_4^{3-} + 20H^+$$

Equation 12

$$2FeAsS + 7O_2 + 2H_2O \rightarrow 2\text{"}FeAsO_4\text{"} + 2SO_4^{2-} + 4H^+$$

"$FeAsO_4$" may vary from crystalline ferric arsenate minerals such as scorodite ($FeAsO_4.2H_2O$) to arsenate anions adsorbed onto hydrous iron oxide surfaces. Regardless of the actual form of "FeAsO4", oxidation of arsenopyrite results in formation of 30.6 kg of sulfuric acid from one tonne of mine waste containing 1% by weight of sulfur, as for pyrite, marcasite and pyrrhotite (Table A1-3). If, however, the iron end product is $Fe(OH)_3$, then the resulting amount of acid (in the form of both sulfuric acid, H_2SO_4, and arsenic acid, H_3AsO_4) will be 2.5 times higher. Alternatively, oxidation of arsenopyrite by this reaction results in formation of 76.5 kg of sulfuric acid equivalents from one tonne of mine waste containing 1% by weight of sulfur.

In conclusion, using a factor of 30.6 to calculate the amount of acidity as kg H_2SO_4/t is only valid if all of the sulfur is present as iron sulfide minerals. If mixed copper, nickel and other base metals are present, use of the 30.6 conversion factor will over-estimate the amount of acidity produced. If arsenopyrite is present, use of the 30.6 conversion factor may under-estimate the amount of acidity produced.

5. RESIDUAL ACIDITY

It is important to note that material classified as NAF by acid-base accounting methodology described above may not have circum-neutral or alkaline pH values. For reasons outlined in this Section, it is possible for NAF waste to be moderately to highly acidic as a result of existing “residual” or “natural” acidity. Conversely, it is common for PAF waste to be slightly to moderately alkaline.

Laterite waste rock is an example of material that usually classifies as NAF by acid-base accounting procedures described above, but often records moderate to highly acidic pH values. A NAF classification results from very low total sulfur contents, most of which is present in oxidised form, combined with moderate ANC values. However, most of this ANC is associated with silicate minerals that require highly acidic conditions (pH 1.5 to 4.5) to consume acidity in the ANC test procedure.

As discussed in Section 1 of this Appendix, most of the “residual” or “natural” acidity of these materials may be explained by the presence of iron and aluminium sulfate minerals including jarosite and alunite. Additional acidity may be associated with cation exchange properties of highly weathered clay minerals. In circum-neutral or alkaline wastes, basic cations (calcium, magnesium, sodium and potassium) account for most or all of the Cation Exchange Capacity (CEC). In acidic materials, the sum of concentrations of basic cations (expressed in units of centimoles of positive charge per kilogram) is less than CEC expressed with the same units. In these situations, charge neutrality is maintained by the presence of “acidic” cations including H^+, Al^{3+} and Mn^{2+}. The sum of the concentrations of these cations (expressed in units of centimoles of positive charge per kilogram) is referred to as “exchangeable acidity”. The contribution of “exchangeable acidity” in acidic, clay-rich lateritic waste rock may be as high as 5 kg H_2SO_4/t (depending on clay mineralogy). It is important to note that leachate from materials containing only “exchangeable acidity” usually contain low levels of soluble acidity, which presents a low risk to the receiving environment. However, elevated levels of “exchangeable acidity” are toxic to plants, meaning that such materials are unsuitable as a growth medium or as a subsoil water storage layer for plants.

pH values of freshly mined waste rock, regardless of a NAF or PAF classification, is determined by the presence of various acid-consuming minerals. A summary of typical pH conditions associated with different waste types is presented in Table A1-4.

Table A1-4: pH Values of Various Waste Rock Types as Controlled by Significant Minerals

Typical pH Values	Significant Minerals	Typical Waste Rock Types
Greater than 9.0	Sodium and potassium carbonate, reactive silicates such as forsterite (Mg_2SiO_4), wollastonite ($CaSiO_3$) and cordierite $(Mg,Fe)_2Al3(Si_5AlO_{18})$.	Mafic and ultramafic volcanics.
8.0 to 9.0	Calcium and magnesium carbonates such as calcite ($CaCO_3$), magnesite ($MgCO_3$), dolomite ($CaMg(CO_3)_2$) and ankerite ($Ca(Fe,Mg,Mn)(CO_3)_2$).	Mafic and ultramafic volcanics, calcareous sedimentary rocks.
5.0 to 9.0	Many common silicate and aluminosilicate minerals such as feldspars, micas and pyroxenes.	Many igneous, non-calcareous sedimentary and metamorphic rock types.
4.0 to 5.0	Highly weathered clay minerals including kaolinite ($Al_2Si_2O_5(OH)_4$), goethite ($FeOOH$) and gibbsite ($Al(OH)_3$).	Laterite and saprock developed over acidic igneous rock types.
Less than 4.0	Alunite, jarosite and related minerals.	Gossans, acid sulfate soils, oxidised sulfidic wastes.

APPENDIX 2: COLLATED RESULTS

LIST OF APPENDIX 2 TABLES

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Table A2-1: Acid Base Accounting

Sample	Ore Location	Total S %	ANC	MPA	NAPP	pH	NAG pH	NAG to pH 7 kg H_2SO_4/t	NAG to pH 4.5 kg H_2SO_4/t	NPR	Classification
			kg H_2SO_4/t			pH units					
BK7875	Heffernans (syenite)	0.85	64	26	-38	9.2	8.9	0	0	2.5	NAF
BK7876	Heffernans (syenite)	1.06	67	32	-35	9.2	8.6	0	0	2.1	NAF
BK7877	Heffernans (basalt)	1.09	206	33	-173	9.2	8.6	0	0	6.2	NAF (AC)
BK8791	Heffernans (composite)	0.72	127	22	-105	9.3	9.8	0	0	5.8	NAF (AC)
BK8295	Beresford (composite)	2.31	122	71	-51	9.6	7.7	0	0	1.7	NAF
BK8296	Beresford (composite)	2.31	111	71	-40	9.7	7.9	0	0	1.6	NAF
BK8783	Beresford (composite)	2.39	102	73	-29	9.6	7.7	0	0	1.4	NAF
BK8298	Allanson (composite)	4.86	109	149	40	9.6	2.5	39	29	0.7	PAF
BK8299	Allanson (composite)	4.84	97	148	51	9.6	2.7	32	19	0.7	PAF
BK8784	Allanson (composite)	4.64	91	142	51	9.6	2.7	31	20	0.6	PAF
BK8790	Doublejay (composite)	0.74	107	23	-84	9.7	9.7	0	0	4.7	NAF

Table A2-2: Elemental Composition

Sample Number	Ore Location	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg
BK7875	Heffernans (syenite)	0.06	7.69%	11	1,765	4.1	0.63	2.14%	0.03	16.0	574	50	2.19%	N/A	3.05%	0.52%
BK7876	Heffernans (syenite)	0.09	7.32%	2.2	1,744	2.6	0.72	2.05%	<0.02	14.7	457	43	2.06%	N/A	3.60%	0.55%
BK7877	Heffernans (basalt)	0.07	5.65%	6.9	164	2.1	0.59	6.83%	0.04	40.9	381	102	6.44%	N/A	1.28%	2.74%
BK8791	Heffernans (composite)	0.08	7.19%	4.0	1,021	3.1	0.73	4.54%	0.05	24.9	382	73	4.58%	0.016	2.63%	1.87%
BK8295	Beresford (composite)	0.21	2.32%	32	414	1.0	0.60	2.52%	0.77	17.1	287	84	19.7%	N/A	0.48%	1.09%
BK8296	Beresford (composite)	0.18	2.33%	27	410	0.8	0.54	2.51%	0.62	17.4	281	83	19.9%	N/A	0.48%	1.07%
BK8783	Beresford (composite)	0.31	2.39%	31	395	0.8	0.59	2.50%	0.64	16.3	368	79	19.4%	0.035	0.49%	1.04%
BK8298	Allanson (composite)	0.59	3.97%	70	111	0.7	1.06	2.25%	0.71	27.1	456	106	11.7%	N/A	0.18%	2.20%
BK8299	Allanson (composite)	0.50	3.95%	71	104	0.9	1.11	2.22%	0.85	27.6	391	122	11.4%	N/A	0.18%	2.19%
BK8784	Allanson (composite)	0.57	4.00%	68	88	1.3	1.00	2.38%	0.68	26.8	635	119	11.3%	0.025	0.17%	2.28%
BK8790	Doublejay (composite)	0.24	7.13%	3.0	932	3.2	2.54	3.83%	0.15	23.3	411	108	4.51%	0.024	2.75%	1.58%

All units of measure are mg/kg unless otherwise specified

Sample Number	Ore Location	Mn	Mo	Na	Ni	Pb	Sb	Se	Sn	Te	Th	U	V	Zn
BK7875	Heffernans (syenite)	456	76	4.12%	449	37.6	0.95	0.5	1.1	2.8	31.1	9.1	28	36
BK7876	Heffernans (syenite)	410	79	3.54%	433	77.3	1.55	0.5	0.9	4.2	32.1	8.5	28	37
BK7877	Heffernans (basalt)	1240	55	2.24%	338	8.9	1.56	<0.5	0.6	0.9	3.10	1.0	175	74
BK8791	Heffernans (composite)	841	36.3	2.75%	219	29.7	1.62	<0.5	0.5	1.8	12.0	3.56	122	64
BK8295	Beresford (composite)	721	39	0.54%	216	16.3	0.85	1.8	1.1	0.6	0.95	0.29	59	264
BK8296	Beresford (composite)	726	41	0.56%	217	15.7	0.82	1.7	1.1	0.7	0.94	0.28	59	239
BK8783	Beresford (composite)	715	35	0.55%	197	14.8	0.69	1.8	0.9	0.6	0.88	0.26	66	254
BK8298	Allanson (composite)	774	47	2.01%	329	25.2	1.05	3.8	0.9	1.7	2.05	0.66	65	230
BK8299	Allanson (composite)	733	46	1.99%	321	23.1	1.02	4.0	0.9	5.3	1.98	0.64	66	236
BK8784	Allanson (composite)	749	38.6	1.91%	307	21.7	0.73	3.9	0.7	1.8	2.10	0.68	73	235
BK8790	Doublejay (composite)	839	114	2.88%	222	80.8	1.64	<0.5	0.5	1.6	24.3	6.86	128	76

All units of measure are mg/kg unless otherwise specified, N/A indicates not analysed

Table A2-3: Global Abundance Index Classification Waste Rock Samples

Sample Number	Ore Location	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg
BK7875	Heffernans (syenite)	0	0	0	1	0	1	0	0	0	2	0	0	N/A
BK7876	Heffernans (syenite)	0	0	0	1	0	1	0	0	0	2	0	0	N/A
BK7877	Heffernans (basalt)	0	0	0	0	0	1	0	0	0	1	0	0	N/A
BK8791	Heffernans (composite)	0	0	0	1	0	2	0	0	0	1	0	0	0
BK8295	Beresford (composite)	1	0	0	0	0	1	0	2	0	1	0	2	N/A
BK8296	Beresford (composite)	1	0	0	0	0	1	0	2	0	1	0	2	N/A
BK8783	Beresford (composite)	2	0	0	0	0	1	0	2	0	1	0	2	0
BK8298	Allanson (composite)	2	0	1	0	0	2	0	2	0	2	0	1	N/A
BK8299	Allanson (composite)	2	0	1	0	0	2	0	2	0	1	1	1	N/A
BK8784	Allanson (composite)	2	0	1	0	0	2	0	2	0	2	1	1	0
BK8790	Doublejay (composite)	1	0	0	1	0	3	0	0	0	1	1	0	0
Average Crustal/Soil Abundance		**0.07**	**8.2%**	**25**	**425**	**2.8**	**0.17**	**4.1%**	**0.11**	**20**	**100**	**50**	**4.1%**	**0.08**

Table A2-3: Global Abundance Index Classification Waste Rock Samples, continued

Sample Number	Ore Location	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Sn	Te	Th	U	V	Zn
BK7875	Heffernans (syenite)	0	0	0	5	0	2	1	2	1	0	6	1	1	0	0
BK7876	Heffernans (syenite)	0	0	0	5	0	2	2	2	1	0	6	1	1	0	0
BK7877	Heffernans (basalt)	0	0	0	5	0	1	0	2	0	0	6	0	0	0	0
BK8791	Heffernans (composite)	0	0	0	4	0	1	1	2	0	0	6	0	0	0	0
BK8295	Beresford (composite)	0	0	0	4	0	1	0	2	3	0	6	0	0	0	1
BK8296	Beresford (composite)	0	0	0	4	0	1	0	1	3	0	6	0	0	0	1
BK8783	Beresford (composite)	0	0	0	4	0	1	0	1	3	0	6	0	0	0	1
BK8298	Allanson (composite)	0	0	0	4	0	1	0	2	4	0	6	0	0	0	1
BK8299	Allanson (composite)	0	0	0	4	0	1	0	2	4	0	6	0	0	0	1
BK8784	Allanson (composite)	0	0	0	4	0	1	0	1	4	0	6	0	0	0	1
BK8790	Doublejay (composite)	0	0	0	6	0	1	2	2	0	0	6	1	1	0	0
Average Crustal/Soil Abundance		**2.1%**	**2.3%**	**950**	**1.5**	**2.3%**	**80**	**14**	**0.2**	**0.2**	**2**	**0.001**	**10**	**2.4**	**160**	**75**

Notes: *Cells shaded yellow indicate GAI greater than or equal to three.*

Unless indicated otherwise, values for average crustal/soil abundance are reported as mg/kg. Reference values were provided by Bowen (1999) or AIMM (1991).

Table A2-4: pH, EC and Alkalinity (1:5 Extract)

Sample Number	Ore Location	pH pH units	EC µS/cm	Alkalinity			
				HCO_3	CO_3	OH	Total
				mg $CaCO_3$/L			
BK7875	Heffernans (syenite)	9.2	170	<2	53	4	56
BK7876	Heffernans (syenite)	9.2	183	<2	27	4	31
BK7877	Heffernans (basalt)	9.2	166	<2	33	10	43
BK8791	Heffernans (composite)	9.3	190	15	25	<1	40
BK8295	Beresford (composite)	9.6	154	<2	26	<1	27
BK8296	Beresford (composite)	9.7	132	<2	14	15	29
BK8783	Beresford (composite)	9.6	150	<2	29	<1	30
BK8298	Allanson (composite)	9.6	167	<2	12	16	28
BK8299	Allanson (composite)	9.6	150	<2	17	13	30
BK8784	Allanson (composite)	9.6	180	9	22	<1	31
BK8790	Doublejay (composite)	9.7	230	16	55	<1	71

Table A2-5: Major Ions (1:5 Extract)

Sample Number	Ore Location	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L
BK7875	Heffernans (syenite)	10.2	3.3	15.6	3.3	14	28
BK7876	Heffernans (syenite)	10.2	1.3	17.0	3.8	15	30
BK7877	Heffernans (basalt)	7.3	3	18.8	4.3	13	17
BK8791	Heffernans (composite)	8.81	4.14	16.3	5.9	11	33
BK8295	Beresford (composite)	7.3	6.2	11.2	1.7	15	32
BK8296	Beresford (composite)	7.4	6.0	9.5	1.3	15	22
BK8783	Beresford (composite)	7.4	5.02	10.6	2	17	28
BK8298	Allanson (composite)	7.5	5.4	15.3	1	26	35
BK8299	Allanson (composite)	7.1	5.1	12.9	1	26	29
BK8784	Allanson (composite)	7.35	4.95	16.8	1.3	22	40
BK8790	Doublejay (composite)	2.68	0.91	38.3	4.4	13	23

Table A2-6: Water Soluble Metals and Metalloids (1:5 Extract)

Sample Number	Ore Location	Ag	Al	As	Ba	B	Be	Bi	Cd	Co	Cr	Cu	Fe	Hg
BK7875	Heffernans (syenite)	<0.00001	0.15	0.0032	0.211	0.16	<0.0001	0.000031	<0.00002	0.0002	<0.01	<0.01	0.07	N/A*
BK7876	Heffernans (syenite)	<0.00001	0.10	0.0008	0.211	0.17	<0.0001	0.000027	0.00002	0.0002	<0.01	<0.01	0.06	N/A*
BK7877	Heffernans (basalt)	<0.00001	0.12	0.0009	0.164	0.15	<0.0001	0.000008	0.00002	0.0004	<0.01	<0.01	0.11	N/A*
BK8791	Heffernans (composite)	<0.00001	0.21	0.0007	0.352	0.09	<0.0001	<0.000005	<0.00002	0.0004	<0.01	<0.01	0.19	<0.0001
BK8295	Beresford (composite)	0.00012	<0.01	0.0008	0.027	0.05	<0.0001	<0.000005	<0.00002	0.0026	<0.01	0.07	0.33	N/A*
BK8296	Beresford (composite)	0.00018	<0.01	0.0003	0.022	0.08	<0.0001	<0.000005	<0.00002	0.0004	<0.01	0.14	0.07	N/A*
BK8783	Beresford (composite)	0.0001	0.05	0.0012	0.016	0.09	<0.0001	<0.000005	<0.00002	0.0006	<0.01	0.02	0.34	<0.0001
BK8298	Allanson (composite)	0.00059	0.02	0.0064	0.030	0.03	<0.0001	<0.000005	<0.00002	0.0022	<0.01	0.02	0.16	N/A*
BK8299	Allanson (composite)	0.00050	0.02	0.0044	0.024	0.05	<0.0001	<0.000005	<0.00002	0.0006	<0.01	0.01	0.04	N/A*
BK8784	Allanson (composite)	0.00005	0.07	0.0024	0.022	0.1	<0.0001	<0.000005	<0.00002	0.0006	<0.01	<0.01	0.27	<0.0001
BK8790	Doublejay (composite)	<0.00001	0.28	0.0023	0.128	0.11	<0.0001	0.000021	<0.00002	0.001	<0.01	<0.01	0.22	<0.0001
Freshwater		**0.00005**	**0.055**	**0.013**	**N/A**	**0.37**	**N/A**	**N/A**	**0.0002**	**N/A**	**0.01**	**0.0014**	**N/A**	**0.00006**
Livestock Drinking Water (Cattle)		**N/A**	**5**	**0.5**	**N/A**	**5**	**N/A**	**N/A**	**0.01**	**1**	**1**	**1**	**N/A**	**0.002**
Human Drinking Water		**0.1**	**0.2**	**0.01**	**2**	**4**	**0.06**	**N/A**	**0.002**	**N/A**	**0.05**	**2**	**0.3**	**0.001**

Table A2-6: Water Soluble Metals and Metalloids (1:5 Extract), continued

Sample Number	Ore Location	Mn	Mo	Ni	Sb	Se	Sn	Te	Th	U	V	Zn
BK7875	Heffernans (syenite)	0.004	0.0083	<0.01	0.00087	<0.0005	<0.0001	0.0005	0.000236	0.00049	<0.01	<0.01
BK7876	Heffernans (syenite)	<0.001	0.0167	<0.01	0.00114	<0.0005	<0.0001	0.0006	0.000173	0.00038	<0.01	<0.01
BK7877	Heffernans (basalt)	0.001	0.0062	<0.01	0.00134	<0.0005	<0.0001	<0.0001	0.000009	0.00004	<0.01	<0.01
BK8791	Heffernans (composite)	0.008	0.0070	0.02	0.00077	<0.0005	<0.0001	<0.0001	0.000021	0.000056	<0.01	<0.01
BK8295	Beresford (composite)	<0.001	0.0036	<0.01	0.00041	0.0007	<0.0001	<0.0001	<0.000005	<0.000005	<0.01	<0.01
BK8296	Beresford (composite)	0.011	0.0034	<0.01	0.00039	0.0010	<0.0001	<0.0001	<0.000005	<0.000005	<0.01	<0.01
BK8783	Beresford (composite)	0.001	0.0049	0.04	0.0008	0.0009	<0.0001	<0.0001	<0.000005	<0.000005	<0.01	<0.01
BK8298	Allanson (composite)	0.001	0.0057	0.04	0.00224	0.0013	<0.0001	<0.0001	<0.000005	<0.000005	<0.01	<0.01
BK8299	Allanson (composite)	0.002	0.0036	0.03	0.00180	0.0010	<0.0001	<0.0001	<0.000005	<0.000005	<0.01	<0.01
BK8784	Allanson (composite)	0.001	0.0067	0.05	0.00109	0.0012	<0.0001	<0.0001	<0.000005	<0.000005	<0.01	<0.01
BK8790	Doublejay (composite)	0.002	0.0166	0.01	0.00071	0.0013	<0.0001	<0.0001	0.000086	0.000296	<0.01	<0.01
Freshwater		**1.9**	**N/A**	**0.011**	**N/A**	**0.011**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.008**
Livestock Drinking Water (Cattle)		**N/A**	**0.15**	**1**	**N/A**	**0.02**	**N/A**	**N/A**	**N/A**	**0.2**	**N/A**	**20**
Human Drinking Water		**0.5**	**0.05**	**0.02**	**0.003**	**0.01**	**N/A**	**N/A**	**N/A**	**0.017**	**N/A**	**3**

N/A = not available as a consequence of a lack of published toxicity data or very low toxicity.

All units of measure are mg/L.

** Mercury in these samples not analysed or not reported due to mercury use by the metallurgy laboratory invalidating mercury results.*

Table A2-7: Cyanide Forms (1:5 Extract)

Sample Number	Ore Lithology	CN-Total	CN-Free	CN-WAD
BK8295	Beresford (composite)	2	<1	<1
BK8296	Beresford (composite)	<1	<1	<1
BK8783	Beresford (composite)	<1	<1	<1
BK8298	Allanson (composite)	1	<1	<1
BK8299	Allanson (composite)	<1	<1	<1
BK8784	Allanson (composite)	<1	<1	<1
BK8790	Doublejay (composite)	<1	<1	<1
BK8791	Heffernans (composite)	<1	<1	<1

All units of measure are mg/L

APPENDIX 3: LABORATORY REPORTS

ANALYTICAL REPORT

DACIAN GOLD LIMITED
PO Box 928
APPLECROSS, W.A. 6153
AUSTRALIA

JOB INFORMATION

JOB CODE : 1839.0/1602470
No. of SAMPLES : 3
No. of ELEMENTS : 46
CLIENT O/N : DGMMWC (Job 1 of 0)
SAMPLE SUBMISSION No. :
PROJECT : MT MORGANS GOLD PROJECT
STATE : Taillings
DATE RECEIVED : 26/02/2016
DATE COMPLETED : 22/03/2016
DATE PRINTED : 22/03/2016
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

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JOHANNESBURG LABORATORY

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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
[redacted]

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.

ANALYSIS

ELEMENTS	Ag	Ag	Al	Al	ANC	As
UNITS	ppm	ug/l	ppm	mg/l	kgH2SO4/t	ppm
DETECTION LIMIT	0.05	0.01	50	0.01	1	0.5
DIGEST	4A/	Ws/	4A/	Ws/	ANCx/	4A/
ANALYTICAL FINISH	MS	MS	OE	OE	VOL	MS
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	0.06	X	7.69%	0.15	64	11.1
0002 BK 7876 (CSZ Syenite)	0.09	X	7.32%	0.10	67	2.2
0003 BK 7876 (CSZ Baslat)	0.07	X	5.65%	0.12	206	6.9
CHECKS						
0001 BK 7876 (CSZ Syenite)		X		0.14		
0002 BK 7876 (CSZ Syenite)	0.11		7.39%			2.6
0003 BK 7876 (CSZ Syenite)					66	
STANDARDS						
0001 ANC-1					96	
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e	0.32		6.73%			17.3
BLANKS						
0001 Control Blank					-0	
0002 Control Blank	X		X			X
0003 Control Blank		X		X		

ANALYSIS

ELEMENTS	As	B	Ba	Ba	Be	Be
UNITS	ug/l	mg/l	ppm	ug/l	ppm	ug/l
DETECTION LIMIT	0.1	0.01	0.1	0.05	0.05	0.1
DIGEST	Ws/	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	OE	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	3.2	0.16	1765.1	211.23	4.05	X
0002 BK 7876 (CSZ Syenite)	0.8	0.17	1743.7	211.34	2.59	X
0003 BK 7876 (CSZ Baslat)	0.9	0.15	164.5	31.59	2.13	X
CHECKS						
0001 BK 7876 (CSZ Syenite)	0.9	0.17		215.92		X
0002 BK 7876 (CSZ Syenite)			1746.8		2.50	
0003 BK 7876 (CSZ Syenite)						
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e			255.0		0.62	
BLANKS						
0001 Control Blank						
0002 Control Blank			0.1		X	
0003 Control Blank	X	X		X		X

ANALYSIS

ELEMENTS	Bi	Bi	CO3	Ca	Ca	Cd
UNITS	ppm	ug/l	mgCaCO3/L	ppm	mg/l	ppm
DETECTION LIMIT	0.01	0.005	2	50	0.01	0.02
DIGEST	4A/	Ws/	Ws/	4A/	Ws/	4A/
ANALYTICAL FINISH	MS	MS	VOL	OE	OE	MS
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	0.63	0.031	53	2.14%	10.17	0.03
0002 BK 7876 (CSZ Syenite)	0.72	0.027	27	2.05%	10.24	X
0003 BK 7876 (CSZ Baslat)	0.59	0.008	33	6.83%	7.33	0.04
CHECKS						
0001 BK 7876 (CSZ Syenite)		0.035	27		10.17	
0002 BK 7876 (CSZ Syenite)	0.69			2.06%		0.06
0003 BK 7876 (CSZ Syenite)						
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2			X			
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e	0.29			730		0.05
BLANKS						
0001 Control Blank						
0002 Control Blank	X			X		X
0003 Control Blank		X			X	

ANALYSIS

ELEMENTS	Cd	Cl	Co	Co	ColourChange	Cr
UNITS	ug/l	mg/L	ppm	ug/l	NONE	ppm
DETECTION LIMIT	0.02	2	0.1	0.1	0	5
DIGEST	Ws/	Ws/	4A/	Ws/	ANCx/	4A/
ANALYTICAL FINISH	MS	VOL	MS	MS	QUAL	OE
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	X	14	16.0	0.2	Yes	574
0002 BK 7876 (CSZ Syenite)	X	15	14.7	0.2	Yes	457
0003 BK 7876 (CSZ Baslat)	X	13	40.9	0.4	Yes	381
CHECKS						
0001 BK 7876 (CSZ Syenite)	X	14		0.2		
0002 BK 7876 (CSZ Syenite)			14.6			505
0003 BK 7876 (CSZ Syenite)					Yes	
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e			57.3			976
BLANKS						
0001 Control Blank						
0002 Control Blank			X			X
0003 Control Blank	X	X		X		

ANALYSIS

ELEMENTS	Cr	Cu	Cu	EC	Fe	Fe
UNITS	mg/l	ppm	mg/l	uS/cm	%	mg/l
DETECTION LIMIT	0.01	1	0.01	10	0.01	0.01
DIGEST	Ws/	4A/	Ws/	Ws/	4A/	Ws/
ANALYTICAL FINISH	OE	OE	OE	MTR	OE	OE
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	X	50	X	170	2.19	0.07
0002 BK 7876 (CSZ Syenite)	X	43	X	183	2.06	0.06
0003 BK 7876 (CSZ Baslat)	X	102	X	166	6.44	0.11
CHECKS						
0001 BK 7876 (CSZ Syenite)	X		X	176		0.04
0002 BK 7876 (CSZ Syenite)		46			2.13	
0003 BK 7876 (CSZ Syenite)						
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e		781			24.66	
BLANKS						
0001 Control Blank						
0002 Control Blank		X			X	
0003 Control Blank	X		X			X

ANALYSIS

ELEMENTS	Final-pH	Fizz-Rate	HCO3	Hg	K	K
UNITS	NONE	NONE	mgCaCO3/L	ug/l	ppm	mg/l
DETECTION LIMIT	0.1	0.1	2	0.1	20	0.1
DIGEST	ANCx/	ANCx/	Ws/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MTR	QUAL	VOL	MS	OE	OE
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	1.2	2.0	X	1.4	3.05%	3.3
0002 BK 7876 (CSZ Syenite)	1.2	2.0	X	3.1	3.60%	3.8
0003 BK 7876 (CSZ Baslat)	1.2	3.0	X	5.1	1.28%	4.3
CHECKS						
0001 BK 7876 (CSZ Syenite)			X	3.6		3.7
0002 BK 7876 (CSZ Syenite)					3.66%	
0003 BK 7876 (CSZ Syenite)	1.1	2.0				
STANDARDS						
0001 ANC-1	1.2					
0002 ENV_MS_Spike2			X			
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e					3361	
BLANKS						
0001 Control Blank	0.9					
0002 Control Blank					X	
0003 Control Blank				X		X

ANALYSIS

ELEMENTS	Mg	Mg	Mn	Mn	Mo	Mo
UNITS	ppm	mg/l	ppm	mg/l	ppm	ug/l
DETECTION LIMIT	20	0.01	1	0.001	0.1	0.05
DIGEST	4A/	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	OE	OE	OE	OE	MS	MS
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	5247	3.31	456	0.004	76.0	8.28
0002 BK 7876 (CSZ Syenite)	5472	3.34	410	X	78.7	16.72
0003 BK 7876 (CSZ Baslat)	2.74%	3.04	1245	0.001	55.2	6.22
CHECKS						
0001 BK 7876 (CSZ Syenite)		3.33		X		16.42
0002 BK 7876 (CSZ Syenite)	5515		416		78.9	
0003 BK 7876 (CSZ Syenite)						
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e	1570		551		2.5	
BLANKS						
0001 Control Blank						
0002 Control Blank	X		X		X	
0003 Control Blank		X		X		X

ANALYSIS

ELEMENTS	Na	Na	NAG	NAGpH	NAG(4.5)	Ni
UNITS	ppm	mg/l	kgH2SO4/t	NONE	kgH2SO4/t	ppm
DETECTION LIMIT	20	0.1	1	0.1	1	1
DIGEST	4A/	Ws/	NAGx/	NAGx/	NAGx/	4A/
ANALYTICAL FINISH	OE	OE	VOL	MTR	VOL	OE
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	4.12%	15.6	0	8.9	0	449
0002 BK 7876 (CSZ Syenite)	3.54%	17.0	0	8.6	0	433
0003 BK 7876 (CSZ Baslat)	2.24%	18.8	0	8.6	0	338
CHECKS						
0001 BK 7876 (CSZ Syenite)		16.1				
0002 BK 7876 (CSZ Syenite)	3.63%					445
0003 BK 7876 (CSZ Syenite)			0	8.5	0	
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3			23	2.6	17	
0004 OREAS 13b						
0005 OREAS 45e	626					471
BLANKS						
0001 Control Blank			5	4.5	0	
0002 Control Blank	X					X
0003 Control Blank		X				

ANALYSIS

ELEMENTS	Ni	OH	Pb	pH	pH Drop	S
UNITS	mg/l	mgCaCO3/L	ppm	NONE	NONE	%
DETECTION LIMIT	0.01	2	0.5	0.1	0.1	0.01
DIGEST	Ws/	Ws/	4A/	Ws/	ANCx/	
ANALYTICAL FINISH	OE	VOL	MS	MTR	MTR	/CSA
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	X	4	37.6	9.2	3.3	0.85
0002 BK 7876 (CSZ Syenite)	X	4	77.3	9.2	3.4	1.06
0003 BK 7876 (CSZ Baslat)	X	10	8.9	9.2	2.9	1.09
CHECKS						
0001 BK 7876 (CSZ Syenite)	X	X		9.3		
0002 BK 7876 (CSZ Syenite)			77.3			1.08
0003 BK 7876 (CSZ Syenite)					3.3	
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2		X				
0003 NAG Std 3						
0004 OREAS 13b						1.16
0005 OREAS 45e			18.1			
BLANKS						
0001 Control Blank						
0002 Control Blank			X			X
0003 Control Blank	X					

ANALYSIS

ELEMENTS	S	SO4	Sb	Sb	Se	Se
UNITS	mg/l	mg/l	ppm	ug/l	ppm	ug/l
DETECTION LIMIT	0.05	0.2	0.05	0.01	0.5	0.5
DIGEST	Ws/		4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	OE	/CALC	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	9.18	27.5	0.95	0.87	0.5	X
0002 BK 7876 (CSZ Syenite)	10.01	30.0	1.55	1.14	0.5	X
0003 BK 7876 (CSZ Baslat)	5.60	16.8	1.56	1.34	X	X
CHECKS						
0001 BK 7876 (CSZ Syenite)				1.13		X
0002 BK 7876 (CSZ Syenite)			1.69		X	
0003 BK 7876 (CSZ Syenite)						
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e			0.99		3.0	
BLANKS						
0001 Control Blank						
0002 Control Blank			X		X	
0003 Control Blank	X	X		X		X

ANALYSIS

ELEMENTS	Sn	Sn	Te	Te	Th	Th
UNITS	ppm	ug/l	ppm	ug/l	ppm	ug/l
DETECTION LIMIT	0.1	0.1	0.2	0.1	0.01	0.005
DIGEST	4A/	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	1.1	X	2.8	0.5	31.08	0.236
0002 BK 7876 (CSZ Syenite)	0.9	X	4.2	0.6	32.14	0.173
0003 BK 7876 (CSZ Baslat)	0.6	X	0.9	X	3.10	0.009
CHECKS						
0001 BK 7876 (CSZ Syenite)		X		0.8		0.205
0002 BK 7876 (CSZ Syenite)	1.0		3.6		33.09	
0003 BK 7876 (CSZ Syenite)						
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e	1.3		X		13.00	
BLANKS						
0001 Control Blank						
0002 Control Blank	X		X		X	
0003 Control Blank		X		X		X

ANALYSIS

ELEMENTS	TotAlk	U	U	V	V	Zn
UNITS	mgCaCO3/L	ppm	ug/l	ppm	mg/l	ppm
DETECTION LIMIT	5	0.01	0.005	1	0.01	1
DIGEST		4A/	Ws/	4A/	Ws/	4A/
ANALYTICAL FINISH	/CALC	MS	MS	OE	OE	OE
SAMPLE NUMBERS						
0001 BK 7875 (Syenite)	56	9.10	0.489	28	X	36
0002 BK 7876 (CSZ Syenite)	31	8.52	0.376	28	X	37
0003 BK 7876 (CSZ Baslat)	43	1.02	0.035	175	X	74
CHECKS						
0001 BK 7876 (CSZ Syenite)			0.321		X	
0002 BK 7876 (CSZ Syenite)		8.64		30		38
0003 BK 7876 (CSZ Syenite)						
STANDARDS						
0001 ANC-1						
0002 ENV_MS_Spike2						
0003 NAG Std 3						
0004 OREAS 13b						
0005 OREAS 45e		2.42		323		44
BLANKS						
0001 Control Blank						
0002 Control Blank		X		X		X
0003 Control Blank			X		X	

ANALYSIS

ELEMENTS	Zn
UNITS	mg/l
DETECTION LIMIT	0.01
DIGEST	Ws/
ANALYTICAL FINISH	OE
SAMPLE NUMBERS	
0001 BK 7875 (Syenite)	X
0002 BK 7876 (CSZ Syenite)	X
0003 BK 7876 (CSZ Baslat)	X
CHECKS	
0001 BK 7876 (CSZ Syenite)	X
0002 BK 7876 (CSZ Syenite)	
0003 BK 7876 (CSZ Syenite)	
STANDARDS	
0001 ANC-1	
0002 ENV_MS_Spike2	
0003 NAG Std 3	
0004 OREAS 13b	
0005 OREAS 45e	
BLANKS	
0001 Control Blank	
0002 Control Blank	
0003 Control Blank	X

METHOD CODE DESCRIPTION

<table>
<tr><th>Method Code</th><th>Analysing Laboratory
NATA Laboratory Accreditation</th><th>NATA Scope of Accreditation</th></tr>
<tr><td>/CALC</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">No digestion or other pre-treatment undertaken. Results Determined by calculation from other reported data.</td></tr>
<tr><td>/CSA</td><td>Intertek Genalysis Perth
3244 3237</td><td>MPL_W043, CSA : MPL_W043</td></tr>
<tr><td colspan="3">Induction Furnace Analysed by Infrared Spectrometry</td></tr>
<tr><td>4A/MS</td><td>Intertek Genalysis Perth
3244 3237</td><td>4A/ : MPL_W002, MS : ICP_W003</td></tr>
<tr><td colspan="3">Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. Analysed by Inductively Coupled Plasma Mass Spectrometry.</td></tr>
<tr><td>4A/OE</td><td>Intertek Genalysis Perth
3244 3237</td><td>4A/ : MPL_W002, OE : ICP_W004</td></tr>
<tr><td colspan="3">Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.</td></tr>
<tr><td>ANCx/MTR</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement</td></tr>
<tr><td>ANCx/QUAL</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection</td></tr>
<tr><td>ANCx/VOL</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.</td></tr>
<tr><td>NAGx/MTR</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement</td></tr>
<tr><td>NAGx/VOL</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.</td></tr>
<tr><td>Ws/MS</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Inductively Coupled Plasma Mass Spectrometry.</td></tr>
<tr><td>Ws/MTR</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed with Electronic Meter Measurement</td></tr>
<tr><td>Ws/OE</td><td>Intertek Genalysis Perth
3244 3237</td><td></td></tr>
<tr><td colspan="3">Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.</td></tr>
</table>

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory **NATA Laboratory Accreditation**	NATA Scope of Accreditation
Ws/VOL	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Volumetric Technique.

ANALYTICAL REPORT

DACIAN GOLD LIMITED
PO Box 928
APPLECROSS, W.A. 6153
AUSTRALIA

COMMENTS

1. Amended Report - This report replaces the previously issued results

JOB INFORMATION

JOB CODE : 1839.0/1604695
No. of SAMPLES : 4
No. of ELEMENTS : 49
CLIENT O/N : DGMMWC (Job 1 of 0)
SAMPLE SUBMISSION No. :
PROJECT : MT MORGANS GOLD PROJECT
STATE : Taillings
DATE RECEIVED : 12/04/2016
DATE COMPLETED : 06/07/2016
DATE PRINTED : 06/07/2016
ANALYSING LABORATORY : Intertek Genalysis Perth

LEGEND

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

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PO Box 144, Gosnells 6990, Western Australia
Tel: +61 8 9251 8100 Fax: +61 8 9251 8110
[redacted]
Web Page: www.genalysis.com.au

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ADELAIDE LABORATORY
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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
[redacted]

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.

ANALYSIS

ELEMENTS	Ag	Ag	Al	Al	ANC	As
UNITS	ppm	ug/l	ppm	mg/l	kgH2SO4/t	ppm
DETECTION LIMIT	0.05	0.01	50	0.01	1	0.5
DIGEST	4A/	Ws/	4A/	Ws/	ANCx/	4A/
ANALYTICAL FINISH	MS	MS	OE	OE	VOL	MS
SAMPLE NUMBERS						
0001 BK8295	0.21	0.12	2.32%	X	122	32.3
0002 BK8296	0.18	0.09	2.33%	X	111	27.2
0003 BK8298	0.59	0.20	3.97%	0.02	109	70.4
0004 BK8299	0.50	0.06	3.95%	0.02	97	71.3
CHECKS						
0001 BK8298		0.21		0.02		
0002 BK8298	0.72		3.93%			68.5
0003 BK8296					101	
STANDARDS						
0001 AMIS0157						
0002 ANC-1					97	
0003 MPL-5	29.40		3.40%			1022.6
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank					0	
0002 Control Blank		X		X		
0003 Control Blank	X		X			X

ANALYSIS

ELEMENTS	As	B	Ba	Ba	Be	Be
UNITS	ug/l	mg/l	ppm	ug/l	ppm	ug/l
DETECTION LIMIT	0.1	0.01	0.1	0.05	0.05	0.1
DIGEST	Ws/	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	OE	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 BK8295	0.8	0.05	414.4	26.96	0.97	X
0002 BK8296	0.3	0.08	410.3	22.11	0.80	X
0003 BK8298	6.4	0.03	111.3	29.98	0.73	X
0004 BK8299	4.4	0.05	104.5	23.96	0.89	X
CHECKS						
0001 BK8298	6.7	X		31.14		X
0002 BK8298			110.0		0.85	
0003 BK8296						
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5			584.5		21.07	
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank	X	X		X		X
0003 Control Blank			X		X	

ANALYSIS

ELEMENTS	Bi	Bi	CO3	Ca	Ca	Cd
UNITS	ppm	ug/l	mgCaCO3/L	ppm	mg/l	ppm
DETECTION LIMIT	0.01	0.005	1	50	0.01	0.02
DIGEST	4A/	Ws/	Ws/	4A/	Ws/	4A/
ANALYTICAL FINISH	MS	MS	VOL	OE	OE	MS
SAMPLE NUMBERS						
0001 BK8295	0.60	X	26	2.52%	7.33	0.77
0002 BK8296	0.54	X	14	2.51%	7.42	0.62
0003 BK8298	1.06	X	12	2.25%	7.51	0.71
0004 BK8299	1.11	X	17	2.22%	7.12	0.85
CHECKS						
0001 BK8298		X			7.46	
0002 BK8298	1.11			2.23%		0.79
0003 BK8296						
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5	38.65			4.29%		3.00
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank		X	X		X	
0003 Control Blank	X			X		X

ANALYSIS

ELEMENTS	Cd	Cl	Co	Co	ColourChange	Cr
UNITS	ug/l	mg/L	ppm	ug/l	NONE	ppm
DETECTION LIMIT	0.02	2	0.1	0.1	0	5
DIGEST	Ws/	Ws/	4A/	Ws/	ANCx/	4A/
ANALYTICAL FINISH	MS	COL	MS	MS	QUAL	OE
SAMPLE NUMBERS						
0001 BK8295	X	15	17.1	2.6	Yes	287
0002 BK8296	X	15	17.4	0.4	Yes	281
0003 BK8298	X	26	27.1	2.2	Yes	456
0004 BK8299	X	26	27.6	0.6	Yes	391
CHECKS						
0001 BK8298	X	27		2.3		
0002 BK8298			27.1			493
0003 BK8296					Yes	
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5			134.1			512
0004 N191		100				
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank	X	X		X		
0003 Control Blank			X			X

ANALYSIS

ELEMENTS	Cr	Cu	Cu	EC	Fe	Fe
UNITS	mg/l	ppm	mg/l	uS/cm	%	mg/l
DETECTION LIMIT	0.01	1	0.01	10	0.01	0.01
DIGEST	Ws/	4A/	Ws/	Ws/	4A/	Ws/
ANALYTICAL FINISH	OE	OE	OE	MTR	OE	OE
SAMPLE NUMBERS						
0001 BK8295	X	84	0.07	154	19.73	0.33
0002 BK8296	X	83	0.14	132	19.89	0.07
0003 BK8298	X	106	0.02	167	11.66	0.16
0004 BK8299	X	122	0.01	150	11.39	0.04
CHECKS						
0001 BK8298	X		0.01			0.16
0002 BK8298		109			11.43	
0003 BK8296						
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5		1905			3.86	
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank	X		X	X		X
0003 Control Blank		X			X	

ANALYSIS

ELEMENTS	Final-pH	Fizz-Rate	HCO3	Hg	Hg	K
UNITS	NONE	NONE	mgCaCO3/L	ug/l	ppm	ppm
DETECTION LIMIT	0.1	0	5	0.1	0.2	20
DIGEST	ANCx/	ANCx/	Ws/	Ws/	HG1/	4A/
ANALYTICAL FINISH	MTR	QUAL	VOL	MS	MS	OE
SAMPLE NUMBERS						
0001 BK8295	1.2	1.0000000	X	204.3	20.7	4837
0002 BK8296	1.1	2.0000000	X	16.1	12.3	4788
0003 BK8298	1.1	1.0000000	X	45.0	13.8	1843
0004 BK8299	1.7	1.0000000	X	15.0	22.9	1837
CHECKS						
0001 BK8298				47.7		
0002 BK8298						1867
0003 BK8296	1.1	2.0000000				
STANDARDS						
0001 AMIS0157						
0002 ANC-1	1.3					
0003 MPL-5						1.14%
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5					1.1	
BLANKS						
0001 Control Blank	1.1					
0002 Control Blank			X	X		
0003 Control Blank						X

ANALYSIS

ELEMENTS	K	Mg	Mg	Mn	Mn	Mo
UNITS	mg/l	ppm	mg/l	ppm	mg/l	ppm
DETECTION LIMIT	0.1	20	0.01	1	0.001	0.1
DIGEST	Ws/	4A/	Ws/	4A/	Ws/	4A/
ANALYTICAL FINISH	OE	OE	OE	OE	OE	MS
SAMPLE NUMBERS						
0001 BK8295	1.7	1.09%	6.23	721	X	39.3
0002 BK8296	1.3	1.07%	6.04	726	0.011	40.7
0003 BK8298	1.0	2.20%	5.41	774	0.001	47.3
0004 BK8299	1.0	2.19%	5.08	733	0.002	46.2
CHECKS						
0001 BK8298	1.1		5.40		0.003	
0002 BK8298		2.17%		741		48.9
0003 BK8296						
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5		8828		2262		20.5
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank	X		0.02		X	
0003 Control Blank		X		2		X

ANALYSIS

ELEMENTS	Mo	CN-Tot	CN-WAD	FreeCN	Na	Na
UNITS	ug/l	mg/L	mg/L	mg/L	ppm	mg/l
DETECTION LIMIT	0.05	1	1	1	20	0.1
DIGEST	Ws/	Ws/	Ws/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	COL	COL	COL	OE	OE
SAMPLE NUMBERS						
0001 BK8295	3.61	2	X	X	5424	11.2
0002 BK8296	3.40	X	X	X	5614	9.5
0003 BK8298	5.70	1	X	X	2.01%	15.3
0004 BK8299	3.65	X	X	X	1.99%	12.9
CHECKS						
0001 BK8298	6.15			X		15.2
0002 BK8298					1.99%	
0003 BK8296						
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5					5558	
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank	X	X	X			X
0003 Control Blank					X	

ANALYSIS

ELEMENTS	NAG	NAGpH	NAG(4.5)	Ni	Ni	OH
UNITS	kgH2SO4/t	NONE	kgH2SO4/t	ppm	mg/l	mgCaCO3/L
DETECTION LIMIT	1	0.1	1	1	0.01	1
DIGEST	NAGx/	NAGx/	NAGx/	4A/	Ws/	Ws/
ANALYTICAL FINISH	VOL	MTR	VOL	OE	OE	VOL
SAMPLE NUMBERS						
0001 BK8295	0	7.7	0	216	X	X
0002 BK8296	0	7.9	0	217	X	15
0003 BK8298	39	2.5	29	329	0.04	16
0004 BK8299	32	2.7	19	321	0.03	13
CHECKS						
0001 BK8298					X	
0002 BK8298				331		
0003 BK8296	0	7.9	0			
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5				2427		
0004 N191						
0005 NAG Std 3	23	2.6	19			
0006 HgSTD-5						
BLANKS						
0001 Control Blank	6	4.5	0			
0002 Control Blank					X	X
0003 Control Blank				X		

ANALYSIS

ELEMENTS	Pb	pH	pH Drop	S	S	SO4
UNITS	ppm	NONE	NONE	%	mg/l	mg/l
DETECTION LIMIT	0.5	0.1	0.1	0.01	0.05	0.2
DIGEST	4A/	Ws/	ANCx/		Ws/	
ANALYTICAL FINISH	MS	MTR	MTR	/CSA	OE	/CALC
SAMPLE NUMBERS						
0001 BK8295	16.3	9.6	2.7	2.31	10.82	32.4
0002 BK8296	15.7	9.7	2.7	2.31	7.32	21.9
0003 BK8298	25.2	9.6	2.8	4.86	11.69	35.0
0004 BK8299	23.1	9.6	2.8	4.84	9.58	28.7
CHECKS						
0001 BK8298					11.54	34.6
0002 BK8298	27.4					
0003 BK8296			2.7	2.32		
STANDARDS						
0001 AMIS0157				2.21		
0002 ANC-1						
0003 MPL-5	2098.6					
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank				X		
0002 Control Blank					X	X
0003 Control Blank	X					

ANALYSIS

ELEMENTS	Sb	Sb	Se	Se	Sn	Sn
UNITS	ppm	ug/l	ppm	ug/l	ppm	ug/l
DETECTION LIMIT	0.05	0.01	0.5	0.5	0.1	0.1
DIGEST	4A/	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 BK8295	0.85	0.41	1.8	0.7	1.1	X
0002 BK8296	0.82	0.39	1.7	1.0	1.1	X
0003 BK8298	1.05	2.24	3.8	1.3	0.9	X
0004 BK8299	1.02	1.80	4.0	1.0	0.9	X
CHECKS						
0001 BK8298		2.38		1.3		X
0002 BK8298	1.35		4.3		0.9	
0003 BK8296						
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5	344.42		122.6		7.4	
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank		X		X		X
0003 Control Blank	X		X		X	

ANALYSIS

ELEMENTS	Te	Te	Th	Th	TotAlk	U
UNITS	ppm	ug/l	ppm	ug/l	mgCaCO3/L	ppm
DETECTION LIMIT	0.2	0.1	0.01	0.005	5	0.01
DIGEST	4A/	Ws/	4A/	Ws/		4A/
ANALYTICAL FINISH	MS	MS	MS	MS	/CALC	MS
SAMPLE NUMBERS						
0001 BK8295	0.6	X	0.95	X	27	0.29
0002 BK8296	0.7	X	0.94	X	29	0.28
0003 BK8298	1.7	X	2.05	X	28	0.66
0004 BK8299	5.3	X	1.98	X	30	0.64
CHECKS						
0001 BK8298		X		X		
0002 BK8298	1.5		2.13			0.69
0003 BK8296						
STANDARDS						
0001 AMIS0157						
0002 ANC-1						
0003 MPL-5	29.9		94.55			11.44
0004 N191						
0005 NAG Std 3						
0006 HgSTD-5						
BLANKS						
0001 Control Blank						
0002 Control Blank		X		X		
0003 Control Blank	X		X			X

ANALYSIS

ELEMENTS	U	V	V	Zn	Zn
UNITS	ug/l	ppm	mg/l	ppm	mg/l
DETECTION LIMIT	0.005	1	0.01	1	0.01
DIGEST	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	OE	OE	OE	OE
SAMPLE NUMBERS					
0001 BK8295	X	59	X	264	X
0002 BK8296	X	59	X	239	X
0003 BK8298	X	65	X	230	X
0004 BK8299	X	66	X	236	X
CHECKS					
0001 BK8298	X		X		X
0002 BK8298		65		241	
0003 BK8296					
STANDARDS					
0001 AMIS0157					
0002 ANC-1					
0003 MPL-5		199		1305	
0004 N191					
0005 NAG Std 3					
0006 HgSTD-5					
BLANKS					
0001 Control Blank					
0002 Control Blank	X		X		X
0003 Control Blank		X		X	

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory **NATA Laboratory Accreditation**	**NATA Scope of Accreditation**
/CALC	Intertek Genalysis Perth **3244 3237**	

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

/CSA	Intertek Genalysis Perth **3244 3237**	**MPL_W043, CSA : MPL_W043**

Induction Furnace Analysed by Infrared Spectrometry

4A/MS	Intertek Genalysis Perth **3244 3237**	**4A/ : MPL_W002, MS : ICP_W003**

Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. Analysed by Inductively Coupled Plasma Mass Spectrometry.

4A/OE	Intertek Genalysis Perth **3244 3237**	**4A/ : MPL_W002, OE : ICP_W004**

Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANCx/MTR	Intertek Genalysis Perth **3244 3237**	

Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement

ANCx/QUAL	Intertek Genalysis Perth **3244 3237**	

Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection

ANCx/VOL	Intertek Genalysis Perth **3244 3237**	

Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.

HG1/MS	Intertek Genalysis Perth **3244 3237**	**HG1/ : MPL_W008, MS : ICP_W003**

Low temperature Perchloric acid digest specific for Mercury. Analysed by Inductively Coupled Plasma Mass Spectrometry.

NAGx/MTR	Intertek Genalysis Perth **3244 3237**	

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

NAGx/VOL	Intertek Genalysis Perth **3244 3237**	

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

Ws/COL	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by UV-Visible Spectrometry.

Ws/MS	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Inductively Coupled Plasma Mass Spectrometry.

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory **NATA Laboratory Accreditation**	**NATA Scope of Accreditation**
Ws/MTR	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed with Electronic Meter Measurement

Ws/OE	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

Ws/VOL	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Volumetric Technique.

ANALYTICAL REPORT

DACIAN GOLD LIMITED
PO Box 928
APPLECROSS, W.A. 6153
AUSTRALIA

JOB INFORMATION

JOB CODE : 1839.0/1609907
No. of SAMPLES : 4
No. of ELEMENTS : 49
CLIENT O/N : DGMMWC (Job 1 of 0)
SAMPLE SUBMISSION No. :
PROJECT : MT MORGANS GOLD PROJECT
STATE : Taillings
DATE RECEIVED : 28/07/2016
DATE COMPLETED : 19/08/2016
DATE PRINTED : 19/08/2016
ANALYSING LABORATORY : Intertek Genalysis Perth

LEGEND

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

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SAMPLE DETAILS

DISCLAIMER

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

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

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

The results provided are not intended for commercial settlement purposes.

SIGNIFICANT FIGURES

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

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

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

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

SAMPLE STORAGE OF SOLUTIONS

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

ANALYSIS

ELEMENTS	Ag	Ag	Al	Al	ANC	As
UNITS	ppm	ug/l	ppm	mg/l	kgH2SO4/t	ppm
DETECTION LIMIT	0.05	0.01	50	0.01	1	0.5
DIGEST	4A/	Ws/	4A/	Ws/	ANCx/	4A/
ANALYTICAL FINISH	MS	MS	OE	OE	VOL	MS
SAMPLE NUMBERS						
0001 A16995 BK 8783	0.31	0.10	2.39%	0.05	102	31.2
0002 A16995 BK 8784	0.57	0.05	4.00%	0.07	91	67.7
0003 A17118 BK 8790	0.24	X	7.13%	0.28	107	3.4
0004 A17213 BK 8791	0.08	X	7.18%	0.21	127	3.9
CHECKS						
0001 A16995 BK 8784	0.55	0.05	4.09%	0.07		67.0
0002 A17118 BK 8790						
0003 A16995 BK 8784					93	
STANDARDS						
0001 OREAS 928	5.36		6.36%			9.6
0002 ANC-2					121	
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank					0	
0002 Control Blank						
0003 Control Blank	X	X	X	X		X

ANALYSIS

ELEMENTS	As	B	Ba	Ba	Be	Be
UNITS	ug/l	mg/l	ppm	ug/l	ppm	ug/l
DETECTION LIMIT	0.1	0.01	0.1	0.05	0.05	0.1
DIGEST	Ws/	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	OE	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 A16995 BK 8783	1.2	0.09	395.2	16.27	0.78	X
0002 A16995 BK 8784	2.4	0.10	87.6	22.35	1.29	X
0003 A17118 BK 8790	2.3	0.11	931.8	128.00	3.24	X
0004 A17213 BK 8791	0.7	0.09	1020.8	352.39	3.11	X
CHECKS						
0001 A16995 BK 8784	2.5	0.10	86.9	24.30	0.79	X
0002 A17118 BK 8790						
0003 A16995 BK 8784						
STANDARDS						
0001 OREAS 928			309.0		1.88	
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Bi	Bi	CO3	Ca	Ca	Cd
UNITS	ppm	ug/l	mgCaCO3/L	ppm	mg/l	ppm
DETECTION LIMIT	0.01	0.005	1	50	0.01	0.02
DIGEST	4A/	Ws/	Ws/	4A/	Ws/	4A/
ANALYTICAL FINISH	MS	MS	VOL	OE	OE	MS
SAMPLE NUMBERS						
0001 A16995 BK 8783	0.59	X	29	2.50%	7.40	0.64
0002 A16995 BK 8784	1.00	X	22	2.38%	7.35	0.68
0003 A17118 BK 8790	2.54	0.021	55	3.82%	2.68	0.15
0004 A17213 BK 8791	0.73	X	25	4.54%	8.81	0.05
CHECKS						
0001 A16995 BK 8784	0.94	X	31	2.45%	7.27	0.66
0002 A17118 BK 8790						
0003 A16995 BK 8784						
STANDARDS						
0001 OREAS 928	78.18			4475		0.57
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Cd	Cl	Co	Co	ColourChange	Cr
UNITS	ug/l	mg/l	ppm	ug/l	NONE	ppm
DETECTION LIMIT	0.02	2	0.1	0.1	0	5
DIGEST	Ws/	Ws/	4A/	Ws/	ANCx/	4A/
ANALYTICAL FINISH	MS	VOL	MS	MS	QUAL	OE
SAMPLE NUMBERS						
0001 A16995 BK 8783	X	17	16.3	0.6	Yes	368
0002 A16995 BK 8784	X	22	26.8	0.6	Yes	635
0003 A17118 BK 8790	X	13	23.3	1.0	Yes	411
0004 A17213 BK 8791	X	11	24.9	0.4	Yes	382
CHECKS						
0001 A16995 BK 8784	X	23	27.6	0.6		653
0002 A17118 BK 8790						
0003 A16995 BK 8784					Yes	
STANDARDS						
0001 OREAS 928			30.5			67
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X		X

ANALYSIS

ELEMENTS	Cr	Cu	Cu	EC	Fe	Fe
UNITS	mg/l	ppm	mg/l	uS/cm	%	mg/l
DETECTION LIMIT	0.01	1	0.01	10	0.01	0.01
DIGEST	Ws/	4A/	Ws/	Ws/	4A/	Ws/
ANALYTICAL FINISH	OE	OE	OE	MTR	OE	OE
SAMPLE NUMBERS						
0001 A16995 BK 8783	X	79	0.02	150	19.43	0.34
0002 A16995 BK 8784	X	119	X	180	11.32	0.27
0003 A17118 BK 8790	X	108	X	230	4.51	0.22
0004 A17213 BK 8791	X	73	X	190	4.58	0.19
CHECKS						
0001 A16995 BK 8784	X	116	X	180	11.68	0.26
0002 A17118 BK 8790						
0003 A16995 BK 8784						
STANDARDS						
0001 OREAS 928		1.56%			8.69	
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Final-pH	Fizz-Rate	HCO3	Hg	Hg	K
UNITS	NONE	NONE	mgCaCO3/L	ppb	ug/l	ppm
DETECTION LIMIT	0.1	0	2	1	0.1	20
DIGEST	ANCx/	ANCx/	Ws/	AR01/	Ws/	4A/
ANALYTICAL FINISH	MTR	QUAL	VOL	CV	MS	OE
SAMPLE NUMBERS						
0001 A16995 BK 8783	1.3	2.0000000	X	35	X	4892
0002 A16995 BK 8784	1.6	2.0000000	9	25	X	1712
0003 A17118 BK 8790	1.3	2.0000000	16	24	X	2.75%
0004 A17213 BK 8791	1.4	3.0000000	15	16	X	2.63%
CHECKS						
0001 A16995 BK 8784			X		X	1700
0002 A17118 BK 8790				17		
0003 A16995 BK 8784	1.7	2.0000000				
STANDARDS						
0001 OREAS 928						1.94%
0002 ANC-2	1.4					
0003 HgSTD-8				3142		
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank	1.0					
0002 Control Blank				2		
0003 Control Blank			X		X	X

ANALYSIS

ELEMENTS	K	Mg	Mg	Mn	Mn	Mo
UNITS	mg/l	ppm	mg/l	ppm	mg/l	ppm
DETECTION LIMIT	0.1	20	0.01	1	0.001	0.1
DIGEST	Ws/	4A/	Ws/	4A/	Ws/	4A/
ANALYTICAL FINISH	OE	OE	OE	OE	OE	MS
SAMPLE NUMBERS						
0001 A16995 BK 8783	2.0	1.04%	5.02	715	0.001	35.0
0002 A16995 BK 8784	1.3	2.28%	4.95	749	0.001	38.6
0003 A17118 BK 8790	4.4	1.58%	0.91	839	0.002	114.0
0004 A17213 BK 8791	5.9	1.87%	4.14	841	0.008	36.3
CHECKS						
0001 A16995 BK 8784	1.3	2.36%	4.83	780	0.001	38.3
0002 A17118 BK 8790						
0003 A16995 BK 8784						
STANDARDS						
0001 OREAS 928		1.68%		1103		1.1
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Mo	CN-Tot	CN-WAD	FreeCN	Na	Na
UNITS	ug/l	mg/l	mg/l	mg/l	ppm	mg/l
DETECTION LIMIT	0.05	0.2	0.2	0.2	20	0.1
DIGEST	Ws/	Ws/	Ws/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	COL	COL	COL	OE	OE
SAMPLE NUMBERS						
0001 A16995 BK 8783	4.85	0.3	X	X	5517	10.6
0002 A16995 BK 8784	6.65	0.5	0.4	X	1.91%	16.8
0003 A17118 BK 8790	16.60	X	X	X	2.88%	38.3
0004 A17213 BK 8791	6.98	0.3	0.4	X	2.75%	16.3
CHECKS						
0001 A16995 BK 8784	6.40	0.5	0.3	X	1.95%	16.7
0002 A17118 BK 8790						
0003 A16995 BK 8784						
STANDARDS						
0001 OREAS 928					1916	
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	NAG	NAGpH	NAG(4.5)	Ni	Ni	OH
UNITS	kgH2SO4/t	NONE	kgH2SO4/t	ppm	mg/l	mgCaCO3/L
DETECTION LIMIT	1	0.1	1	1	0.01	1
DIGEST	NAGx/	NAGx/	NAGx/	4A/	Ws/	Ws/
ANALYTICAL FINISH	VOL	MTR	VOL	OE	OE	VOL
SAMPLE NUMBERS						
0001 A16995 BK 8783	0	7.7	0	197	0.04	X
0002 A16995 BK 8784	31	2.7	20	307	0.05	X
0003 A17118 BK 8790	0	9.7	0	222	0.01	X
0004 A17213 BK 8791	0	9.8	0	219	0.02	X
CHECKS						
0001 A16995 BK 8784				314	0.05	X
0002 A17118 BK 8790						
0003 A16995 BK 8784	29	2.8	19			
STANDARDS						
0001 OREAS 928				28		
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3	22	2.6	18			
0005 OREAS 406						
BLANKS						
0001 Control Blank	5	4.5	0			
0002 Control Blank						
0003 Control Blank				X	X	X

ANALYSIS

ELEMENTS	Pb	pH	pH Drop	S	S	SO4
UNITS	ppm	NONE	NONE	%	mg/l	mg/l
DETECTION LIMIT	0.5	0.1	0.1	0.01	0.05	0.2
DIGEST	4A/	Ws/	ANCx/		Ws/	
ANALYTICAL FINISH	MS	MTR	MTR	/CSA	OE	/CALC
SAMPLE NUMBERS						
0001 A16995 BK 8783	14.8	9.6	2.7	2.39	9.30	27.8
0002 A16995 BK 8784	21.7	9.6	2.8	4.64	13.34	40.0
0003 A17118 BK 8790	80.8	9.7	3.3	0.74	7.58	22.7
0004 A17213 BK 8791	29.7	9.3	3.2	0.72	11.04	33.1
CHECKS						
0001 A16995 BK 8784	20.0	9.6			13.12	39.3
0002 A17118 BK 8790				0.73		
0003 A16995 BK 8784			2.8			
STANDARDS						
0001 OREAS 928	121.8					
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406				4.28		
BLANKS						
0001 Control Blank						
0002 Control Blank				X		
0003 Control Blank	X				X	X

ANALYSIS

ELEMENTS	Sb	Sb	Se	Se	Sn	Sn
UNITS	ppm	ug/l	ppm	ug/l	ppm	ug/l
DETECTION LIMIT	0.05	0.01	0.5	0.5	0.1	0.1
DIGEST	4A/	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	MS	MS	MS	MS	MS
SAMPLE NUMBERS						
0001 A16995 BK 8783	0.69	0.80	1.8	0.9	0.9	X
0002 A16995 BK 8784	0.73	1.09	3.9	1.2	0.7	X
0003 A17118 BK 8790	1.64	0.71	X	1.3	0.5	X
0004 A17213 BK 8791	1.62	0.77	X	X	0.5	X
CHECKS						
0001 A16995 BK 8784	0.71	1.18	3.8	1.2	0.6	X
0002 A17118 BK 8790						
0003 A16995 BK 8784						
STANDARDS						
0001 OREAS 928	1.38		18.6		25.7	
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Te	Te	Th	Th	TotAlk	U
UNITS	ppm	ug/l	ppm	ug/l	mgCaCO3/L	ppm
DETECTION LIMIT	0.2	0.1	0.01	0.005	5	0.01
DIGEST	4A/	Ws/	4A/	Ws/		4A/
ANALYTICAL FINISH	MS	MS	MS	MS	/CALC	MS
SAMPLE NUMBERS						
0001 A16995 BK 8783	0.6	X	0.88	X	30	0.26
0002 A16995 BK 8784	1.8	X	2.10	X	31	0.68
0003 A17118 BK 8790	1.6	X	24.27	0.086	71	6.86
0004 A17213 BK 8791	1.8	X	12.00	0.021	40	3.56
CHECKS						
0001 A16995 BK 8784	1.7	X	2.02	X		0.68
0002 A17118 BK 8790						
0003 A16995 BK 8784						
STANDARDS						
0001 OREAS 928	X		13.10			2.54
0002 ANC-2						
0003 HgSTD-8						
0004 NAG Std 3						
0005 OREAS 406						
BLANKS						
0001 Control Blank						
0002 Control Blank						
0003 Control Blank	X	X	X	X		X

ANALYSIS

ELEMENTS	U	V	V	Zn	Zn
UNITS	ug/l	ppm	mg/l	ppm	mg/l
DETECTION LIMIT	0.005	1	0.01	1	0.01
DIGEST	Ws/	4A/	Ws/	4A/	Ws/
ANALYTICAL FINISH	MS	OE	OE	OE	OE
SAMPLE NUMBERS					
0001 A16995 BK 8783	X	66	X	254	X
0002 A16995 BK 8784	X	73	X	235	X
0003 A17118 BK 8790	0.296	128	X	76	X
0004 A17213 BK 8791	0.056	122	X	64	X
CHECKS					
0001 A16995 BK 8784	X	75	X	233	X
0002 A17118 BK 8790					
0003 A16995 BK 8784					
STANDARDS					
0001 OREAS 928		76		434	
0002 ANC-2					
0003 HgSTD-8					
0004 NAG Std 3					
0005 OREAS 406					
BLANKS					
0001 Control Blank					
0002 Control Blank					
0003 Control Blank	X	X	X	X	X

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory NATA Laboratory Accreditation	NATA Scope of Accreditation
/CALC	Intertek Genalysis Perth **3244 3237**	
No digestion or other pre-treatment undertaken. Results Determined by calculation from other reported data.		
/CSA	Intertek Genalysis Perth **3244 3237**	**MPL_W043, CSA : MPL_W043**
Induction Furnace Analysed by Infrared Spectrometry		
4A/MS	Intertek Genalysis Perth **3244 3237**	**4A/ : MPL_W002, MS : ICP_W003**
Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. Analysed by Inductively Coupled Plasma Mass Spectrometry.		
4A/OE	Intertek Genalysis Perth **3244 3237**	**4A/ : MPL_W002, OE : ICP_W004**
Multi-acid digest including Hydrofluoric, Nitric, Perchloric and Hydrochloric acids in Teflon Tubes. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.		
ANCx/MTR	Intertek Genalysis Perth **3244 3237**	
Acid Neutralizing Capacity Digestion Procedure. Analysed with Electronic Meter Measurement		
ANCx/QUAL	Intertek Genalysis Perth **3244 3237**	
Acid Neutralizing Capacity Digestion Procedure. Analysed by Qualitative Inspection		
ANCx/VOL	Intertek Genalysis Perth **3244 3237**	
Acid Neutralizing Capacity Digestion Procedure. Analysed by Volumetric Technique.		
AR01/CV	Intertek Genalysis Perth **3244 3237**	
Aqua-Regia digest. Analysed by Cold Vapour Generation Atomic Absorption Spectrometry.		
NAGx/MTR	Intertek Genalysis Perth **3244 3237**	
Net Acid Generation Extraction of samples with H2O2 Analysed with Electronic Meter Measurement		
NAGx/VOL	Intertek Genalysis Perth **3244 3237**	
Net Acid Generation Extraction of samples with H2O2 Analysed by Volumetric Technique.		
Ws/COL	Intertek Genalysis Perth **3244 3237**	
Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by UV-Visible Spectrometry.		
Ws/MS	Intertek Genalysis Perth **3244 3237**	
Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Inductively Coupled Plasma Mass Spectrometry.		

METHOD CODE DESCRIPTION

Method Code	Analysing Laboratory **NATA Laboratory Accreditation**	**NATA Scope of Accreditation**
Ws/MTR	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed with Electronic Meter Measurement

Ws/OE	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

Ws/VOL	Intertek Genalysis Perth **3244 3237**	

Water Extraction using a sample:water ratio of 1:5 or to client request. Analysed by Volumetric Technique.