Geochemistry Report A

Geochemistry Report
Eastern Leases Project

Prepared for: **Hansen Bailey**

On behalf of**: South32 Pty Ltd**

Geochemistry Report

EASTERN LEASES PROJECT

Prepared for: Hansen Bailey

DOCUMENT CONTROL			
Report Title	Geochemistry Report Eastern Leases Project		
Project Name	Eastern Leases Project		
Job Number	121312	**Client**	Hansen Bailey

 ..... 123 Wynne St, Sunnybank Hills, QLD 4109 www.rgsenv.com

Limitations and disclaimer:

This report documents the work undertaken by RGS Environmental Pty Ltd (RGS).This report should be read in full. While the findings presented in this report are based on information that RGS considers reliable unless stated otherwise, the accuracy and completeness of source information cannot be guaranteed, although RGS has taken reasonable steps to verify the accuracy of such source data. RGS has made no independent verification of this information beyond the agreed scope of works and RGS assumes no responsibility for any inaccuracies or omissions outside of RGS's direct control. Furthermore, the information compiled in this report addresses the specific needs of the client, so may not address the needs of third parties using this report for their own purposes. Thus, RGS and their employees accept no liability for any losses or damage for any action taken or not taken on the basis of any part of the contents of this report. Those acting on information provided in this report do so entirely at their own risk.

This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF GRAPHS

LIST OF ATTACHMENTS

GLOSSARY OF TERMS AND ACRONYMS

Acidity	A measure of hydrogen ion (H+) concentration; generally expressed as pH.
ABA	Acid Base Account, an evaluation of the balance between acid generation and acid neutralisation processes. Generally determines the MPA and the inherent ANC, as defined below, and is commonly used in assessing the potential for AMD associated with mining.
AHD	Australian Height Datum used for altitude measurement in Australia.
AMD	Acid and metalliferous drainage caused by exposure of sulfide minerals in mine waste materials to oxygen and water. Typically characterised by low pH and elevated concentrations of salts, sulfate and metals.
ANC	Acid neutralising capacity of a sample as kg H_2SO_4 per tonne of sample. Commonly referred to as the buffering capacity.
ANC:MPA Ratio	Ratio of the acid neutralising capacity and maximum potential acidity of a sample. Used to assess the risk of a sample generating acid conditions.
Dispersive	Dispersive soil and rock materials are structurally unstable and disperse into basic particles such as sand, silt and clay in water. When a dispersive soil is wet, the basic structure has a tendency to collapse, whereas when it is dry it is prone to surface sealing and crusting.
EC	Electrical Conductivity, expressed as µS/cm, is a measure of electrical conductance.
eCEC	Effective cation exchange capacity provides a measure of the amount of exchangeable cations (Ca, Mg, Na and K) in a sample.
ESP	Exchangeable sodium percentage provides a measure of the sodicity of a materials and propensity to erode.
Interburden	The material found in between ore layers, and considered to be of low economic value (ie. a type of waste material).
KLC test	Kinetic leach column tests are procedures used to measure the geochemical/ weathering behaviour of a sample of mine material over time, and are a recognised laboratory method of replicating natural processes affecting in-situ mine material.
LoR	Limit of Reporting. Laboratory detection limit for the reporting of results for a particular geochemical test.
Middlings	A form of process residue generated as a result of processing the ore at the concentrator.
MPA	Maximum Potential Acidity calculated by multiplying the total sulfur content of a sample by 30.625 (stoichiometric factor) and expressed as kg H_2SO_4 per tonne.
NAF-Barren	Non-acid forming and barren of sulfur (i.e. less than or equal to 0.1% sulfur). Geochemical classification criterion for a sample that will not generate acid conditions.
NAG test	Net acid generation test. Hydrogen peroxide solution is used to oxidise sulfides in a sample, then any acid generated through oxidation may be consumed by neutralising components in the sample. Any remaining acidity is expressed as kg H_2SO_4 per tonne.

NAPP	Net acid producing potential expressed as kg H_2SO_4 per tonne. NAPP is the balance between the capacity of a sample to generate acidity (MPA) minus its capacity to neutralise acidity (ANC).
NMD	Neutral mine drainage typically caused by exposure of sulfide minerals in mine waste materials to oxygen and water and then neutralisation by gangue minerals. Typically characterised by neutral pH and elevated concentrations of salts, sulfate and metals.
Ore	Material that has been mined with sufficient value to warrant processing.
Overburden	The waste rock material found overlying the first ore horizon within the stratigraphic profile.
PAF	Potentially acid forming. Geochemical classification criterion for a sample that has the potential to generate acid conditions.
PSD	Particle size distribution of a sample material measured by hydrometer.
%S	Percent sulfur. A measurement unit for the sulfur content of a sample material.
Scr	Chromium reducible sulfur test measures the sulfide sulfur content of a sample material.
Slaking	Disintegration of unconfined soil or rock after exposure to air and subsequent immersion in water.
Sodic	Sodic soil and rock materials are characterized by a disproportionately high concentration of sodium (Na) in their cation exchange complex and are innately unstable, exhibiting poor physical and chemical properties, which impede water infiltration, water availability, and ultimately plant growth.
Static test	Procedure for characterising the geochemical nature of a sample at one point in time. Static tests may include measurements of mineral and chemical composition of a sample and the Acid Base Account.
Tailing (sand)	A form of process residue generated as a result of processing the ore at the concentrator. Represents the coarser size fraction of the tailings material produced.
Tailing (slime)	A form of process residue generated as a result of processing the ore at the concentrator. Represents the finer size fraction of the tailings material produced.
Total Sulfur	Total sulfur content of a sample generally measured using a 'Leco' analyser expressed as % S.
TSS	Total suspended solids is a measurement of the suspended solids concentration in a water sample.

1.0 INTRODUCTION

1.1 Background

RGS Environmental Pty Ltd (RGS) was commissioned by Hansen Bailey on behalf of BHP Billiton Manganese Australia Pty Ltd to complete a geochemical assessment of ore and mine waste materials as part of the Environmental Impact Statement (EIS) for the Eastern Leases Project (the project). The geochemical assessment has been developed as a stand-alone document suitable for inclusion in the EIS document to support an approval application for the project.

The project proponent is the Groote Eylandt Mining Company Pty Ltd (GEMCO), which has two shareholders, namely South32 Pty Ltd (60%) and Anglo Operations (Australia) Pty Ltd (40%). BHP Billiton Manganese Australia Pty Ltd was previously a shareholder in GEMCO, however its interest is now represented by South32.

The project involves the development of a number of open cut mining areas to the east of the existing GEMCO manganese mine on Groote Eylandt in the Gulf of Carpentaria, approximately 650 km south-east of Darwin (**Figure 1**). The proposed additional mining areas are located on the Eastern Leases, which are two Exploration Licences in Retention (ELRs). ELR28161 is termed the Northern Eastern Lease (Northern EL) and ELR28162 is termed the Southern Eastern Lease (Southern EL).

The Eastern Leases are located 2 km east of the existing GEMCO mine at the closest point. The township of Angurugu is located approximately 6 km to the north-west of the Eastern Leases, and is the closest residential community (**Figure 2**). The Eastern Leases are located on Aboriginal land, scheduled under the *Aboriginal Land Rights Act (Northern Territory) 1976*. The land within the Eastern Leases comprises natural bushland, with the Emerald River and a small section of the Amagula River traversing the Northern EL and Southern EL respectively.

The project involves:

- developing a number of open cut mining areas (termed “quarries”) within the Eastern Leases and mining manganese ore by the same mining methods that are in use at the existing GEMCO mine;
- constructing mine related infrastructure in the Eastern Leases (dams, water fill points, crib hut, truck park up areas and laydown storage areas); and
- transporting the ore by truck on a new haul road to be constructed between the existing GEMCO mine and the Eastern Leases.

Quarry development will involve the removal of overburden and interburden associated with the manganese ore. All overburden will be emplaced in mined quarry areas, or may be temporarily emplaced in out-of-pit emplacement areas until quarry areas are available for backfilling and rehabilitation. Interburden is found within the horizons of the manganese ore and, depending on thickness of this material, may be handled as either overburden or ore. As interburden is geologically comparable to overburden and geochemically distinct relative to manganese ore, interburden and overburden have been assessed collectively in this report. All overburden will be emplaced in mined quarry areas, or may be temporarily emplaced in out-of-pit emplacement areas until quarry areas are available for backfilling and rehabilitation.

Ore will be processed at the concentrator at the existing GEMCO mine and the concentrate would be transported to market via the existing port located at Milner Bay (**Figure 2**). No changes or upgrades to the existing GEMCO mine facilities are required as a result of the project. Ore mined from the Eastern Leases will supplement production from the existing GEMCO mine, but the project will not increase GEMCO’s annual production rate of approximately 5 Million tonnes per annum of product manganese.

The processing of manganese ore from the Eastern Leases will generate tailings (sands and slimes) and middlings. GEMCO has established handling and storage methods for process residues and these methods have been operating since the commencement of operations.

The project site for the purposes of this report is the Northern and Southern ELs.

1.2 Scope of Work

The primary purpose of this report is to complete a geochemical assessment of overburden (i.e. overburden and interburden) to be excavated during quarry development, and identify any environmental risks associated with this material. This material was characterised through field investigations and sample analysis. Where potential environmental risks were identified, conceptual management strategies have been developed by RGS to ensure that these risks are addressed.

As noted in **Section 1.1**, ore from the project will be stockpiled at the existing GEMCO mine and processed at the concentrator, also located at the existing GEMCO mine. The tailings and middlings generated by this process will be managed in accordance with GEMCO's current management strategy for tailings and middlings. In general, the EIS does not include any assessment of operations within the existing GEMCO mine, given that these operations are subject to existing environmental approvals, and will not be altered by the project. However, in accordance with the EIS Terms of Reference (TOR) that the NT Environment Protection Authority (NT EPA) has prepared for the project (NT EPA, 2014), this report includes geochemical characterisation of manganese ore, tailings and middlings. This assessment was prepared following a review of available geochemical data from the existing GEMCO mine, supplemented by targeted sampling and analysis of middlings materials from the existing operations.

The scope of this assessment is summarised as follows:

- Review available geochemical data, geological data and existing exploration and groundwater drilling databases (including plans, drill hole logs and drill core photographs) relevant to the project site;
- Design a geochemical assessment program including sampling and testing requirements for representative materials from the project site;
- Coordinate the material sampling program and geochemical analysis programs;
- Geochemically characterise representative samples of overburden, ore and middlings materials; and
- Prepare a Geochemistry Report (this report) identifying any environmental risks related to the geochemistry of project materials.

2.0 PROJECT SITE SETTING

2.1 Location and Topography

The land within and surrounding the project site comprises natural bushland. No farming or agriculture activities are undertaken within, or in the vicinity of the project site.

GEMCO has been undertaking manganese exploration activities across the Eastern Leases site since 2001. The geology of the Eastern Leases is discussed in **Section 2.2**.

The topography across the project site varies from level to undulating plains, to sandy colluvial footslopes with rugged uplands. Elevations range from approximately 10 m Australian Height Datum (AHD) to 120 m AHD.

Several drainage lines traverse the project site, including sections of the Emerald and Amagula Rivers, and their tributaries.

2.2 Geology

Groote Eylandt was formed on a stable basement of Proterozoic quartzite that outcrops over the majority of the island.

The Proterozoic basement materials were eroded and redeposited under marine conditions during the early Cretaceous period.

A blanket of Cretaceous sediments was subsequently deposited over the basement and reworked basement materials in the west of the island. The distribution of Cretaceous sediments is generally confined to the western plains of the island. The upper Cretaceous sediments contain the manganese deposits.

The manganese ore is a sedimentary layer, consisting of manganese strata occurring between clay and sand beds. The ore body is essentially stratabound and strataform in character and it represents a continuous horizon up to 11 m thick. The ore body consists of pisolitic and oolitic manganese oxides.

Much of the Cretaceous sediment profile (including some of the manganese deposits) has been extensively modified by a long period of tropical weathering (or laterisation) during the Tertiary period. This has resulted in the development of thick laterite profiles up to 25m thick.

The laterite is strongly oxidised and leached and forms the iron and alumina rich layers above the manganese ore.

The typical stratigraphy of the project site is provided in **Figure 3** and comprises (in reverse chronological order):

- A thin veneer of Quaternary sediments;
- A weathered profile of Tertiary laterite and lateritic clays;
- Cretaceous marine clays including the manganese ore;
- Cretaceous marine sandstone;
- Cretaceous sandstone of reworked quartzite basement; and
- the underlying Proterozoic quartzite basement.

The relative depth and thickness of each sedimentary unit varies across the Eastern Leases depending on the depth of the underlying Proterozoic basement.

3.0 METHODOLOGY

The geochemical assessment of the project materials was guided by the requirements of the NT EPA Environmental Assessment Guideline on Acid and Metalliferous Drainage (AMD) (NT EPA, 2013). The geochemical assessment strategy was developed taking into account the key information sources, legislative requirements and methodology described in the Guideline.

3.1 Investigation Strategy

RGS developed a site-specific investigation strategy to characterise the geochemistry of materials to be mined and processed as part of the project (RGS, 2013). The strategy was developed taking into account Australian (TEAM NT, 2004; DME, 1995; and DITR, 2006a,b; 2007a,b; 2008) and international (INAP, 2009) technical guidelines for the geochemical assessment of mine waste materials (NT EPA, 2013).

The strategy took into account the availability of detailed site-specific exploration and geological data, to allow the targeted collection of representative samples of ore and overburden from the lithological profile at the project site. In addition, the investigation layout was designed to provide sample distribution across the proposed mining areas. This combined approach allowed RGS to accurately characterise materials likely to be generated by the project.

The investigation strategy also involved review of existing geochemical data on slime and sand tailings materials and collection of middlings samples from the existing GEMCO operation to allow comparison with the results of the site-specific investigations.

3.2 Field Investigation and Sampling Program

Based upon the available site-specific exploration and geological data, field investigations undertaken at the project site included:

- Rotary coring and full core logging of six geochemistry bores; and
- Open hole drilling and logging of drill chips from 19 groundwater monitoring bores and 4 groundwater production bores (located at a total of 10 sites).

All drill holes were logged and sampled by a suitably qualified geologist or hydrogeologist to ensure the collection of representative samples.

Following review of the drilling logs, samples were selected for detailed geochemical analysis. Samples were preferentially selected from geochemistry bores due to the high quality of the cored material. Additional samples of drill chip materials were collected from representative monitoring bores.

A total of 112 ore and overburden samples were selected, comprising 54 drill core samples and 58 drill chip samples. Four supplementary middlings samples were collected from the existing middlings storage at GEMCO operation on 6 June 2014.

The distribution of samples collected is shown on **Figure 4**. **Table 1** provides the number of samples of each type of material collected and used in the geochemical assessment.

Drill chip and middlings samples typically comprised 1 to 2 kg of material stored in plastic sample bags. Drill core samples typically comprised full core taken from targeted drill core depth intervals no greater than 0.5 m. All samples were stored in a cool dry location until dispatch to Australian Laboratory Services in Brisbane (ALS Brisbane) for geochemical testing.

Table 1. Sample materials used for geochemical testing

Project Material	Representative Sample Material	Number of samples
Overburden Emplacements	Overburden	78
	Interburden	8
Ore Stockpiles	Manganese Ore Body	26
Middlings Process Residue	Middlings Process Residue	4
	Total	**116 samples**

3.3 Geochemical Test Program

The GEMCO samples received by ALS Brisbane were prepared by crushing (where necessary) and pulverising to ≤ 75 µm particle size. This standard laboratory procedure provides a homogenous sample but also generates a large sample surface area in contact with the resultant assay solution, thereby providing greater potential for dissolution and reaction, and represents an assumed initial 'worst case' scenario for these materials.

A series of static and kinetic geochemical tests were completed on the GEMCO samples. The geochemical test program was designed to assess the degree of risk from the presence and potential oxidation of sulfides, acid generation and the presence/leaching of soluble metals/metalloids and salts. The assessment also included characterisation of standard soil parameters including salinity, dispersion, cation exchange capacity, exchangeable sodium percentage, and major metal concentrations.

A summary of the parameters involved in geochemical assessment of ore and mine waste materials is provided in **Attachment A**.

3.3.1 Static Geochemical Tests

Static geochemical tests provide a 'snapshot' of the geochemical characteristics of a sample material at a single point in time. These tests were staged to screen a large number of samples before selecting either individual and/or composite samples for more detailed static test work.

The Acid Base Account (ABA) was used as a screening procedure whereby the acid-neutralising and acid-generating characteristics of a material are assessed. All 116 samples were screened using ABA. The ABA screening included static geochemical testing for the following parameters:

- pH (1:5 w:v, sample:deionised water);
- Electrical conductivity (EC) (1:5 w:v, sample:deionised water);
- Total sulfur [Leco method]; and
- Acid neutralising capacity (ANC) [AMIRA, 2002 method].

The results of the ABA screening assessment are discussed in **Section 4.1**. Where initial ABA screening results indicated that total sulfur content was greater than average crustal abundance (0.1%) (INAP, 2009), samples were selected for further sulfur speciation testing. A total of four samples were tested for chromium reducible sulfur (Scr) [AS 4969.7-2008 method].

From the total sulfur (or Scr where available) and ANC results, the maximum potential acidity (MPA) and net acid producing potential (NAPP) values of the sample materials were calculated. Where

available, the MPA and NAPP values were calculated using Scr data instead of total sulfur data. Scr data (for fresh samples) generally provides a more accurate representation of the MPA that could theoretically be generated, as acid generation primarily occurs from oxidation of reactive sulfides (eg. pyrite), whereas total sulfur includes other forms of sulfur such as sulfate and organic sulfur, which produce negligible acidity.

After the results of the ABA screening tests were received and interpreted, 18 drill core samples and four middlings samples were selected, prepared and subjected to multi-element analysis. The samples were selected based on material type, location, lithology and geochemical characteristics. All selected samples underwent multi-element testing on both the solid and soluble fractions. The 22 selected samples were tested for:

- Total alkalinity and acidity (automatic titrator measured as $CaCO_3$);
- Total metals/metalloids (Al, Ag, As, B, Ba, Be, Cd, Cr, Co, Cu, Fe, Hg, Pb, Mn, Mo, Ni, Sb, Se, Th, U, V and Zn) in solids [HCl and HNO_3 acid digest followed by FIMS and/or ICP-AES/MS];
- Total cations (Ca, Mg, Na and K) [HCl and HNO_3 acid digest followed by ICP-AES/MS];
- Soluble metals/metalloids (Al, Ag, As, B, Ba, Be, Cd, Cr, Co, Cu, Fe, Hg, Pb, Mn, Mo, Ni, Sb, Se, Th, U, V and Zn) [ICP-AES/MS and FIMS (1:5 w:v water extracts)];
- Major cations (Ca, Mg, Na and K) [ICP-AES/MS (1:5 w:v water extracts)]; and
- Major anions (Cl, F and SO_4) [ICP-AES/MS and PC Titrator (1:5 w:v water extracts)].

A total of six samples were logged as containing a visual abundance of the clay minerals smectite and kaolinite. These samples included one sample from EL-N-GC02 (4.5-4.85m); three samples from EL-N-GC03 (8.6-9.0 m, 21.0-21.5 m and 22.65-22.8 m) and two samples from EL-S-GC04 (8.4-8.7 m and 9.5 to 9.8 m). As these samples were located in overburden (two samples) and interburden (four samples), and were visually distinct, these six samples were subjected to additional detailed testing to confirm the likely behaviour of these clays if disturbed by mining, including:

- Exchangable Cations (Ca, Mg, Na, K) [by ICP-AES/MS];
- Effective Cation Exchange Capacity (eCEC) and Exchangeable Sodium Percentage (ESP);
- Particle Size Distribution (PSD) [hydrometer - AS1289.3.6.3]; and
- Emerson Aggregate test.

The ALS test results for the static geochemical test program are provided in **Attachment B**. Summary results tables are provided in **Attachment C** and discussed in **Sections 4** to **6**.

3.3.2 Kinetic Geochemical Tests

Following receipt and interpretation of the static geochemical test results, six Kinetic Leach Column (KLC) tests were set up at the RGS in-house laboratory using crushed or 'as received' samples. The KLC tests comprised the most representative composite samples of overburden (four samples), ore (one sample) and middlings (one sample). The KLC tests commenced in August 2014 and operated under a monthly watering and leaching cycle for six months until February 2015. The KLC tests followed standard mining industry guidelines for such tests (AMIRA, 2002).

Approximately 1-2 kg of each selected sample was used in the KLC tests with the weight varying according to sample bulk density. Heat lamps were used on a daily basis to simulate sunshine and ensure that the KLC test materials were unsaturated and subject to oxidising conditions between leaching events. This method essentially represents the worst case or maximum potential for sulfide oxidation and potential acid/salt generation.

All leachate samples collected from the KLC tests were sent to ALS Brisbane for analysis of various parameters including:

- pH and EC;
- Acidity and alkalinity [Automatic titrator];
- Dissolved metals/metalloids (Ag, Al, As, B, Ba, Be, Cd, Cr, Co, Cu, F, Fe, Hg, Pb, Mn, Mo, Ni, Sb, Se, Th, U, V and Zn) [ICP-AES and FIMS];
- Dissolved major cations (Ca, Mg, Na and K) [ICP-AES]; and
- Dissolved major anions (Cl, SO_4) [ICP-AES].

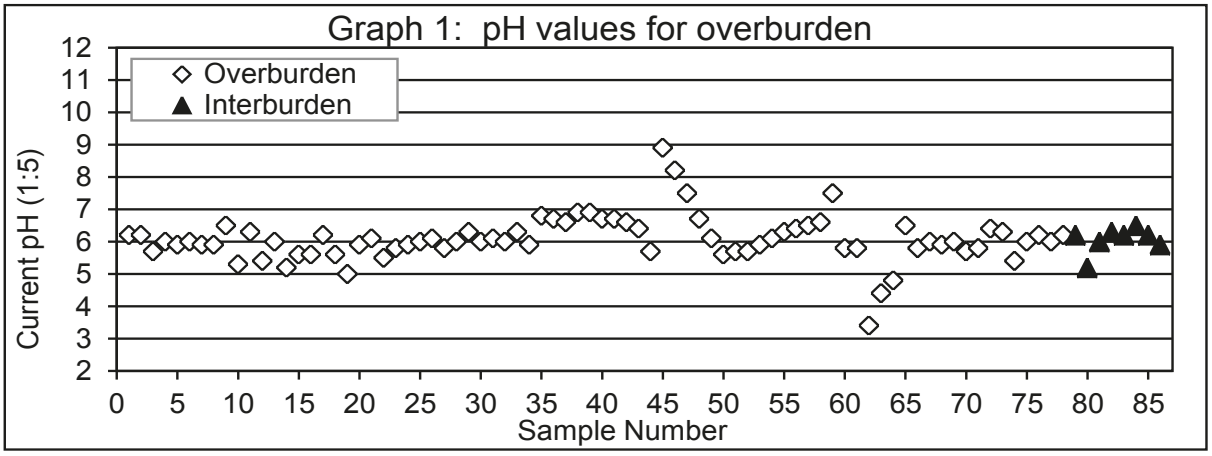
The ALS test results for the kinetic geochemical test program are provided in **Attachment B**. Summary results tables are provided in **Attachment D** and discussed in **Sections 4** to **6**.

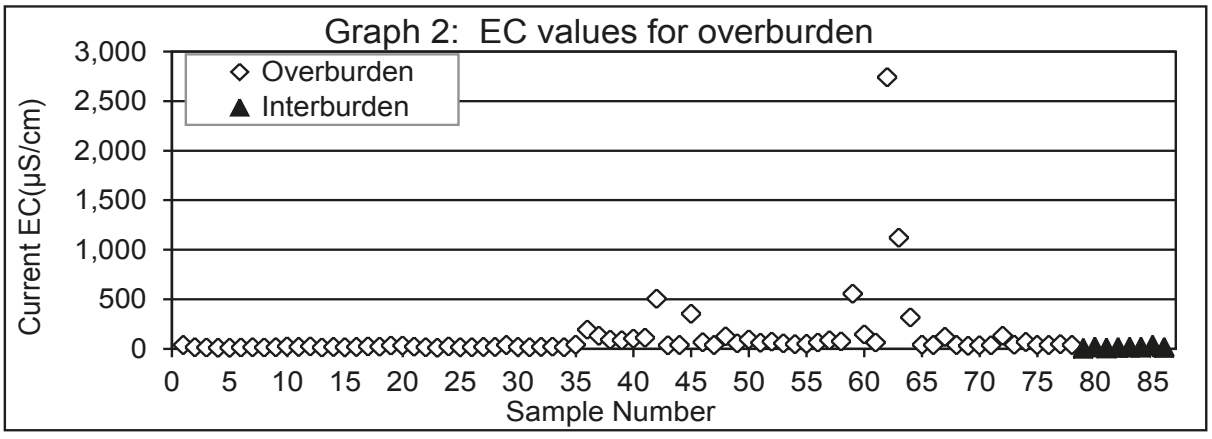
4.0 OVERBURDEN GEOCHEMISTRY

4.1 Acid Base Account Results

The ABA results for the 86 overburden samples are provided in **Table C-1 (Attachment C).** For the purposes of this discussion, the term overburden has been used to refer to both overburden and interburden samples. An explanation of the methodology used in this section, including a description of the ABA screening method, is provided at **Section 3.3** and a glossary of terms and acronyms used is listed on **Page IV**. The ABA data trends discussed in this section are presented in **Graphs 1** to **5**.

- **pH**: The natural pH of the deionised water used in the pH tests is typically in the pH range 5.0 to 6.5. The $pH_{(1:5)}$ of the 86 overburden samples ranges from pH 3.4 to 8.9 and has a neutral median pH value of 6.0 (**Graph 1**). The majority of the samples (92 %) have pH values within the range pH 5.0 to 7.0. Four overburden samples have a pH value greater than pH 7.0 indicating the presence of some alkalinity. Three overburden samples have pH values less than pH 5.0 indicating the presence of some acidity. The three samples with reduced pH values represent clay (drill chip) overburden material sampled from drill hole EL-S-MB06 (18m, 21m and 24m depth) located at the north-west of the Southern Eastern Lease. There is no other correlation between sample pH and sample location, depth, type or lithology.
- **Electrical Conductivity (EC)**: The current $EC_{(1:5)}$ of the 86 overburden samples ranges from 6 to 2,740 µS/cm and is typically low, (median 36 µS/cm). Two overburden samples have an EC value greater than 1,000 µS/cm (**Graph 2**) and represent clay (drill chip) overburden material sampled from drill hole EL-S-MB06 at 18m and 21m depth. There is no other correlation between sample EC and sample location, depth, type or lithology.

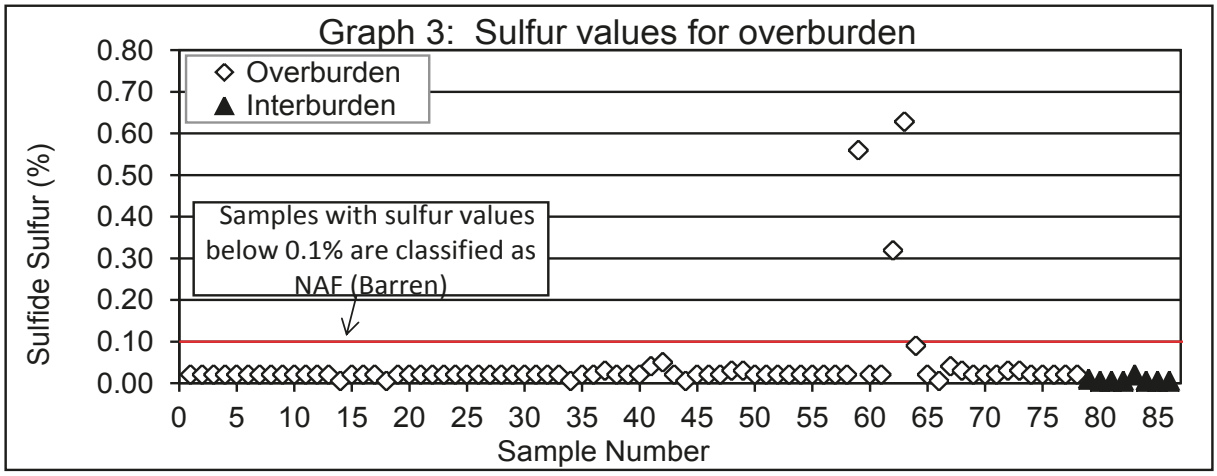




- **Total Sulfur:** The total sulfur content of the 86 overburden samples range from 0.005 percent sulfur (%S) to 0.87 %S and is typically low (median 0.02 %S) compared to average crustal abundance (0.1 %) for this element (INAP, 2009). Materials with a total sulfur content less than or equal to 0.1 %S are essentially barren of sulfur, generally represent background concentrations, and have negligible capacity to generate acidity[1]. Three of the 86 overburden samples tested (3.5 %) had total sulfur values greater than 0.1 %S. These samples represent overburden from bores EL-S-MBO5 (36 m) and EL-S-MB06 (18 m and 21 m).

- **Sulfide Sulfur:** Scr analysis was undertaken on the three overburden samples with total sulfur values greater than 0.1 %S to confirm their sulfide sulfur content. One of the three samples (EL-S-MB-06 (18 m)) had a sulfide sulfur value significantly less than the total sulfur value, indicating that much of the sulfur is likely to be present as other forms of sulfur such as organic sulfur and sulfate which, in comparison to a reactive sulfur form such as pyrite, has negligible capacity to generate acidity if exposed to oxidising conditions. The remaining two samples have sulfide sulfur values similar to total sulfur values indicating that most of the sulfur is likely to be present as reactive sulfur (eg. pyrite).

  Graph 3 shows the sulfur content of the overburden materials[2] and illustrates that these materials typically have very low sulfide sulfur content, with 83 of the 86 samples (96.5 %) having sulfide sulfur content less than 0.1 %S.



- **Maximum Potential Acidity (MPA)**: The MPA for the overburden samples ranges from 0.2 to 19.2 kg H_2SO_4/t, and is typically very low with a median value of 0.6 kg H_2SO_4/t.

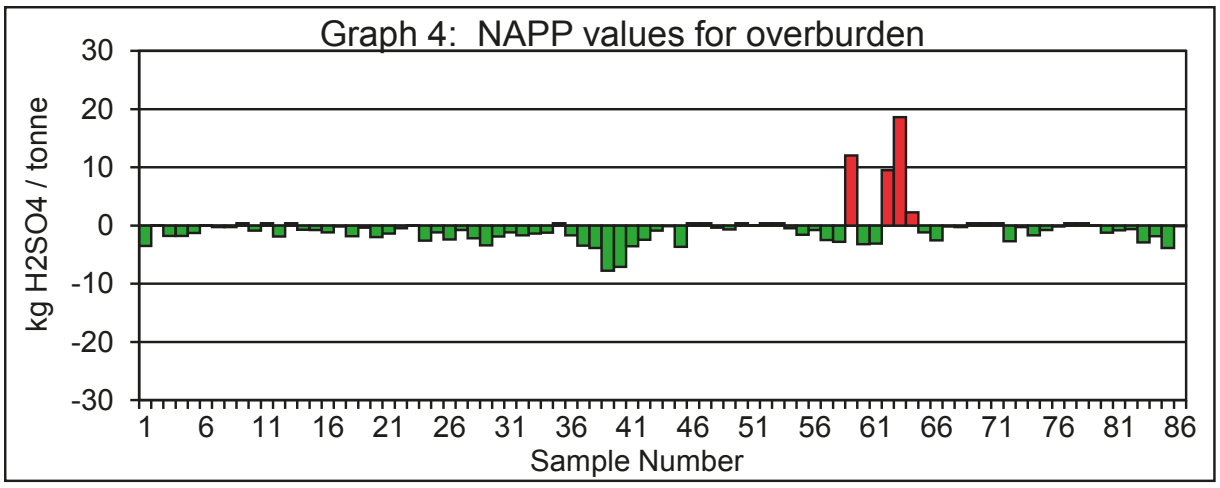
- **Acid Neutralising Capacity (ANC)**: The ANC value for the overburden samples ranges from 0.25 to 8.4 kg H_2SO_4/t and has a median value of 1.4 kg H_2SO_4/t (more than double the median MPA).

- **Net Acid Producing Potential (NAPP)**: The NAPP is the balance between the capacity of a sample to generate acidity (MPA) minus its capacity to neutralise acidity (ANC). The calculated NAPP value for the samples ranges from -7.8 to +18.6 kg H_2SO_4/t and has a negative median value of -0.8 kg H_2SO_4/t. The NAPP data for the overburden samples are presented in **Graph 4** and illustrate that the vast majority of overburden samples have NAPP values that are negative or close to zero.

  Given the typically low sulfide sulfur content of these materials, the risk of generating any significant acidity and/or neutral mine drainage (NMD) from bulk overburden materials is

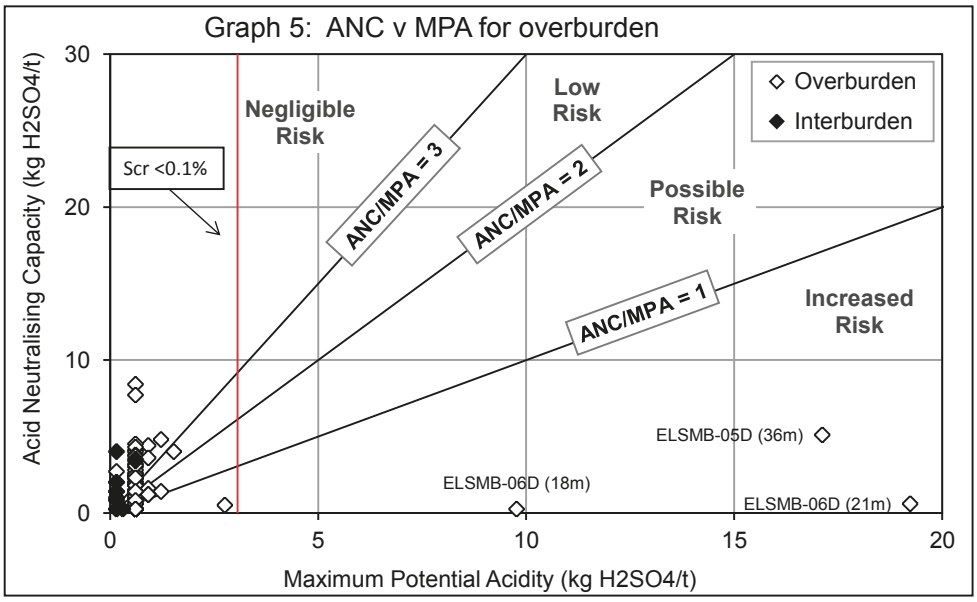
[1] The average crustal abundance of sulfur is approximately 0.1 % (INAP, 2009).
[2] The total sulfur content of the samples was used in the graph when no sulfide sulfur data was available.

negligible. Only three overburden samples have a significantly positive NAPP value (ie. greater than 3 kg H_2SO_4/t) (INAP, 2009). The three samples were all sourced from two drill holes (EL-S-MB05 and EL-S-MB06) located at the north-west end of the Southern Eastern Lease and correspond to the 3 samples which had sulfide sulfur values >0.1%.



- **ANC:MPA ratio**: The ANC:MPA ratio of the overburden samples ranges from 0.03 to 26.1 and is typically elevated (median 2.5). In simplistic terms, this means that the ANC is greater than double the small amount of MPA that could theoretically be generated from the overburden samples.

Graph 5 shows a plot of ANC versus MPA for the overburden samples. ANC:MPA ratio lines have been plotted on the graph to illustrate the factor of safety associated with the samples, in terms of potential for generation of AMD. Generally those samples with an ANC:MPA ratio of greater than 2 and a sulfide sulfur content of <0.1% are considered to represent material with a low to negligible risk of acid generation and a high factor of safety in terms of potential for AMD (DITR, 2007; INAP, 2009). The majority of the samples fall within the negligible and low risk domains in the graph and therefore have a high factor of safety and very low risk of acid generation.



Three of the overburden samples fall in the 'increased risk' domain and represent clay overburden materials sampled from two drill holes (EL-S-MB05-D and EL-S-MB06-D) located at the north-west end of the Southern Eastern Lease. These samples correspond to those samples that reported sulfide sulfur >0.1% and elevated NAPP.

The ABA test data presented in **Table C-1 (Attachment C)** and discussed in this section has been used to classify the acid forming nature of the overburden materials. These classification criteria generally reflect Australian (DITR, 2007) and international (INAP, 2009) guideline criteria for classification of mine waste materials. **Table 2** provides a summary of the criteria used by RGS to classify the acid forming nature of the samples and a breakdown of the number of samples in each classification category by material type.

The data presented in **Table 2** illustrate that 83 of the 86 overburden samples (96.5%) are classified as Non-Acid Forming-Barren (NAF-Barren) and only 3.5 % are classified as Potentially Acid Forming (PAF). The three samples classified as PAF were all sourced from below 18 m depth at two drill holes (EL-S-MB05 and EL-S-MB06) located at the north-west end of the Southern Eastern Lease.

Table 2: Geochemical classification criteria for overburden

Geochemical Classification	Sulfide Sulfur[1] (%)	NAPP (kg H_2SO_4/t)	ANC:MPA Ratio	Overburden (n = 86)
Non-Acid Forming (Barren)[2]	≤ 0.1	-	-	83
Uncertain[3]	> 0.1	< 3	< 2	0
Potentially Acid Forming	> 0.1	> 3	< 2	3

Notes:
1. If total sulfur or sulfide sulfur is less than or equal to 0.1 %, the NAPP and ANC:MPA ratio are not required for material classification as the sample is essentially barren of oxidisable sulfur.
2. A sample classified as NAF can be further described as 'barren' if the total sulfur and/or sulfide sulfur content is less than or equal to 0.1 per cent, as the sample essentially has negligible acid generating capacity.
3. Samples that fall outside the stated NAF-Barren/PAF classification categories based on the criteria provided are classified as Uncertain.

4.2 Multi-Element Concentration in Solids

Multi-element scans were carried out on 16 selected samples of overburden to identify any elements (metals/metalloids) present in these materials at concentrations that may be of environmental concern with respect to materials handling, storage, and water quality. The results were compared to potentially relevant guideline criteria to determine any concerns related to mine operation and final rehabilitation. To provide relevant context, RGS has compared the total metal/metalloid concentration in samples to National Environmental Protection Council (NEPC) Health-based Investigation Levels (HIL(C)) for soils in public open spaces (NEPC, 2013).

The 16 samples of overburden materials used in the multi-element test work are described in **Table C-2 (Attachment C)**. The results from multi-element testing (total metals/metalloids) of the samples are presented in **Table C-3 (Attachment C)**. The results indicate that the overburden materials typically have low total metal and metalloid concentrations in solids, many below the laboratory limit of reporting (LoR) and all below the applied NEPC (HIL(C)) guideline for soils. The only exception is the elevated concentration of manganese, which exceeds the NEPC (HIL(C)) guideline in 11 of 16 samples. This is expected given that these samples were taken from in and around a manganese deposit.

4.3 Dispersion and Erosion

4.3.1 Sodicity

The exchangeable sodium percentage (ESP) results for 16 overburden samples described in **Section 4.2** are presented in **Table C-3 (Attachment C).**

The ESP results for the composite overburden samples range from <0.1 to 3.5 % and have a median value of 1.8 %. Generally samples with ESP values less than 6 are considered non-sodic and unlikely to be susceptible to dispersion and erosion (Isbell, 2002; and Northcote and Skene, 1972).

Overall, the results of the eCEC and ESP tests indicate that the overburden materials are likely to be non-sodic, and are consequently unlikely to be susceptible to dispersion and erosion.

4.3.2 Ultrafine Clays

As described in **Section 3.3.1**, smectite and kaolinite clay minerals occur within some of the overburden and interburden materials at the Eastern Leases and are generally ultrafine-grained (normally considered to be less than 2 µm in size in standard particle size classification systems).

The results of Particle Size Distribution (PSD) and Emerson Aggregate (EA) tests on these materials are summarised in **Table C-4** (**Attachment C).**

The PSD results indicate that the composition of the six overburden samples selected for testing is between 9 % and 45 % clay minerals, with the remainder comprising silt, sand and gravel.

The EA test results indicate that the six overburden samples are characterised as either slaking but non-dispersive (Class 4) or non-slaking and non-dispersive (Class 8).

Overall, the PSD and EA results suggest that materials represented by the six overburden samples generally contain a smaller proportion of clay minerals compared to their combined silt, sand and gravel fraction and are classified as non-dispersive.

4.4 Water Quality Static Leach Tests

RGS has compared the multi-element results in water extracts from the 16 overburden samples described in **Section 4.2** with ANZECC & ARMCANZ (2000) guideline values. These guidelines are provided for context only and are not intended to be interpreted as “maximum permissible levels” for site water storage or discharge. Site-specific water quality criteria are described in detail in the EIS Surface Water Section.

It should also be recognised that direct comparison of geochemical data with guideline values can be misleading. For the purpose of this study, guideline values are only provided for broad context and should not be interpreted as arbitrary ‘maximum’ values or ‘trigger’ values. Using sample pulps (ground to passing 75 µm) provides a very high surface area to solution ratio, which encourages mineral reaction and dissolution of the solid phase. As such, the results of screening tests on water extract solutions are assumed to represent an assumed ‘worst case’ scenario for initial surface runoff and seepage from overburden materials.

The results from multi-element testing of water extracts (1:5 solid:water) from the 16 overburden samples are presented in **Table C-5 (Attachment C)**.

The pH of the water extracts ranges from pH 4.9 to 6.2 (median 5.7) and is typically within the pH range of the deionised water used in the water extract tests (ie. pH 5.0 to 6.5). This indicates that these materials are unlikely to contribute any acidity to initial surface runoff and seepage.

This is further supported by the typically low acidity of the water extracts, which ranges from 3 to 14 mg/L (median 5 mg/L). The alkalinity of the water extracts spans the same range (3 to 14 mg/L) (median 6 mg/L), and is typically equivalent to the measured acidity.

The EC in the water extracts is typically very low, ranging from 8 to 36 µS/cm (median 17 µS/cm). This confirms that these materials exhibit low salinity and low concentrations of dissolved solids when in contact with water. The concentrations of the major cations and anions in the water extracts are typically very low and below the LoR.

The concentration of all trace metals/metalloids tested in the water extracts is below the laboratory LoR in all samples. The only exception is manganese, which is above the LoR in most samples. However, the maximum and median values of 0.254 mg/L and 0.007 mg/L are well below the guideline value of 1.90 mg/L for protection of freshwater ecosystems.

The results indicate that dissolved metal/metalloid concentrations in initial surface runoff and seepage from permanent overburden emplacements are unlikely to impact upon the quality of surface and groundwater resources at relevant storage facilities.

4.5 Water Quality Kinetic Leach Tests

As described in **Section 3.3.2** and **Attachment A**, KLC tests were undertaken for four composite samples of overburden from the project site (i.e. KLC 1 to KLC 4). The composite KLC samples comprised three samples (KLC2, KLC3 and KLC4) that are representative of the NAF materials that comprise the vast majority of the overburden that will be generated by the project. A composite KLC sample (KLC1) was also selected to further investigate the characteristics of the small proportion of the potential overburden material that was identified as PAF from static testing.

The KLC test results are presented in **Attachment D** and interpreted in this section**.** The compositions of the four composite samples used in the KLC tests are provided in **Table C-9 (Attachment C).** The static ABA test results for the individual samples used to make up the four composite KLC samples are detailed in **Table C-10** (**Attachment C**).

The KLC leachate concentrations are presented alongside ANZECC & ARMCANZ (2000) guideline values. These guidelines are provided for context only and are not intended to be interpreted as “maximum permissible levels” for site water storage or discharge. It should be noted that the ratio of sample to water in most of the KLC tests is typically 2:1 (w/v) (i.e. concentrated), whereas the ratio of sample to water generally used in tests where results can (arbitrarily) be compared against guideline concentrations to provide relevant context is an order of magnitude more dilute at 1:5 (w/v). Whilst arbitrary comparisons against guideline concentrations can be useful in some situations and help to provide relevant context, such comparisons cannot be directly extrapolated to the field situation at the project.

5.4.1 Bulk Overburden Leachate

The KLC leachate pH trends show that the leachate pH from the three NAF overburden samples is fairly consistent over the six month test period and remains within the pH range 5.3 to 7.3. Dynamic contact with overburden typically adds very little acidity or alkalinity to the deionised water used in the KLC tests (the typical pH of the deionised water used in the tests is in the pH range 5 to 6.5).

The EC value of KLC leachate from the overburden samples is typically low and ranges from 12 to 99 µS/cm. The EC generally shows a steady or decreasing trend over the test period. After the initial leaching event, the EC of KLC leachate remains below 50 µS/cm, even under ideal oxidising (wetting and drying) conditions.

The concentration of sulfate in leachate from the KLC tests has been used to calculate the residual sulfur content of the overburden materials. The results show that at least 97.8 % of the total sulfur content remains in the NAF samples. For these samples, the sulfate concentration in KLC leachate is generally two orders of magnitude lower than the applied guideline value (ANZECC & ARMCANZ, 2000).

The concentrations of dissolved calcium and magnesium in leachate from the KLC tests have been used to calculate the residual ANC remaining in the overburden materials. The results indicate that for

the NAF samples, at least 99.2 % of the measured ANC remains in the samples at the end of the test period.

The sulfate generation rate results obtained for the four KLC tests on overburden have been used to determine the rate of sulfide oxidation in these materials. Most sulfate salts generated from sulfide reaction involving materials with a relatively low sulfide sulfur concentration are highly soluble, and therefore will be collected in column leachate. The dissolved sulfate (and calcium) concentrations in the KLC leachate are typically less than the solubility limit of gypsum ($CaSO_4$), which indicates that sulfate generation is not controlled by gypsum dissolution in the KLC test materials. Therefore, the sulfate concentrations and oxidation rate calculations provide reasonable estimates of these parameters and the results align well with existing static and dynamic geochemical data derived from a wide range of mine waste materials (AMIRA, 1995). The sulfate generation rate and associated sulfide oxidation rate for the four KLC tests are shown in **Table 3**.

Table 3: Sulfate Generation and Sulfide Oxidation Rates for KLC Tests on Overburden

KLC Sample No.	Sample Description	Sulfate Generation Rate (mg/kg/week)	Oxidation Rate ($kg/O_2/m^3/s$)
KLC 1	PAF Overburden	302.3	1.2×10^{-7}
KLC 2	NAF Overburden	0.3	1.3×10^{-10}
KLC 3	NAF Overburden	0.1	4.1×10^{-11}
KLC 4	NAF Overburden	0.2	7.3×10^{-11}

The concentration of dissolved sulfate in leachate from the NAF samples is relatively consistent and tends towards a long term equilibrium value. The sulfate generation rate from the NAF overburden KLC samples ranges from 0.1 to 0.3 mg/kg/week indicating that the rate of sulfide oxidation is low in these materials (equivalent to an oxidation rate ranging from 4.1×10^{-11} to 1.3×10^{-10} kg $O_2/m^3/s$). Mine materials with an oxidation rate in this range have an increased factor of safety, and are likely to generate leachate that is pH neutral and/or has low levels of acidity (AMIRA, 1995; Bennett *et al*., 2000). Hence, all of the NAF overburden samples fall into this category and the KLC results reflect the NAF material characteristics predicted from static geochemical test results presented in **Section 4.1**.

The concentration of dissolved trace metals/metalloids in leachate from the four KLC tests on NAF overburden materials is typically very low, below the laboratory LoR, and within applied water quality guidelines. The only exception is manganese, which is above the LoR in the leachate samples with maximum and median values of 0.157 mg/L and 0.014 mg/L, respectively. These values are below the default water quality guideline value of 1.9 mg/L for protection of freshwater ecosystems.

Overall, these results indicate that dissolved metal/metalloid concentrations in ongoing surface runoff and seepage from the bulk overburden materials at emplacement areas are unlikely to significantly impact upon the quality of surface and groundwater resources.

5.4.1 Localised PAF Overburden

As expected, the KLC leachate from the single PAF overburden sample (KLC1) has an acidic pH value, which remains within the range pH 4.9 to 2.3 and shows a decreasing trend from week 13 of the test period. This sample initially generates low EC leachate (109 µS/cm), but shows an increasing trend over the test period towards a final EC of approximately 7,000 µS/cm.

Approximately 60 % of the total sulfur content remains in the PAF sample at the end of the six month test period and the sulfate concentration in this leachate is also elevated towards the end of the test

period, as the ANC is consumed. However, the high residual ANC (99%) of the bulk overburden materials is likely to offset the depleted ANC exhibited by localised PAF material.

Nonetheless, the rates of sulfate generation and sulfide oxidation (**Table 4**) are greater than the bulk overburden and indicate that the localised PAF overburden material has a reduced factor of safety (AMIRA, 1995; Bennett *et al*., 2000). Management measures for handling and placing the small amount of PAF materials at overburden emplacement areas are provided at **Section 4.6**.

The concentration of dissolved trace metals/metalloids in this leachate shows a slight increase in metal concentrations (for aluminium, cobalt, copper, nickel and selenium) over the test period. While this indicates that localised PAF overburden materials have some potential to leach trace metals/metalloids into contact water with prolonged exposure to ideal oxidising (wetting and drying) conditions, management measures are proposed for handling and placing the small amount of PAF materials to ensure that these conditions are mitigated (**Section 4.6**).

4.6 Management Measures

The interburden materials were found to be geochemically stable and no specific management measures are required to manage dispersion or erosion.

The bulk overburden materials were also geochemically stable, with no special management measures are required for the handling or storage of the majority of these materials.

However, there will be specific management measures for the handling and placing of overburden from the small area in the Southern Eastern Lease, which has been identified as containing PAF material. Management measures for this area include:

- Undertaking geochemical sampling ahead of mining in areas located within 500 m of EL-S-MB06 and EL-S-MB05 in order to identify any PAF material;
- Selectively handling and burying any PAF material within the centre of overburden emplacement areas away from final outer surfaces. PAF material will be placed directly within in-pit overburden emplacements, and will not be stored within temporary overburden emplacements.

In addition, samples will be collected at random from overburden emplacements and analysed on-site using net acid generation (NAG) tests as a rapid screening tool.

Surface water and seepage from overburden emplacement areas will be monitored to ensure that key water quality parameters remain within appropriate criteria. The proponent will:

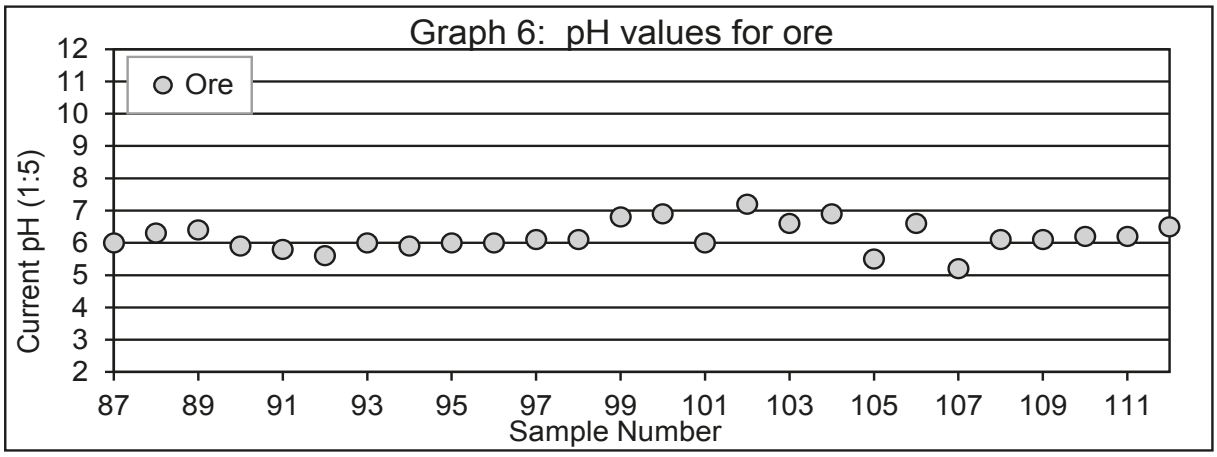
- Monitor surface run-off and seepage from the proposed overburden emplacement areas for pH, EC, total suspended solids (TSS) and the range of dissolved trace metals/metalloids and major ions including manganese on a quarterly basis; and
- Undertake groundwater monitoring in accordance with the program described in the EIS Groundwater Report.

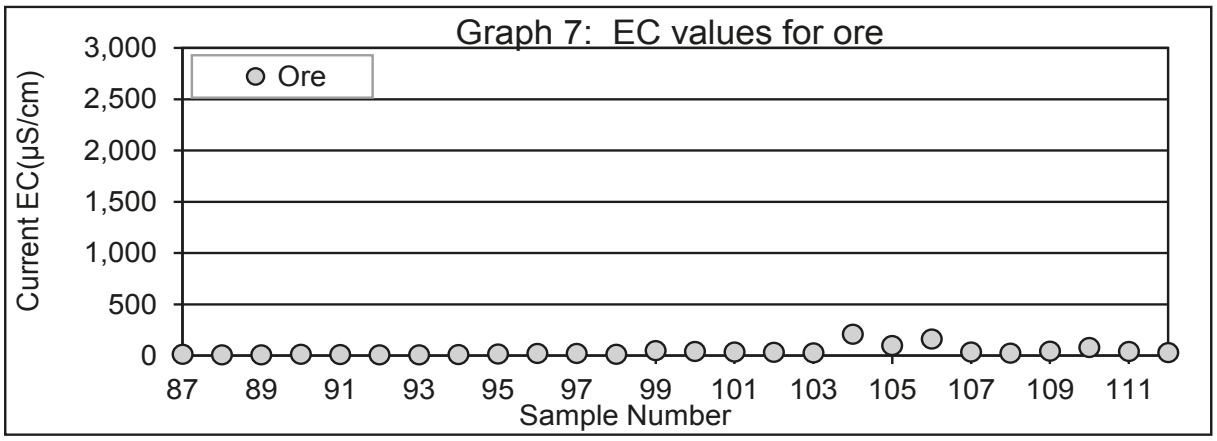
5.0 ORE GEOCHEMISTRY

5.1 Acid Base Account Results

The ABA results for the 26 ore samples are provided in **Table C-1 (Attachment C).** The ABA data trends for ore are discussed in this section and presented in **Graphs 6** to **10**.

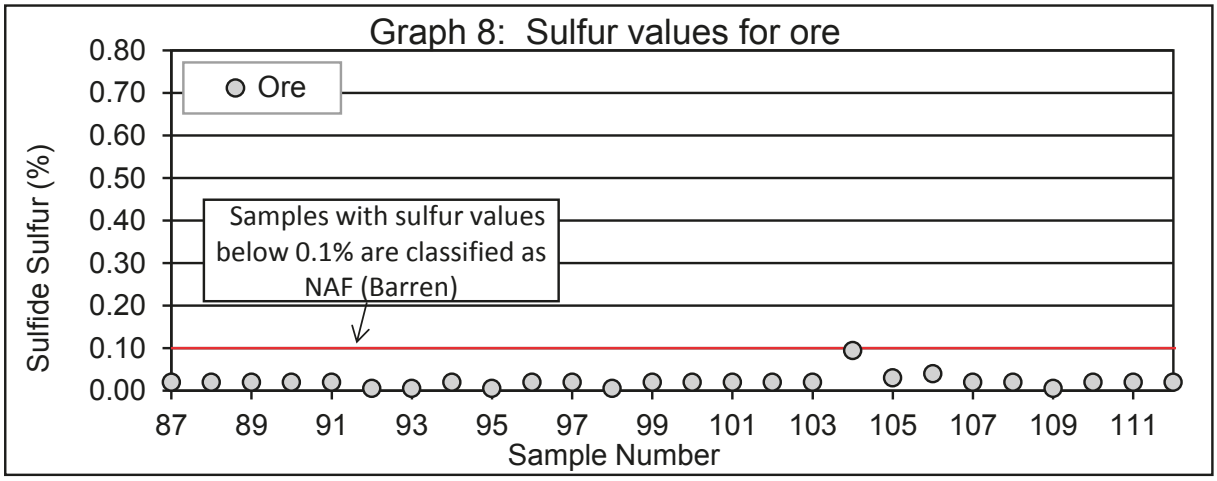
- **pH**: The natural pH of the deionised water used in the pH tests is typically in the pH range 5.0 to 6.5. The $pH_{(1:5)}$ of the 26 ore samples ranges from pH 5.2 to 7.2 and has a neutral median pH value of 6.1 (**Graph 6**).
- **EC**: The current $EC_{(1:5)}$ of the 26 ore samples ranges from 8 to 209 µS/cm and is typically low, (median 26 µS/cm) (**Graph 7**).





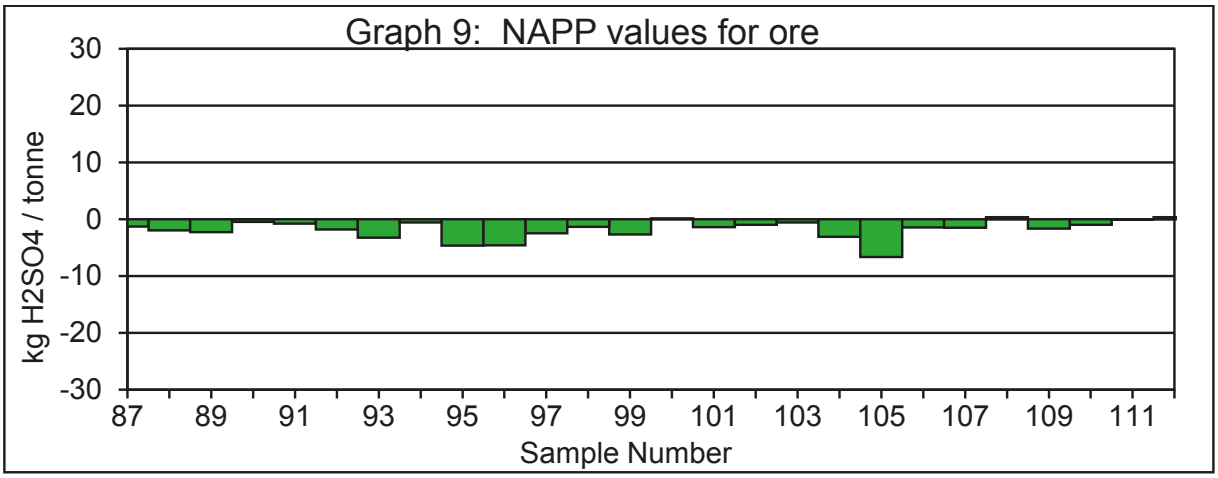
- **Total Sulfur:** The total sulfur content of the 26 ore samples ranges from 0.005 %S to 0.31 %S and is typically low (median 0.02 %S) compared to background levels (0.1 %) for this element (INAP, 2009).
- **Sulfide Sulfur:** Scr analysis was undertaken on the single ore sample (EL-S-MB05 (39 m)) with a total sulfur value greater than 0.1 %S to confirm its sulfide sulfur content. The ore sample had a sulfide sulfur value of <0.1%. This is significantly less than the total sulfur value, indicating that much of the sulfur is likely to be present as other forms of sulfur such as organic sulfur and sulfate which, in comparison to a reactive sulfur form such as pyrite, has negligible capacity to generate acidity if exposed to oxidising conditions.

Graph 8 shows the sulfide sulfur content of the ore samples and illustrates that these materials typically have very low sulfide sulfur content, and all samples have a sulfide sulfur content less than or equal to 0.1 %S.



- **Maximum Potential Acidity (MPA)**: The MPA for the ore samples ranges from 0.2 to 2.9 kg H_2SO_4/t, and is typically very low with a median value of 0.6 kg H_2SO_4/t.
- **Acid Neutralising Capacity (ANC)**: The ANC value for the ore samples ranges from 0.25 to 7.6 kg H_2SO_4/t and has a median value of 2 kg H_2SO_4/t (i.e. more than three times the median MPA).
- **Net Acid Producing Potential (NAPP)**: The calculated NAPP value for the ore samples ranges from -6.7 to +0.4 kg H_2SO_4/t and has a negative median value of -1.4 kg H_2SO_4/t. The NAPP data for the ore samples are presented in **Graph 9** and illustrate that all ore samples have NAPP values that are negative or close to zero.

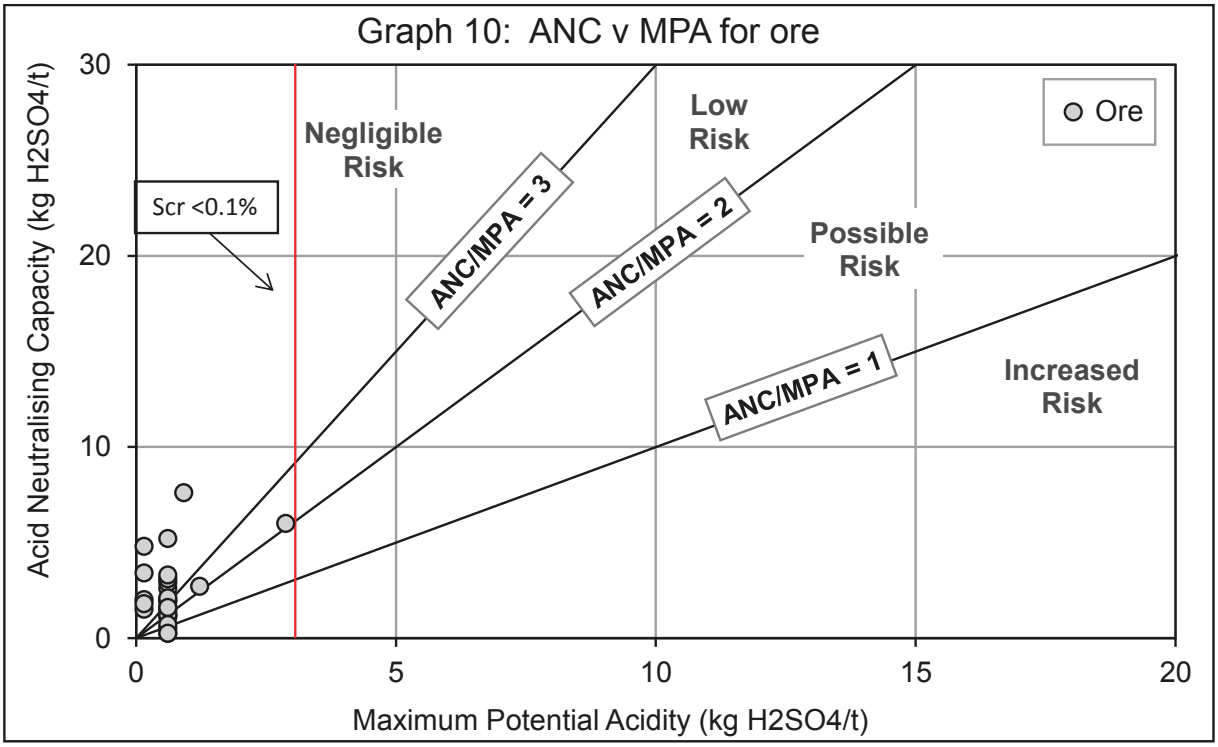
  Given the uniformly low sulfide sulfur content of these samples, the risk of generating any significant acidity and/or neutral mine drainage (NMD) from bulk ore materials is negligible.



- **ANC:MPA ratio**: The ANC:MPA ratio of the ore samples ranges from 0.4 to 31.3 and is typically elevated (median 3.2). In simplistic terms, this means that the ANC is more than three times the small amount of MPA that could theoretically be generated from the ore samples.

Graph 10 shows a plot of ANC versus MPA for the ore samples. ANC:MPA ratio lines have been plotted on the graph to illustrate the factor of safety associated with the samples, in terms of potential for generation of AMD. All of the samples fall within the negligible and low risk domains in the graph or have a negligible MPA content; and therefore have a high factor of safety and very low risk of acid generation.

The geochemical classification criteria previously presented in **Table 2** highlights that all of the ore samples are classified as NAF-Barren.



5.2 Multi-Element Concentration in Solids

Multi-element scans were carried out on two selected samples of ore to identify any elements (metals/metalloids) present in these materials at concentrations that may be of environmental concern with respect to materials handling, storage, and water quality. The ore samples used in the multi-element test work are described in **Table C-2 (Attachment C)**. The results from multi-element testing (total metals/metalloids) of the samples are presented in **Table C-3 (Attachment C)**.

The results indicate that the ore materials typically have low total metal and metalloid concentrations in solids, many below the LoR and all below the applied NEPC (HIL(C)) guideline for soils. The only exception is the elevated concentration of manganese, which exceeds the NEPC (HIL(C)) guideline in both samples. This is expected given that these samples were taken from within a manganese deposit.

5.3 Water Quality Static Leach Tests

The results from multi-element testing of water extracts (1:5 solid:water) from the two samples of ore materials described in **Section 5.2** are presented in **Table C-5 (Attachment C)**.

The pH of the water extracts from the two ore samples is pH 5.0 and 5.8 and is therefore within the pH range of the deionised water used in the water extract tests (ie. pH 5.0 to 6.5). This indicates that these materials are unlikely to contribute any acidity to initial surface runoff and seepage.

This is further supported by the typically low acidity of the water extracts from the two samples (ie. 6 and 8 mg/L. The alkalinity of the water extracts from the two samples has a similar low value (3 and 7 mg/L), which is essentially equivalent to the measured acidity.

The EC in the water extracts from the two ore samples is very low (11 and 15 µS/cm). This confirms that these materials exhibit low salinity and low concentrations of dissolved solids when in contact with water. The concentrations of the major cations and anions in the two water extracts are typically very low and below the LoR.

The concentration of all trace metals/metalloids tested in the water extracts is below the laboratory LoR in all samples. The only exception is manganese, which is above the LoR in most samples. However, the maximum value of 0.014 mg/L is well below the guideline value of 1.90 mg/L for protection of freshwater ecosystems.

The results indicate that dissolved metal/metalloid concentrations in initial surface runoff and seepage from stockpiled run-of-mine ore materials are unlikely to impact upon the quality of surface and groundwater resources at relevant storage facilities.

5.4 Water Quality Kinetic Leach Tests

As described in **Section 3.2.2** and **Attachment A**, a KLC test was undertaken on a representative composite sample of ore from the project site. The composition of the composite sample used in the KLC test is listed in **Table C-9** (**Attachment C**). The static ABA test results for the individual samples used to make up the composite KLC ore sample are detailed in **Table C-10** (**Attachment C**). The KLC results are presented in **Attachment D** and interpreted in this section**.**

The KLC leachate pH trends for the ore sample in **Attachment D** show that the leachate pH from the sample (KLC5) is fairly consistent over the six month test period and trends from a pH of 6.7 towards a pH of 4.9. Dynamic contact with NAF ore typically adds very little acidity or alkalinity to the deionised water used in the KLC tests.

The EC value of KCL leachate from the ore sample is low and ranges from 17 to 31 µS/cm. The EC generally shows a slight decreasing trend over the test period.

The concentration of dissolved sulfate in leachate shows that at least 99 % of the total sulfur content remains in the ore at the end of the test period. The sulfate concentration in ore leachate is three orders of magnitude lower than the applied guideline value. At least 99 % of the measured ANC remains in the sample material at the end of the test period.

The concentration of dissolved sulfate in ore leachate is very low, relatively consistent, and tends towards a long term equilibrium value. The sulfate generation rate and associated sulfide oxidation rate for the KLC test on ore are shown in **Table 4**.

Table 4: Sulfate Generation and Sulfide Oxidation Rates for KLC Tests on Ore

RGS-KLC Sample No.	Sample Description	Sulfate Generation Rate (mg/kg/week)	Oxidation Rate ($kg/O_2/m^3/s$)
KLC 5	**NAF Ore**	**0.03**	**1.3×10^{-11}**

The sulfate generation rate from the KLC test on the ore sample is 0.03 mg/kg/week indicating that the rate of sulfide oxidation is low (equivalent to an oxidation rate of 1.3×10^{-11} kg $O_2/m^3/s$), with an increased factor of safety (AMIRA, 1995, Bennett *et al*., 2000). These materials are likely to generate

leachate that is pH neutral and/or has a low level of acidity. Hence, the kinetic ore leachate results reflect the characteristics predicted from static geochemical test results presented in **Section 5.1**.

The concentration of dissolved trace metals/metalloids in leachate from the KLC test on the ore sample is typically very low, below the laboratory LoR, and within applied water quality guidelines. The only exception is naturally occurring manganese, which is above the LoR in the leachate samples, but with maximum and median values of 0.297 mg/L and 0.227 mg/L remains well below the guideline value of 1.9 mg/L for protection of freshwater ecosystems.

Overall, these results indicate that ongoing surface runoff and seepage from ore materials are unlikely to significantly impact upon the quality of surface water and groundwater. In addition, these materials are only stockpiled for a relatively short period of time and have limited interaction with contact water.

5.5 Management Measures

The geochemistry of the material does not indicate the need for any special management measures for the handling or stockpiling of the ore.

6.0 MIDDLINGS GEOCHEMISTRY

6.1 Acid Base Account Results

As described in **Section 3**, ABA and multi-element tests were completed on four representative samples of process residue (middlings) material from the project site.

The ABA results are presented in **Table C-6** (**Attachment C**) and show that the middlings have pH values within the pH range typical of the deionised water used in the tests (ie. pH 5.0 to 6.5). This indicates that the middlings are unlikely to contribute any acidity to initial surface runoff and seepage.

The salinity of water extracts from the middlings materials is very low (EC varies from 18 to23 µS/cm). This confirms that these materials exhibit low salinity and low concentrations of dissolved solids when in contact with water.

The sample materials have a very low total sulfur concentration, well below background levels for this element (ie. below 0.1%S) (INAP, 2009), resulting in a low MPA value of 0.15 kg H_2SO_4/t. The ANC for the samples is also relatively low, but remains at least an order of magnitude greater than the MPA, resulting in a negative NAPP and a high ANC:MPA ratio (median of 19.25). On the basis of these results, the middlings samples are classified as NAF-Barren and have a high factor of safety with respect to potential for acid generation.

6.2 Multi-Element Concentration in Solids

The multi-element results (metals/metalloids in solids) for the middlings are presented in **Table C-7** (**Attachment C**). The results indicate that the middlings have low total metal/metalloid concentrations in solids within the applied HIL(C) guideline criteria (NEPC, 2013), except for manganese. The elevated manganese concentration in the middlings is expected given that these samples are derived from processing manganese ore.

6.3 Water Quality Static Leach Tests

The results from multi-element testing of water extracts (1:5 solid:water) from the middlings materials are presented in **Table C-8 (Attachment C)**. The concentration of all trace metals/metalloids tested in the water extracts is below the laboratory LoR, with the exception of manganese. However, the maximum concentration of 0.04 mg/L remains well below the guideline value of 1.9 mg/L for protection of freshwater aquatic ecosystems.

The water extract results indicate that dissolved metal/metalloid concentrations in any surface runoff from middlings materials are unlikely to impact upon the quality of surface and groundwater resources at the project site.

6.4 Water Quality Kinetic Leach Tests

As described in **Section 3.2.2** and **Attachment A**, a KLC test was undertaken on a representative composite sample of middlings from the project site. The composition of the composite sample used in the KLC test is listed in **Table C-9** (**Attachment C**). The static ABA test results for the individual samples used to make up the composite KLC middlings sample are detailed in **Table C-10** (**Attachment C**). The KLC results are presented in **Attachment D** and interpreted in this section**.**

The KLC leachate trends for the middlings sample in **Attachment D** show that pH is fairly consistent over the test period and ranges from pH 6.9 to 5.2. Dynamic contact with middlings typically adds very little acidity or alkalinity to the deionised water used in the KLC tests (the typical pH of the deionised water used in the tests is in the pH range 5 to 6.5).

The EC value of KLC leachate from the middlings sample is low and ranges from 13 to 41 µS/cm, with a slight decreasing trend over the test period.

The residual sulfur content of this material shows that at least 99% of the total sulfur content remains in the sample at the end of the six month test period. The sulfate concentration in KLC middlings leachate is three orders of magnitude lower than the applied guideline value. The concentrations of dissolved calcium and magnesium in leachate indicate that at least 99% of the measured ANC remains in the sample material at the end of the test period.

The concentration of dissolved sulfate in middlings leachate is relatively consistent and tends towards a long term equilibrium value. The sulfate generation rate and associated sulfide oxidation rate for the KLC test on middlings are shown in **Table 5**.

Table 5: Sulfate Generation and Sulfide Oxidation Rates for KLC Tests on Middlings

RGS-KLC Sample No.	Sample Description	Sulfate Generation Rate (mg/kg/week)	Oxidation Rate ($kg/O_2/m^3/s$)
KLC 6	NAF Middlings	0.03	1.1×10^{-11}

The sulfate generation rate from the KLC test on the middlings sample is 0.03 mg/kg/week indicating that the rate of sulfide oxidation is low (equivalent to an oxidation rate of 1.1×10^{-11} kg $O_2/m^3/s$), with an increased factor of safety (AMIRA, 1995, Bennett *et al*., 2000). These materials are likely to generate leachate that is pH neutral and/or has a low level of acidity. Hence, the KLC results reflect the characteristics predicted from static geochemical test results presented in **Section 6.1**.

The concentration of dissolved trace metals/metalloids in leachate from the KLC test on the middlings sample is typically very low, below the laboratory LoR, and within applied water quality guidelines. The only exception is naturally occurring manganese, which is above the LoR in the leachate samples, but with maximum and median values of 0.077 mg/L and 0.067 mg/L remains well below the guideline value of 1.9 mg/L for protection of freshwater ecosystems.

Overall, these results indicate that ongoing surface runoff and seepage from middlings materials are unlikely to significantly impact upon the quality of surface water and groundwater.

6.5 Management Measures

The geochemistry of the material does not indicate the need for any special management measures for the handling or storage of the middlings.

7.0 REVIEW OF TAILINGS GEOCHEMISTRY

While the EIS does not include any assessment of operations within the existing GEMCO mine, a review of geochemical data available for tailings generated and stored at the existing operations has been included for completeness.

GEMCO has established handling and storage methods for process residues and these methods have been operating since the commencement of operations.

As previously discussed in **Section 2.2**, the ore lithology is relatively uniform across the west of the island. It is therefore likely that the tailings samples selected and tested at the existing GEMCO mine will provide a good representation of the geochemical properties of the range of tailings materials likely to be generated from the processing of ore from the Eastern Leases.

The proponent maintains a database of geochemical data on the geochemistry of the slime and sand tailings (GEMCO, 2014). These data have been reviewed by RGS and the main findings are summarised as follows:

- The slime and sand tailings are classified as NAF on the basis of having negligible sulfur content and excess buffering capacity.
- The slime and sand tailings typically have relatively low total metal/metalloid concentrations in solids which are within applied Health Based (HIL(C)) guideline criteria for recreational open spaces (NEPC, 2013), except for manganese. The elevated manganese concentration in these materials is expected given that the samples are derived from processing manganese ore.
- Leachate from slime and sand materials is typically towards the lower end of the pH neutral range and also has a low salinity.
- The concentration of most trace metals/metalloids in leachate from slime and sand tailings is low, typically below the laboratory limit of reporting, and less than the applied ANZECC & ARMCANZ (2000) trigger values for 95 % species protection.

This information confirms that from a geochemical perspective, the slime and sand tailings are relatively benign and very similar to the middlings materials. The geochemistry of the material does not indicate the need for any special management measures for the handling or storage of the tailings material.

8.0 CONCLUSIONS

RGS has completed a geochemical assessment of overburden, ore and process residue materials likely to be generated by the project. The main findings of the geochemical assessment are presented in the following sections.

8.1 Overburden

- The overwhelming majority of overburden show excess acid buffering capacity, and a high factor of safety with respect to potential acid generation.
- The bulk excavated overburden material generated by the project will have a significant excess buffering capacity at least double the MPA and is therefore considered to be NAF.
- Smectite and kaolinite clay minerals that may be sporadically present within the excavated overburden material are non-dispersive and should not provide a significant materials handling issue.
- The concentrations of metals and metalloids in excavated overburden material are within relevant health-based criteria. Only manganese was found to be elevated, reflecting the natural geological setting of the project. During the project life, these materials will be handled and stored within operational mining areas and there will be negligible potential for human health impacts through contact with these materials. Mined areas will be progressively rehabilitated, further reducing potential manganese exposure pathways.
- Surface runoff and seepage from excavated overburden material is likely to exhibit low acidity with excess buffering capacity. Salinity will be low due to a general absence of dissolved solids.
- Static and kinetic leach tests indicate that trace metals/metalloids and major ions will be sparingly soluble in runoff and seepage from excavated overburden material. Dissolved concentrations will remain within applied water quality guideline criteria and will not present any significant environmental risks for on-site or downstream water quality. Dilution effects from rainfall and natural attenuation are also likely to occur in the field and further reduce the concentrations of soluble metals and metalloids in runoff and seepage.
- Based on the benign nature of the overburden material, no special management measures are required for the handling or storage of the majority of the overburden. There will, however, be specific management measures for the handling and placing of overburden from the small area which has been identified as containing PAF material, and these measures are described in the report (as discussed in **Section 4.6**).
- Surface water and seepage from overburden emplacement areas will be monitored to ensure that key water quality parameters remain within appropriate criteria. Groundwater monitoring will also be undertaken.

8.2 Ore

- The run of mine ore generated by the project has an excess buffering capacity, which is significantly greater than the MPA, and is therefore considered to be NAF. Storage of run of mine ore generated by the project is therefore unlikely to generate acid.
- The concentrations of metals and metalloids in run of mine ore are within relevant health-based criteria. Only manganese was found to be elevated, reflecting the natural geological setting of the project. During the project life, run of mine ore will be handled and stored within operational mining areas and there will be negligible potential for human health impacts through contact with these materials. No run of mine ore materials will remain on site following mine closure and rehabilitation.

- Surface runoff and seepage from run of mine ore is likely to exhibit low acidity with excess buffering capacity. Salinity will be low due to a general absence of dissolved solids.
- Static and kinetic leach tests indicate that trace metals/metalloids and major ions are sparingly soluble in runoff and seepage from run of mine ore. Dissolved concentrations will remain within applied water quality guideline criteria and will not present any significant environmental risks for on-site or downstream water quality. Dilution effects from rainfall and natural attenuation are also likely to occur in the field and further reduce the concentrations of soluble metals and metalloids in runoff and seepage.
- The geochemistry of the Eastern Leases ore does not indicate the need for any special management measures for the handling or temporary storage of the run of mine ore materials.

8.3 Tailings and Middlings

- The tailings and middlings generated by the project have an excess buffering capacity, which is significantly greater than the MPA, and are therefore considered to be NAF. Storage and reuse of tailings and middlings generated by the project is unlikely to generate acid.
- The concentrations of metals and metalloids in tailings and middlings are within relevant health-based criteria. Only manganese was found to be elevated, reflecting the natural geological setting of the project. During the project life, these materials will be handled and stored within operational mining areas and there will be negligible potential for human health impacts through contact with these materials. As part of mine closure and rehabilitation activities, materials will be removed or capped, further reducing potential manganese exposure pathways.
- Surface runoff and seepage from tailings and middlings are likely to exhibit low acidity with excess buffering capacity. Salinity will be low due to a general absence of dissolved solids.
- Static and kinetic leach tests indicate that trace metals/metalloids and major ions are sparingly soluble in runoff and seepage from tailings and middlings. Dissolved concentrations will remain within applied water quality guideline criteria and will not present any significant environmental risks for on-site or downstream water quality. Dilution effects from rainfall and natural attenuation are also likely to occur in the field and further reduce the concentrations of soluble metals and metalloids in runoff and seepage.
- The geochemistry of the material does not indicate the need for any special management measures for the handling or storage of the tailings or middlings.

9.0 REFERENCES

AMIRA (1995). Mine Waste Management: *Project P387 Prediction and Identification of Acid Forming Mine Waste*. Australian Minerals Industry Research Association, Report prepared by EGi Pty Ltd, August 1995.

AMIRA (2002). *ARD Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage*, Australian Minerals Industry Research Association, Ian Wark Research Institute and Environmental Geochemistry International Pty Ltd, May 2002.

ANZECC & ARMCANZ (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000).

AS 4969.7-2008. *Analysis of acid sulfate soil – Dried samples – Methods of test. Method 7: Determination of chromium reducible sulfur (Scr)*. Standards Australia, June 2008.

Bennett J.W, Comarmond J.M. and Jeffrey J.J. (2000). *Comparison of Oxidation Rates of Sulfidic Mine Wastes in the Laboratory and Field*. Paper prepared by the Australian Nuclear Science and Technology Organisation and Environmental Geochemistry International Pty Ltd, Australian Centre for Mining Environmental Research. February.

DITR (2006a). *Department of Industry, Tourism and Resources. Leading Practice Sustainable Development Program for the Mining Industry. Mine Rehabilitation*. October, Canberra ACT.

DITR (2006b). *Department of Industry, Tourism and Resources. Leading Practice Sustainable Development Program for the Mining Industry. Mine Closure and Completion*. October, Canberra ACT.

DITR (2007a). *Department of Industry, Tourism and Resources. Leading Practice Sustainable Development Program for the Mining Industry. Managing Acid and Metalliferous Drainage*. February, Canberra ACT.

DITR (2007b). *Department of Industry, Tourism and Resources. Leading Practice Sustainable Development Program for the Mining Industry. Tailings Management*. February, Canberra ACT.

DITR (2008). *Department of Industry, Tourism and Resources. Leading Practice Sustainable Development Program for the Mining Industry. Water Management*. May, Canberra ACT.

DME (1995). *Draft Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland, Technical Guideline – Assessment and Management of Acid Drainage and Saline/Sodic Wastes*. Queensland Department of Minerals and Energy (DME).

INAP (2009). *Global Acid Rock Drainage Guide (GARD Guide)*. Document prepared by Golder Associates on behalf of the International Network on Acid Prevention (INAP). June 2009 (http://www.inap.com.au/).

Isbell, RF. (2002). *The Australian Soil Classification (revised edition)*. CSIRO Publishing. Victoria.

GEMCO Pty Ltd (2014). *Internal Database. Existing information on the* geochemistry of slime and sand tailings.

NEPC (2013). [Amendment of Schedule B1to B7 of 1999 version]. National Environmental Protection Council (NEPC). *National Environmental Protection (Assessment of Site Contamination) Measure (NEPM). Guideline on Investigation Levels for Soil and Groundwater, Health-Based Investigation Level - HIL(C): generic land use including recreational open spaces*.

NT EPA (2013). *Environmental Assessment Guidelines. Acid and Metalliferous Drainage. Version 1.2. April*

NT EPA (2014). *Terms of Reference for the Preparation of an Environmental Impact Statement. GEMCO Eastern Leases Project.*

Northcote, KH., Skene, JKM. (1972). *Australian Soils with Saline and Sodic properties.* CSIRO Australia, Soil Publication No. 27, Canberra.

RGS (2013), *GEMCO Eastern Leases Project: Mine Waste Geochemistry Assessment – Sampling Protocol*, provided to Hansen Bailey, 22 November, RGS Project Number 121312.

Team NT (2004). Northern Territory Minerals Council (Inc.) and the Mines and Petroleum Management Division of the Northern Territory Government, 2004, *TEAM NT: Technologies for Environmental Advancement of Mining in the Northern Territory: Toolkit*, D.R. Jones and M. Fawcett, principal authors. Posted on the Northern Territory Minerals Council web page at: http://ntminerals.org.au/VisionEdit/files/TEAMNT.pdf

FIGURES

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

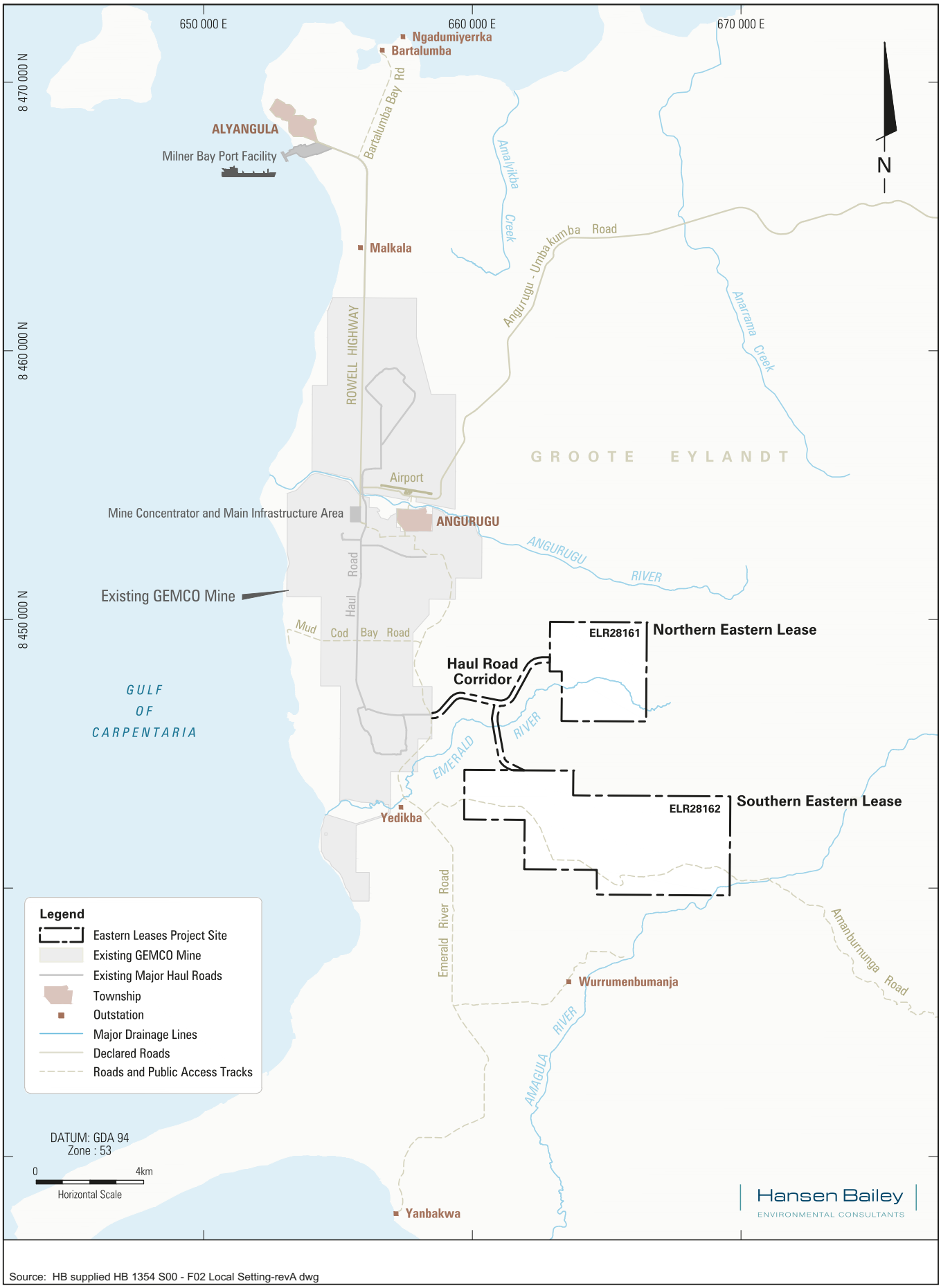
File: 121312 001 A4 - Rev.B
Date: 10/03/2015

GEOCHEMISTRY REPORT

GEMCO EASTERN LEASES PROJECT

Figure: **1**

LOCATION PLAN



Source: HB supplied HB 1354 S00 - F02 Local Setting-revA dwg

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

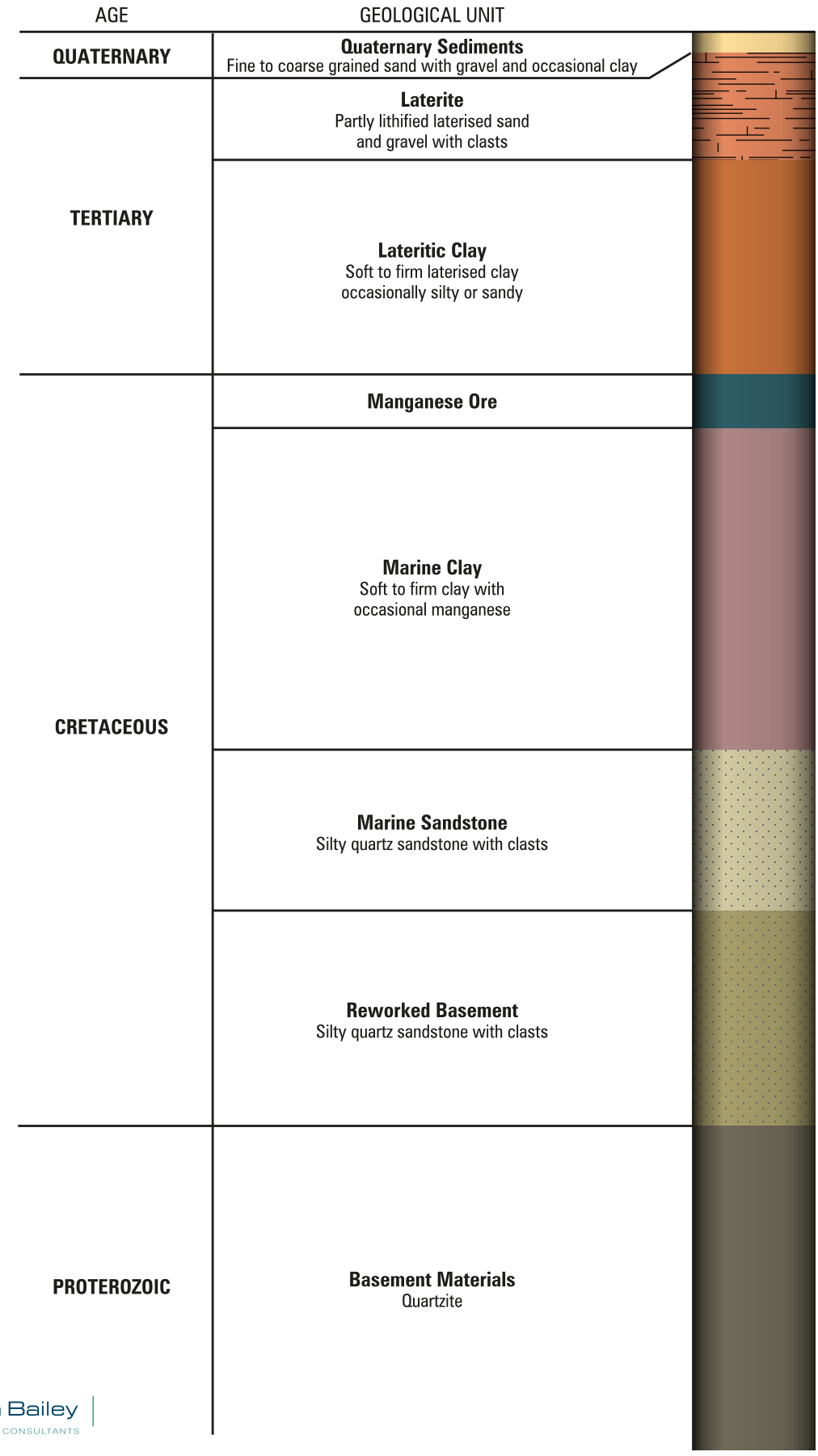
File: 121312 002 A4 - Rev.B
Date: 10/03/2015

GEOCHEMISTRY REPORT

GEMCO EASTERN LEASES PROJECT

Figure: **2**

LOCAL SETTING



Hansen Bailey
ENVIRONMENTAL CONSULTANTS

Source: HB supplied 1354 GEMCO Indicative Stratigraphy dwg

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

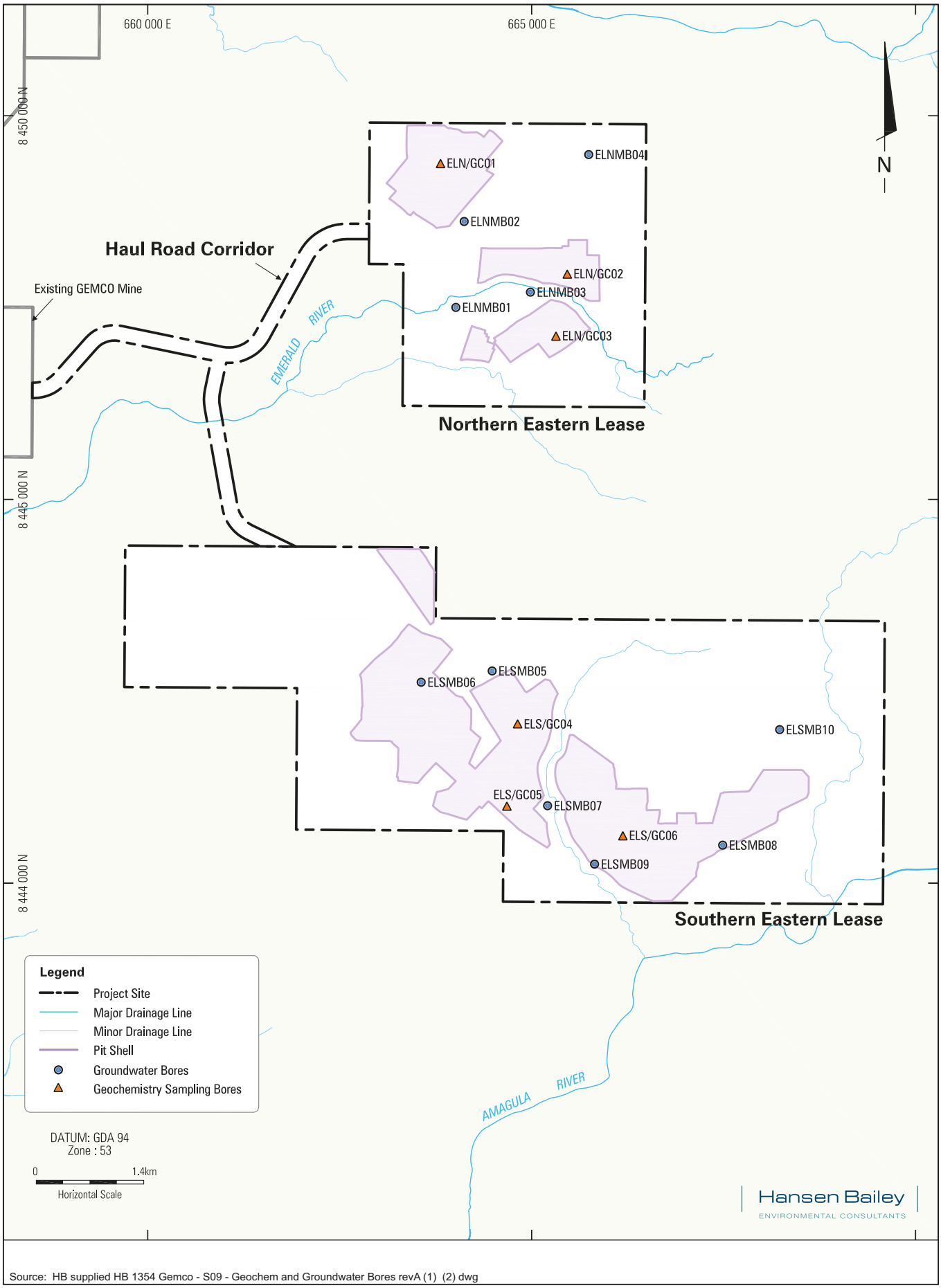
File: 121312 003 A4
Date: 10/03/2015

GEOCHEMISTRY REPORT

GEMCO EASTERN LEASES PROJECT

Figure: **3**

INDICATIVE STRATIGRAPHY



Source: HB supplied HB 1354 Gemco - S09 - Geochem and Groundwater Bores revA (1) (2) dwg

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

File: 121312 004 A4 - Rev.B
Date: 10/03/2015

GEOCHEMISTRY REPORT

GEMCO EASTERN LEASES PROJECT

Figure: **4**

GEOCHEMISTRY SAMPLING BORE LOCATIONS

ATTACHMENT A

Geochemical Assessment Methodology for Mine Waste Materials

ATTACHMENT A

GEOCHEMICAL ASSESSMENT OF MINE WASTE MATERIALS

ACID GENERATION AND PREDICTION

Acid generation is caused by the exposure of sulfide minerals, most commonly pyrite (FeS_2), to atmospheric oxygen and water. Sulfur assay results are used to calculate the maximum amount of acid that could be generated by a material based on either direct measurement of the pyritic S content, or assuming that all sulfur not present as sulfate occurs as pyrite. Pyrite reacts under oxidising conditions to generate acid according to the following overall reaction:

$$FeS_2 + 15/4\ O_2 + 7/2\ H_2O \rightarrow Fe(OH)_3 + 2\ H_2SO_4$$

According to this reaction, the maximum potential acidity (MPA) of a sample containing 1%S as pyrite would be 30.6 kg H_2SO_4/t. The chemical components of the acid generation process consist of the above sulfide oxidation reaction and acid neutralization, which is mainly provided by inherent carbonates and to a lesser extent silicate materials. The amount and rate of acid generation is determined by the interaction and overall balance of the acid generation and neutralisation components.

Net Acid Producing Potential

The net acid producing potential (NAPP) is used as an indicator of materials that may be of concern with respect to acid generation. The NAPP calculation represents the balance between the maximum potential acidity (MPA) of a sample, which is derived from the sulfide sulfur content, and the acid neutralising capacity (ANC) of the material, which is determined experimentally. By convention, the NAPP result is expressed in units of kg H_2SO_4/t sample. If the capacity of the solids to neutralise acid (ANC) exceeds their capacity to generate acid (MPA), then the NAPP of the material is negative. Conversely, if the MPA exceeds the ANC, the NAPP of the material is positive. A NAPP assessment involves a series of analytical tests that include:

Determination of pH and EC

pH and EC measured on 1:5 w/w water extract. This gives an indication of the inherent acidity and salinity of the waste material when initially exposed in an emplacement area.

Total sulfur content and Maximum Potential Acidity (MPA)

Total sulfur content is determined by the Leco high temperature combustion method. The total sulfur content is then used to calculate the MPA, which is based on the assumption that the entire sulfur content is present as reactive pyrite. Direct determination of the pyritic sulfur content can provide a more accurate estimate of the MPA.

Acid neutralising capacity (ANC)

The ANC is determines by addition of acid to a known weight of sample, then titration with NaOH to determine the amount of residual acid. The ANC measures the capacity of a sample to react with and neutralise acid. The ANC can be further evaluated by slow acid titration to a set end-point in the Acid Buffering Characteristic Curve (ABCC) test through calculation of the amount of acid consumed and evaluation of the resultant titration curve.

Net acid producing potential (NAPP)

Calculated from the MPA and ANC results. The NAPP represents the balance between a sample's inherent capacities to generate and neutralise acid. If the MPA is greater than the ANC then the NAPP is positive. If the MPA is less than the ANC then the NAPP is negative.

Net Acid Generation (NAG)

The net acid generation (NAG) test involves the addition of hydrogen peroxide to a sample of mine rock or process residue to oxidise reactive sulfide, then measurement of pH and titration of any net acidity produced by the acid generation and neutralisation reactions occurring in the sample. A significant NAG result (*i.e.* final NAG_{pH} < 4.5) indicates that the sample is potentially acid forming (PAF) and the test provides a direct measure of the net amount of acid remaining in the sample after all acid generating and acid neutralising reactions have taken place. A NAG_{pH} > 4.5 indicates that the sample is non-acid forming (NAF). The NAG test provides a direct assessment of the potential for a material to produce acid after a period of exposure and weathering and is used to refine the results of the theoretical NAPP predictions. The NAG test can be used as a stand-alone test, but is recommended that this only be considered after site specific calibration work is carried out.

ASSESSMENT OF ELEMENT ENRICHMENT AND SOLUBILITY

In mineralised areas it is common to find a suite of enriched elements that have resulted from natural geological processes. Multi-element scans are carried out to identify any elements that are present in a material (or readily leachable from a material) at concentrations that may be of environmental concern with respect to surface water quality, revegetation and public health. The samples are generally analysed for the following elements:

Major elements	Al, Ca, Fe, K, Mg, Na and S.
Minor elements	As, B, Cd, Co, Cr, Cu, F, Hg, Mn, Mo, Ni, Pb, Sb, Se and Zn.

The concentration of these elements in samples can be directly compared with relevant state or national environmental and health based concentration guideline criteria to determine the level of significance. Water extracts are used to determine the immediate element solubilities under the existing sample pH conditions of the sample. The following tests are normally carried out:

Multi-element composition of solids.

Multi-element composition of solid samples determined using a combination of ICP-mass spectroscopy (ICP-MS), ICP-optical emission spectroscopy (OES), and atomic absorption spectrometry (AAS).

Multi-element composition of water extracts (1:5 sample:deionised water).

Multi-element composition of water extracts from solid samples determined using a combination of ICP-mass spectroscopy (ICP-MS), ICP-optical emission spectroscopy (OES), and atomic absorption spectrometry (AAS).

Under some conditions (*e.g.* low pH) the solubility and mobility of common environmentally important elements can increase significantly. If element mobility under initial pH conditions is deemed likely and/or subsequent low pH conditions may occur, kinetic leach column test work may be completed on representative samples.

KINETIC LEACH COLUMN TESTS

Kinetic leach column (KLC) tests can be used to provide information on the reaction kinetics of mine waste materials. The major objectives of kinetics tests are to:

- Provide time-dependent data on the kinetics and rate of acid generation and acid neutralising reactions under laboratory controlled (or onsite conditions);
- Investigate metal release and drainage/seepage quality; and
- Assess treatment options such as addition of alkaline materials.

The KLC tests simulate the weathering process that leads to acid and base generation and reaction under laboratory controlled or site conditions. The kinetic tests allow an assessment of the acid forming characteristics and indicate the rate of acid generation, over what period it will occur, and what management controls may be required.

In KLC tests, water is added to a sample and the mixture allowed to leach products and by-products of acid producing and consuming reactions. Samples of leachate are then collected and analysed. Intermittent water application is applied to simulate rainfall and heat lamps are used to simulate sunshine. These tests provide real-time information and may have to continue for months or years. Monitoring includes trends in pH, sulfate, acidity or alkalinity, and metals, for example. The pH of the collected leachate simulates the acid drainage process, acidity or alkalinity levels indicate the rate of acid production and acid neutralisation, and sulfate production can be related to the rate of sulfide oxidation. Metal concentration data provides an assessment of metal solubility and leaching behaviour.

Figure A1 shows the kinetic leach column set up used by RGS adapted from *AMIRA, 2002*. The columns are placed under heat lamps to allow the sample to dry between water additions to ensure adequate oxygen ingress into the sample material.

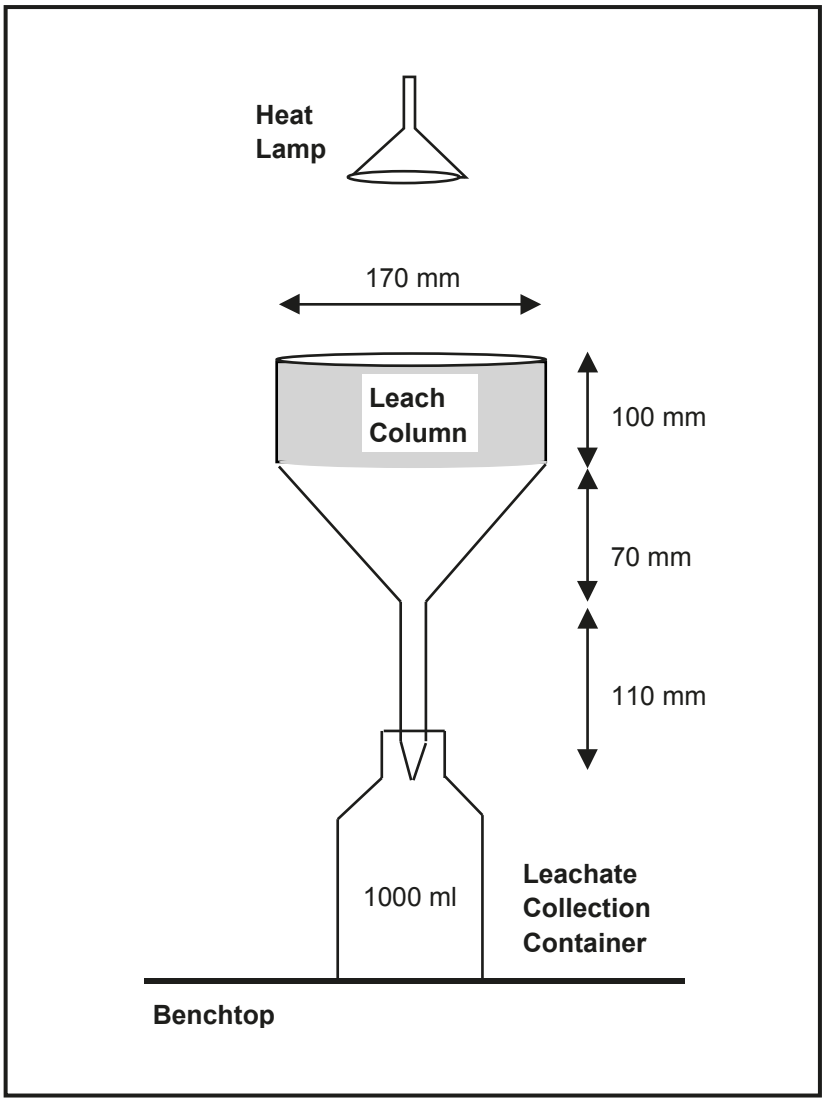
Approximately 2 kg of sample is accurately weighed and used in the leach columns depending on the physical nature of the material and particle size. Some materials can be used on an as-received basis (*i.e.* no crushing as with process residues and tailings materials), whereas others are crushed to nominal 5-10 mm particle size (as with overburden).

The sample in the column is initially leached with deionised water at a rate of about 400 ml/kg of sample and the initial leachate from the columns collected and analysed. Subsequent column leaching is carried out at a rate of about 400 ml/kg per month or quarterly, and again collected and analysed. The leaching rate can be varied to better simulate expected site conditions or satisfy test program data requirements.

The column must be exposed to drying conditions in between watering events. The residual water content and air void content in the column can be determined by comparing the wet and dry column weights. A heat lamp is generally used above the sample during daylight hours to maintain the leach column surface temperature at about 30^{o}C.

Figure A1

Kinetic Leach Column Setup



AMIRA (2002). *ARD Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage*. Australian Minerals Industry Research Association, Ian Wark Research Institute and Environmental Geochemistry International Pty Ltd, May 2002.

ATTACHMENT B

ALS Laboratory Data

(Certificates of Analysis)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1416507**	Page	: 1 of 14
Amendment	: **1**		
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61 7 3243 7218
Project	: Gemco Project (121312)	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 08-JUL-2014
Sampler	: H. McCarthy	Issue Date	: 23-FEB-2015
Site	: ----		
		No. of samples received	: 58
Quote number	: BN/413/12	No. of samples analysed	: 58

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Satishkumar Trivedi	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.**
- **This report has been amended as a result of a request to change sample identification numbers (IDs) received by ALS from RGSENV. All analysis results are as per the previous report.**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-N-MB01 GW01 12m	EL-N-MB01 GW01 15m	EL-N-MB01 GW01 18m	EL-N-MB01 GW01 21m	EL-N-MB01 GW01 24m
				Client sampling date / time	01-DEC-2013 15:00	01-DEC-2013 15:00	01-DEC-2013 15:00	01-DEC-2013 15:00	01-DEC-2013 15:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416507-003**	**EB1416507-004**	**EB1416507-005**	**EB1416507-006**	**EB1416507-007**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.6**	**6.9**	**6.9**	**6.7**	**6.7**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.9**	**0.6**	**0.6**	**0.6**	**1.2**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-3.5**	**-3.9**	**-7.8**	**-7.1**	**-3.6**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**130**	**90**	**85**	**102**	**110**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**4.4**	**4.5**	**8.4**	**7.7**	**4.8**
ANC as CaCO3	----	0.1	% CaCO3		**0.4**	**0.5**	**0.8**	**0.8**	**0.5**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.03**	**0.02**	**0.02**	**0.02**	**0.04**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-N-MB01 GW01 27m	EL-N-MB03 GW03 6m	EL-N-MB03 GW03 9m	EL-N-MB03 GW03 11.5m	EL-N-MB02 GW02 3m
			Client sampling date / time	01-DEC-2013 15:00	03-DEC-2013 15:00	03-DEC-2013 15:00	03-DEC-2013 15:00	10-DEC-2013 15:00
Compound	CAS Number	LOR	Unit	EB1416507-008	EB1416507-009	EB1416507-010	EB1416507-011	EB1416507-012
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.8	6.4	5.7	6.0	6.6
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	0.6	0.6	<0.5	0.6	1.5
Net Acid Production Potential	----	0.5	kg H2SO4/t	-2.7	-0.9	<0.5	-1.4	-2.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	50	35	38	36	504
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	3.3	1.5	<0.5	2.0	4.0
ANC as CaCO3	----	0.1	% CaCO3	0.3	0.2	<0.1	0.2	0.4
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	<0.01	0.02	0.05

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	EL-N-MB02 GW02 5m	EL-N-MB04 GW04 3m	EL-N-MB04 GW04 6m	EL-N-MB04 GW04 9m	EL-N-MB04 GW04 11m
				Client sampling date / time	10-DEC-2013 15:00	13-DEC-2013 15:00	13-DEC-2013 15:00	13-DEC-2013 15:00	13-DEC-2013 15:00
Compound	CAS Number	LOR	Unit		EB1416507-013	EB1416507-014	EB1416507-015	EB1416507-016	EB1416507-017
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		6.9	8.9	8.2	7.5	7.2
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		0.6	0.6	0.6	0.6	0.6
Net Acid Production Potential	----	0.5	kg H2SO4/t		<0.5	-3.7	0.6	0.6	-1.0
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		40	352	65	36	32
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		0.5	4.3	<0.5	<0.5	1.6
ANC as CaCO3	----	0.1	% CaCO3		<0.1	0.4	<0.1	<0.1	0.2
Fizz Rating	----	0	Fizz Unit		0	0	0	0	0
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		0.02	0.02	0.02	0.02	0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-N-MB04 GW04 12m	EL-S-MB06 GW06 12m	EL-S-MB06 GW06 15m	EL-S-MB06 GW06 18m	EL-S-MB06 GW06 21m
			Client sampling date / time	13-DEC-2013 15:00	09-JAN-2014 15:00	09-JAN-2014 15:00	09-JAN-2014 15:00	09-JAN-2014 15:00
Compound	CAS Number	LOR	Unit	EB1416507-018	EB1416507-022	EB1416507-023	EB1416507-024	EB1416507-025
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.6	5.8	5.8	3.4	4.4
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	0.6	0.6	0.6	25.1	26.6
Net Acid Production Potential	----	0.5	kg H2SO4/t	-0.6	-3.2	-3.1	25.1	26.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	27	144	63	2740	1120
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	1.2	3.8	3.7	<0.5	0.6
ANC as CaCO3	----	0.1	% CaCO3	0.1	0.4	0.4	<0.1	<0.1
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.02	0.82	0.87

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-S-MB06 GW06 24m	EL-S-MB06 GW06 27m	EL-S-MB07 GW07 3m	EL-S-MB07 GW07 6m	EL-S-MB05 GW05 3m
				Client sampling date / time	09-JAN-2014 15:00	09-JAN-2014 15:00	12-JAN-2014 15:00	13-JAN-2014 15:00	01-DEC-2013 15:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416507-026**	**EB1416507-027**	**EB1416507-028**	**EB1416507-029**	**EB1416507-030**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**4.8**	**5.5**	**6.6**	**5.2**	**6.7**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**2.8**	**0.9**	**1.2**	**0.6**	**0.9**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**2.2**	**-6.7**	**-1.5**	**-1.5**	<0.5
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**316**	**99**	**162**	**35**	**124**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**0.5**	**7.6**	**2.7**	**2.1**	**1.3**
ANC as CaCO3	----	0.1	% CaCO3		<0.1	**0.8**	**0.3**	**0.2**	**0.1**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.09**	**0.03**	**0.04**	**0.02**	**0.03**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-S-MB05 GW05 6m	EL-S-MB05 GW05 9m	EL-S-MB05 GW05 12m	EL-S-MB05 GW05 15m	EL-S-MB05 GW05 18m
			Client sampling date / time	15-MAY-2014 15:00	15-MAY-2014 15:00	15-MAY-2014 15:00	15-MAY-2014 15:00	15-MAY-2014 15:00
Compound	CAS Number	LOR	Unit	EB1416507-031	EB1416507-032	EB1416507-033	EB1416507-034	EB1416507-035
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.1	5.6	5.7	5.7	5.9
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	0.9	0.6	0.6	0.6	0.6
Net Acid Production Potential	----	0.5	kg H2SO4/t	-0.7	0.6	<0.5	0.6	0.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	54	93	58	70	55
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	1.6	<0.5	0.6	<0.5	<0.5
ANC as CaCO3	----	0.1	% CaCO3	0.2	<0.1	<0.1	<0.1	<0.1
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.02	0.02	0.02	0.02

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-S-MB05 GW05 21m	EL-S-MB05 GW05 24m	EL-S-MB05 GW05 27m	EL-S-MB05 GW05 30m	EL-S-MB05 GW05 33m
				Client sampling date / time	15-MAY-2014 15:00	15-MAY-2014 15:00	15-MAY-2014 15:00	15-MAY-2014 15:00	15-MAY-2014 15:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416507-036**	**EB1416507-037**	**EB1416507-038**	**EB1416507-039**	**EB1416507-040**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.1**	**6.3**	**6.4**	**6.5**	**6.6**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Net Acid Production Potential	----	0.5	kg H2SO4/t		<0.5	**-1.6**	**-0.8**	**-2.5**	**-2.8**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**46**	**47**	**63**	**85**	**73**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**1.1**	**2.2**	**1.4**	**3.1**	**3.4**
ANC as CaCO3	----	0.1	% CaCO3		**0.1**	**0.2**	**0.1**	**0.3**	**0.3**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	**0.02**	**0.02**	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-S-MB05 GW05 36m	EL-S-MB05 GW05 39m	EL-S-MB09 GW09 3m	EL-S-MB09 GW09 6m	EL-S-MB09 GW09 9m
			Client sampling date / time	15-MAY-2014 15:00	15-MAY-2014 15:00	22-MAY-2014 15:00	22-MAY-2014 15:00	22-MAY-2014 15:00
Compound	CAS Number	LOR	Unit	EB1416507-041	EB1416507-042	EB1416507-043	EB1416507-044	EB1416507-045
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.5	6.9	6.4	6.3	5.4
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	17.7	9.5	0.9	0.9	0.6
Net Acid Production Potential	----	0.5	kg H2SO4/t	12.6	3.5	-2.7	<0.5	-1.7
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	554	209	131	41	67
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	5.1	6.0	3.6	1.2	2.3
ANC as CaCO3	----	0.1	% CaCO3	0.5	0.6	0.4	0.1	0.2
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.58	0.31	0.03	0.03	0.02

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-S-MB09 GW09 12m	EL-S-MB09 GW09 14.5-15m	EL-S-MB08 GW08 3m	EL-S-MB08 GW08 6m	EL-S-MB08 GW08 9m
				Client sampling date / time	22-MAY-2014 15:00	22-MAY-2014 15:00	25-MAY-2014 15:00	25-MAY-2014 15:00	25-MAY-2014 15:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416507-046**	**EB1416507-047**	**EB1416507-048**	**EB1416507-049**	**EB1416507-050**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.0**	**6.2**	**5.9**	**6.0**	**5.7**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	**0.9**	**0.6**	**0.6**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-0.8**	**-1.0**	<0.5	**0.6**	**0.6**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**37**	**79**	**37**	**29**	**33**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**1.4**	**1.6**	**1.2**	<0.5	<0.5
ANC as CaCO3	----	0.1	% CaCO3		**0.1**	**0.2**	**0.1**	<0.1	<0.1
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	**0.03**	**0.02**	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	EL-S-MB08 GW08 12m	EL-S-MB08 GW08 15m	EL-S-MB08 GW08 16.6m	EL-S-MB10 GW10 3m	EL-S-MB10 GW10 6m
				Client sampling date / time	25-MAY-2014 15:00	25-MAY-2014 15:00	25-MAY-2014 15:00	27-MAY-2014 15:00	27-MAY-2014 15:00
Compound	CAS Number	LOR	Unit		EB1416507-051	EB1416507-052	EB1416507-053	EB1416507-054	EB1416507-055
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**5.8**	**6.1**	**6.1**	**6.2**	**6.0**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	<0.5	**0.6**	**0.6**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**0.6**	**0.6**	**-1.8**	<0.5	**0.6**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**34**	**24**	**42**	**38**	**45**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		<0.5	<0.5	**1.8**	**0.8**	<0.5
ANC as CaCO3	----	0.1	% CaCO3		<0.1	<0.1	**0.2**	<0.1	<0.1
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	<0.01	**0.02**	**0.02**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-S-MB10 GW10 9m	EL-S-MB10 GW10 12m	EL-S-MB10 GW10 15m	EL-S-MB06 GW06 4m	EL-N-MB01 GW01 6-9m
				Client sampling date / time	27-MAY-2014 15:00	27-MAY-2014 15:00	27-MAY-2014 15:00	09-JAN-2014 15:00	30-JAN-2014 15:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416507-056**	**EB1416507-057**	**EB1416507-058**	**EB1416507-059**	**EB1416507-060**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.2**	**6.2**	**6.5**	**6.5**	**6.7**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**0.6**	<0.5	**0.6**	**-1.2**	**-1.7**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**36**	**41**	**30**	**39**	**192**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		<0.5	**0.7**	<0.5	**1.8**	**2.3**
ANC as CaCO3	----	0.1	% CaCO3		<0.1	<0.1	<0.1	**0.2**	**0.2**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	**0.02**	**0.02**	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-N-MB01 GW01 3-6m	EL-S-MB06 GW06 9m	EL-S-MB06 GW06 6m	----	----
			Client sampling date / time	01-DEC-2013 15:00	01-DEC-2013 15:00	09-JAN-2014 15:00	----	----
Compound	CAS Number	LOR	Unit	EB1416507-061	EB1416507-062	EB1416507-063	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.8**	**6.0**	**5.8**	----	----
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	**0.6**	**1.2**	<0.5	----	----
Net Acid Production Potential	----	0.5	kg H2SO4/t	**0.6**	<0.5	**-2.7**	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**39**	**118**	**38**	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	<0.5	**1.4**	**2.7**	----	----
ANC as CaCO3	----	0.1	% CaCO3	<0.1	**0.1**	**0.3**	----	----
Fizz Rating	----	0	Fizz Unit	**0**	**0**	**0**	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.04**	<0.01	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB1416586**	Page	: 1 of 13
Amendment	: **1**		
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61 7 3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 08-JUL-2014
Sampler	: Coralee Williams	Issue Date	: 23-FEB-2015
Site	: GEMCO Mine		
		No. of samples received	: 54
Quote number	: BN/413/12	No. of samples analysed	: 54

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Matheson	Senior Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Satishkumar Trivedi	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.**
- **This report has been amended as a result of a request to change sample identification numbers (IDs) received by ALS from RGSENV. All analysis results are as per the previous report.**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-S-GC06 GC06-S1 0.25-0.75m	EL-S-GC06 GC06-S2 0.75-1.1m	EL-S-GC06 GC06-S3 2.0-2.4m	EL-S-GC06 GC06-S4 2.9-3.2m	EL-S-GC06 GC06-S5 4.7-5.0m
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416586-001**	**EB1416586-002**	**EB1416586-003**	**EB1416586-004**	**EB1416586-005**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.3**	**6.0**	**6.1**	**6.0**	**6.3**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-3.4**	**-1.9**	**-1.2**	**-1.7**	**-1.4**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**36**	**16**	**13**	**18**	**19**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**4.0**	**2.5**	**1.8**	**2.3**	**2.0**
ANC as CaCO3	----	0.1	% CaCO3		**0.4**	**0.2**	**0.2**	**0.2**	**0.2**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	**0.02**	**0.02**	**0.02**
Sample Preparation Method									
Amount	----	0.01	kg		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-S-GC06 GC06-S6 6.35-6.65m	EL-S-GC06 GC06-S7 6.75-7.0m	EL-S-GC06 GC06-S8 7.3-7.65m	EL-S-GC06 GC06-S9 7.87-8.34m	EL-S-GC05 GC05-S1 0.5-1.0m
			Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	CAS Number	LOR	Unit	EB1416586-006	EB1416586-007	EB1416586-008	EB1416586-009	EB1416586-010
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.9	6.1	5.9	6.1	5.9
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	<0.5	0.6	<0.5	<0.5	0.6
Net Acid Production Potential	----	0.5	kg H2SO4/t	-1.4	-2.5	<0.5	-1.5	-2.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	15	22	14	12	23
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	1.4	3.1	<0.5	1.5	3.2
ANC as CaCO3	----	0.1	% CaCO3	0.1	0.3	<0.1	0.2	0.3
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.02	<0.01	<0.01	0.02
Sample Preparation Method								
Amount	----	0.01	kg	2.00	2.00	2.00	2.00	2.00

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-S-GC05 GC05-S2 2.0-2.4m	EL-S-GC05 GC05-S3 3.0-3.4m	EL-S-GC05 GC05-S4 4.0-4.4m	EL-S-GC05 GC05-S5 5.0-5.4m	EL-S-GC05 GC05-S6 6.5-7.0m
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416586-011**	**EB1416586-012**	**EB1416586-013**	**EB1416586-014**	**EB1416586-015**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.0**	**6.1**	**5.8**	**6.0**	**6.0**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	**0.6**	**0.6**	<0.5
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-1.2**	**-2.4**	**-0.8**	**-2.2**	**-4.8**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**13**	**15**	**16**	**18**	**15**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**1.8**	**3.0**	**1.4**	**2.8**	**4.8**
ANC as CaCO3	----	0.1	% CaCO3		**0.2**	**0.3**	**0.1**	**0.3**	**0.5**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	**0.02**	**0.02**	<0.01
Sample Preparation Method									
Amount	----	0.01	kg		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-S-GC05 GC05-S7 8.0-8.35m	EL-S-GC05 GC05-S8 8.35-8.75m	EL-S-GC04 GC04-S1 0.0-0.4m	EL-S-GC04 GC04-S2 0.6-1.0m	EL-S-GC04 GC04-S3 3.0-3.5m
			Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	CAS Number	LOR	Unit	EB1416586-016	EB1416586-017	EB1416586-018	EB1416586-019	EB1416586-020
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	6.2	6.0	5.9	6.1	5.5
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	<0.5	0.6	0.6	0.6	0.6
Net Acid Production Potential	----	0.5	kg H2SO4/t	-4.0	-4.6	-2.0	-1.4	<0.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	37	22	31	19	14
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	4.0	5.2	2.6	2.0	1.1
ANC as CaCO3	----	0.1	% CaCO3	0.4	0.5	0.3	0.2	0.1
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.02	0.02	0.02	0.02
Sample Preparation Method								
Amount	----	0.01	kg	2.00	2.00	2.00	2.00	2.00

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-S-GC04 GC04-S4 5.6-6.0m	EL-S-GC04 GC04-S5 6.5-7.0m	EL-S-GC04 GC04-S6 8.4-8.7m	EL-S-GC04 GC04-S7 9.15-9.45m	EL-S-GC04 GC04-S8 9.5-9.8m
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416586-021**	**EB1416586-022**	**EB1416586-023**	**EB1416586-024**	**EB1416586-025**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**5.8**	**5.9**	**6.3**	**6.2**	**6.5**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	<0.5	**0.6**	<0.5
Net Acid Production Potential	----	0.5	kg H2SO4/t		<0.5	**-0.6**	**-0.8**	**-2.9**	**-2.0**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**10**	**11**	**13**	**17**	**18**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**0.6**	**1.2**	**0.8**	**3.5**	**2.0**
ANC as CaCO3	----	0.1	% CaCO3		<0.1	**0.1**	<0.1	**0.4**	**0.2**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	<0.01	**0.02**	<0.01
Sample Preparation Method									
Amount	----	0.01	kg		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	EL-N-GC03 GC03-S1 0.6-1.0m	EL-N-GC03 GC03-S2 2.0-2.4m	EL-N-GC03 GC03-S3 3.06-3.40m	EL-N-GC03 GC03-S4 5.0-5.4m	EL-N-GC03 GC03-S5 5.6-5.9m
			Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	CAS Number	LOR	Unit	EB1416586-026	EB1416586-027	EB1416586-028	EB1416586-029	EB1416586-030
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	5.9	5.9	6.5	5.3	6.3
EA009: Nett Acid Production Potential								
Acid Production Potential (APP)	----	0.5	kg H2SO4/t	0.6	0.6	0.6	0.6	0.6
Net Acid Production Potential	----	0.5	kg H2SO4/t	<0.5	<0.5	0.6	-0.9	0.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	15	12	14	22	17
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	0.9	0.9	<0.5	1.5	<0.5
ANC as CaCO3	----	0.1	% CaCO3	<0.1	<0.1	<0.1	0.2	<0.1
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.02	0.02	0.02
Sample Preparation Method								
Amount	----	0.01	kg	2.00	2.00	2.00	2.00	2.00

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-N-GC03 GC03-S6 7.0-7.4m	EL-N-GC03 GC03-S7 8.6-9.0m	EL-N-GC03 GC03-S8 11.0-11.4m	EL-N-GC03 GC03-S9 12.4-13.0m	EL-N-GC03 GC03-S10 13.1-13.5m
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416586-031**	**EB1416586-032**	**EB1416586-033**	**EB1416586-034**	**EB1416586-035**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**5.4**	**6.0**	**5.2**	**5.6**	**5.6**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	<0.5	**0.6**	**0.6**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-1.9**	**0.6**	**-0.9**	**-0.8**	**-1.2**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**24**	**12**	**17**	**15**	**16**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**2.5**	<0.5	**0.9**	**1.4**	**1.8**
ANC as CaCO3	----	0.1	% CaCO3		**0.2**	<0.1	<0.1	**0.1**	**0.2**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	<0.01	**0.02**	**0.02**
Sample Preparation Method									
Amount	----	0.01	kg		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	EL-N-GC03 GC03-S11 14.0-14.4m	EL-N-GC03 GC03-S12 17.6-18.0m	EL-N-GC03 GC03-S13 20-20.37m	EL-N-GC03 GC03-S13a 20.4-21m	EL-N-GC03 GC03-S14 21-21.5m
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	CAS Number	LOR	Unit		EB1416586-036	EB1416586-037	EB1416586-038	EB1416586-039	EB1416586-040
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.2**	**5.6**	**5.0**	**5.6**	**5.2**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	<0.5	**0.6**	<0.5	<0.5
Net Acid Production Potential	----	0.5	kg H2SO4/t		<0.5	**-2.0**	<0.5	**-2.0**	**-1.4**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**24**	**21**	**31**	**8**	**21**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**0.8**	**2.0**	**1.0**	**2.0**	**1.4**
ANC as CaCO3	----	0.1	% CaCO3		<0.1	**0.2**	**0.1**	**0.2**	**0.1**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	<0.01	**0.02**	<0.01	<0.01
Sample Preparation Method									
Amount	----	0.01	kg		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-N-GC03 GC03-S15 21.9-22.4m	EL-N-GC03 GC03-S16 22.65-22.8m	EL-N-GC02 GC02-S1 2.4-3.0m	EL-N-GC02 GC02-S2 3.3-3.7m	EL-N-GC02 GC02-S3 3.7-3.9m
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416586-041**	**EB1416586-042**	**EB1416586-043**	**EB1416586-044**	**EB1416586-045**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.0**	**6.0**	**6.2**	**5.7**	**6.0**
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		<0.5	<0.5	**0.6**	**0.6**	**0.6**
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-3.4**	**-1.0**	<0.5	**-1.8**	**-1.8**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**8**	**8**	**14**	**11**	**10**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**3.4**	**1.0**	**0.6**	**2.4**	**2.4**
ANC as CaCO3	----	0.1	% CaCO3		**0.3**	<0.1	<0.1	**0.2**	**0.2**
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		<0.01	<0.01	**0.02**	**0.02**	**0.02**
Sample Preparation Method									
Amount	----	0.01	kg		**2.00**	**2.00**	**2.00**	**2.00**	**2.00**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	EL-N-GC02 GC02-S4 3.9-4.2m	EL-N-GC02 GC02-S5 4.5-4.85m	EL-N-GC02 GC02-S6 5.15-5.65m	EL-N-GC02 GC02-S7 5.9-6.3m	EL-N-GC01 GC01-S1 0-0.27m
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]
Compound	CAS Number	LOR	Unit		EB1416586-046	EB1416586-047	EB1416586-048	EB1416586-049	EB1416586-050
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		5.9	6.0	5.9	5.8	6.2
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		0.6	0.6	0.6	0.6	0.6
Net Acid Production Potential	----	0.5	kg H2SO4/t		-1.3	<0.5	<0.5	-0.8	-3.5
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		10	11	12	10	37
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		1.9	0.6	1.1	1.4	4.1
ANC as CaCO3	----	0.1	% CaCO3		0.2	<0.1	0.1	0.1	0.4
Fizz Rating	----	0	Fizz Unit		0	0	0	0	0
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		0.02	0.02	0.02	0.02	0.02
Sample Preparation Method									
Amount	----	0.01	kg		2.00	2.00	2.00	2.00	2.00

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	EL-N-GC01 GC01-S2 0.5-1.0m	EL-N-GC01 GC01-S3 2.5-3.0m	EL-N-GC01 GC01-S4 3.11-3.5m	EL-N-GC01 GC01-S5 3.5-3.9m	----
				Client sampling date / time	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	[13-JUN-2014]	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1416586-051**	**EB1416586-052**	**EB1416586-053**	**EB1416586-054**	**----**
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**6.0**	**6.3**	**6.2**	**6.4**	----
EA009: Nett Acid Production Potential									
Acid Production Potential (APP)	----	0.5	kg H2SO4/t		**0.6**	**0.6**	<0.5	**0.6**	----
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-1.3**	**-2.0**	<0.5	**-2.3**	----
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**13**	**8**	**6**	**8**	----
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**1.9**	**2.6**	<0.5	**2.9**	----
ANC as CaCO3	----	0.1	% CaCO3		**0.2**	**0.3**	<0.1	**0.3**	----
Fizz Rating	----	0	Fizz Unit		**0**	**0**	**0**	**0**	----
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	**0.01**	**0.02**	----
Sample Preparation Method									
Amount	----	0.01	kg		**2.00**	**2.00**	**2.00**	**2.00**	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB1417699**	Page	: 1 of 18
Amendment	: **1**		
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61 7 3243 7218
Project	: 121312	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 22-JUL-2014
Sampler	: GEMCO	Issue Date	: 23-FEB-2015
Site	: ----		
		No. of samples received	: 22
Quote number	: BNBQ/218/14	No. of samples analysed	: 22

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Greg Vogel	Laboratory Manager	Brisbane Inorganics
Hamish Murray	Supervisor - Soils	Newcastle - Inorganics
Satishkumar Trivedi	2 IC Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EA058 Emerson: V. = Very, D. = Dark, L. = Light, VD. = Very Dark**
- **EA150H: Soil Particle Density required for Hydrometer analysis according to AS 1289.3.5.1 2006 was not requested by the client. Typical sediment SPD values used for calculations and consequently NATA endorsement does not apply to hydrometer results.**
- **ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl (Method 15G1) is a more suitable method for the determination of exchange acidity (H+ + Al3+).**
- **This report has been amended as a result of a request to change sample identification numbers (IDs) received by ALS from RGSENV. All analysis results are as per the previous report.**

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	EL-S-GC06 GC06-S2 0.75-1.1m	EL-S-GC06 GC06-S5 4.7-5.0m	EL-S-GC05 GC05-S2 2.0-2.4m	EL-S-GC05 GC05-S5 5.0-5.4m	EL-S-GC05 GC05-S6 6.5-7.0m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
					EB1417699-001	EB1417699-002	EB1417699-003	EB1417699-004	EB1417699-005
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		6.0	5.9	5.7	5.6	5.8
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		19	19	13	17	15
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		1.1	0.4	0.6	0.2	----
Exchangeable Magnesium	----	0.1	meq/100g		1.3	1.4	1.3	0.6	----
Exchangeable Potassium	----	0.1	meq/100g		0.1	0.2	0.1	<0.1	----
Exchangeable Sodium	----	0.1	meq/100g		<0.1	<0.1	<0.1	<0.1	----
Cation Exchange Capacity	----	0.1	meq/100g		2.6	2.1	2.0	0.9	----
Exchangeable Sodium Percent	----	0.1	%		1.0	1.9	1.2	3.5	----
ED037: Alkalinity									
Total Alkalinity as CaCO3	----	1	mg/kg		43	26	34	26	34
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg		43	26	34	26	34
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg		<1	<1	<1	<1	<1
ED038A: Acidity									
Acidity	----	1	mg/kg		16	24	24	32	39
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		<10	<10	<10	10	<10
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	10	mg/kg		<10	<10	<10	<10	<10
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		<10	<10	<10	<10	<10
Magnesium	7439-95-4	10	mg/kg		<10	<10	<10	<10	<10
Sodium	7440-23-5	10	mg/kg		10	10	<10	10	10
Potassium	7440-09-7	10	mg/kg		<10	<10	<10	<10	<10
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		<50	130	<50	2000	1500
Potassium	7440-09-7	50	mg/kg		320	1490	1650	4840	8700
Calcium	7440-70-2	50	mg/kg		300	140	180	860	820
Magnesium	7439-95-4	50	mg/kg		370	320	360	500	2420
EG005S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg		<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	EL-S-GC06 GC06-S2 0.75-1.1m	EL-S-GC06 GC06-S5 4.7-5.0m	EL-S-GC05 GC05-S2 2.0-2.4m	EL-S-GC05 GC05-S5 5.0-5.4m	EL-S-GC05 GC05-S6 6.5-7.0m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
					EB1417699-001	EB1417699-002	EB1417699-003	EB1417699-004	EB1417699-005
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**16600**	**18700**	**20900**	**9880**	**15800**
Antimony	7440-36-0	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		<5	**31**	**8**	**6**	**6**
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		**121**	**95**	**80**	**15**	**6**
Cobalt	7440-48-4	2	mg/kg		**79**	**27**	**119**	**75**	**48**
Copper	7440-50-8	5	mg/kg		**51**	**32**	**33**	**130**	**50**
Iron	7439-89-6	50	mg/kg		**102000**	**138000**	**100000**	**135000**	**36800**
Lead	7439-92-1	5	mg/kg		**84**	**135**	**52**	**105**	**56**
Manganese	7439-96-5	5	mg/kg		**29100**	**30800**	**58100**	**344000**	**208000**
Molybdenum	7439-98-7	2	mg/kg		<2	<2	**2**	<2	<2
Nickel	7440-02-0	2	mg/kg		**101**	**16**	**80**	**139**	**126**
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	**19**	**7**
Silver	7440-22-4	2	mg/kg		<2	<2	<2	**3**	**2**
Vanadium	7440-62-2	5	mg/kg		**261**	**346**	**269**	**208**	**123**
Zinc	7440-66-6	5	mg/kg		<5	**20**	**23**	**190**	**170**
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Barium	7440-39-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	7440-41-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**0.02**
Thorium	7440-29-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg		**0.02**	**0.03**	**0.01**	<0.01	**0.05**
Molybdenum	7439-98-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	7440-02-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	EL-S-GC06 GC06-S2 0.75-1.1m	EL-S-GC06 GC06-S5 4.7-5.0m	EL-S-GC05 GC05-S2 2.0-2.4m	EL-S-GC05 GC05-S5 5.0-5.4m	EL-S-GC05 GC05-S6 6.5-7.0m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
					EB1417699-001	EB1417699-002	EB1417699-003	EB1417699-004	EB1417699-005
EG020S: Soluble Metals by ICPMS - Continued									
Uranium	7440-61-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG020T: Total Metals by ICP-MS									
Thorium	7440-29-1	0.1	mg/kg		**9.3**	**7.5**	**5.7**	**4.3**	**5.3**
Uranium	7440-61-1	0.1	mg/kg		**2.7**	**1.5**	**2.6**	**1.2**	**0.7**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	EL-S-GC04 GC04-S2 0.6-1.0m	EL-S-GC04 GC04-S4 5.6-6.0m	EL-S-GC04 GC04-S6 8.4-8.7m	EL-S-GC04 GC04-S8 9.5-9.8m	EL-N-GC03 GC03-S7 8.6-9.0m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
Compound	CAS Number	LOR	Unit		EB1417699-006	EB1417699-007	EB1417699-008	EB1417699-009	EB1417699-010
EA150: Particle Sizing									
+75µm	----	1	%		----	----	19	27	20
+150µm	----	1	%		----	----	7	18	19
+300µm	----	1	%		----	----	7	16	19
+425µm	----	1	%		----	----	7	16	18
+600µm	----	1	%		----	----	6	15	18
+1180µm	----	1	%		----	----	5	12	16
+2.36mm	----	1	%		----	----	3	8	10
+4.75mm	----	1	%		----	----	<1	2	2
+9.5mm	----	1	%		----	----	<1	<1	<1
+19.0mm	----	1	%		----	----	<1	<1	<1
+37.5mm	----	1	%		----	----	<1	<1	<1
+75.0mm	----	1	%		----	----	<1	<1	<1
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		5.8	5.6	6.0	6.2	5.6
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		20	11	8	17	12
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-		----	----	Reddish Brown	L. Yellowish Brown	Light Brown
Texture	----	-	-		----	----	Silty Clay	Silty Clay	Rock
Emerson Class Number	EC/TC	-	-		----	----	4	4	8
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	----	45	43	27
Silt (2-60 µm)	----	1	%		----	----	32	29	51
Sand (0.06-2.00 mm)	----	1	%		----	----	20	20	12
Gravel (>2mm)	----	1	%		----	----	3	8	10
Cobbles (>6cm)	----	1	%		----	----	<1	<1	<1
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		0.2	<0.1	2.3	1.6	<0.1
Exchangeable Magnesium	----	0.1	meq/100g		1.2	0.6	11.9	8.5	0.2
Exchangeable Potassium	----	0.1	meq/100g		0.1	<0.1	0.7	0.6	<0.1
Exchangeable Sodium	----	0.1	meq/100g		<0.1	<0.1	0.2	0.2	<0.1
Cation Exchange Capacity	----	0.1	meq/100g		1.6	0.7	15.2	10.9	0.3
Exchangeable Sodium Percent	----	0.1	%		2.2	<0.1	1.4	1.6	3.5

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	EL-S-GC04 GC04-S2 0.6-1.0m	EL-S-GC04 GC04-S4 5.6-6.0m	EL-S-GC04 GC04-S6 8.4-8.7m	EL-S-GC04 GC04-S8 9.5-9.8m	EL-N-GC03 GC03-S7 8.6-9.0m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
Compound	CAS Number	LOR	Unit		EB1417699-006	EB1417699-007	EB1417699-008	EB1417699-009	EB1417699-010
ED037: Alkalinity									
Total Alkalinity as CaCO3	----	1	mg/kg		34	26	34	68	26
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg		34	26	34	68	26
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg		<1	<1	<1	<1	<1
ED038A: Acidity									
Acidity	----	1	mg/kg		24	24	71	63	24
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		<10	<10	<10	<10	<10
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	10	mg/kg		<10	10	<10	<10	10
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		<10	<10	<10	<10	<10
Magnesium	7439-95-4	10	mg/kg		<10	<10	<10	<10	<10
Sodium	7440-23-5	10	mg/kg		20	<10	<10	<10	<10
Potassium	7440-09-7	10	mg/kg		<10	<10	<10	<10	<10
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		90	<50	110	210	<50
Potassium	7440-09-7	50	mg/kg		610	610	1860	3200	200
Calcium	7440-70-2	50	mg/kg		100	<50	550	500	<50
Magnesium	7439-95-4	50	mg/kg		320	110	2610	2150	<50
EG005S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg		<1	<1	<1	<1	<1
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		22800	4950	8500	10100	4820
Antimony	7440-36-0	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		6	11	<5	7	<5
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		116	6	31	35	26
Cobalt	7440-48-4	2	mg/kg		111	92	12	37	<2
Copper	7440-50-8	5	mg/kg		40	36	18	53	<5
Iron	7439-89-6	50	mg/kg		126000	20300	56500	56400	23300
Lead	7439-92-1	5	mg/kg		56	<5	13	42	<5

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	EL-S-GC04 GC04-S2 0.6-1.0m	EL-S-GC04 GC04-S4 5.6-6.0m	EL-S-GC04 GC04-S6 8.4-8.7m	EL-S-GC04 GC04-S8 9.5-9.8m	EL-N-GC03 GC03-S7 8.6-9.0m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
					EB1417699-006	EB1417699-007	EB1417699-008	EB1417699-009	EB1417699-010
EG005T: Total Metals by ICP-AES - Continued									
Manganese	7439-96-5	5	mg/kg		**36100**	**21700**	**11000**	**51200**	**400**
Molybdenum	7439-98-7	2	mg/kg		**4**	**8**	<2	<2	<2
Nickel	7440-02-0	2	mg/kg		**58**	**5**	**13**	**20**	<2
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Silver	7440-22-4	2	mg/kg		<2	<2	<2	<2	<2
Vanadium	7440-62-2	5	mg/kg		**304**	**126**	**222**	**147**	**45**
Zinc	7440-66-6	5	mg/kg		**12**	**34**	**40**	**59**	<5
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Barium	7440-39-3	0.01	mg/kg		<0.01	**0.01**	<0.01	<0.01	<0.01
Beryllium	7440-41-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	7440-29-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg		**0.04**	**0.04**	<0.01	**0.02**	**0.04**
Molybdenum	7439-98-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	7440-02-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG020T: Total Metals by ICP-MS									
Thorium	7440-29-1	0.1	mg/kg		**7.4**	**1.2**	**6.1**	**4.5**	**1.3**
Uranium	7440-61-1	0.1	mg/kg		**3.6**	**1.0**	**0.2**	**0.6**	**0.1**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EK040S: Fluoride Soluble									

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)				Client sample ID	EL-S-GC04 GC04-S2 0.6-1.0m	EL-S-GC04 GC04-S4 5.6-6.0m	EL-S-GC04 GC04-S6 8.4-8.7m	EL-S-GC04 GC04-S8 9.5-9.8m	EL-N-GC03 GC03-S7 8.6-9.0m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1417699-006**	**EB1417699-007**	**EB1417699-008**	**EB1417699-009**	**EB1417699-010**
EK040S: Fluoride Soluble - Continued									
Fluoride	16984-48-8	1	mg/kg		<1	<1	<1	**2**	<1

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)				Client sample ID	EL-N-GC03 GC03-S10 13.1-13.5m	EL-N-GC03 GC03-S13 20-20.37m	EL-N-GC03 GC03-S13a 20.4-21m	EL-N-GC03 GC03-S14 21-21.5m	EL-N-GC03 GC03-S16 22.65-22.8m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1417699-011**	**EB1417699-012**	**EB1417699-013**	**EB1417699-014**	**EB1417699-015**
EA150: Particle Sizing									
+75µm	----	1	%		----	----	----	**32**	**61**
+150µm	----	1	%		----	----	----	**21**	**58**
+300µm	----	1	%		----	----	----	**18**	**58**
+425µm	----	1	%		----	----	----	**15**	**57**
+600µm	----	1	%		----	----	----	**14**	**55**
+1180µm	----	1	%		----	----	----	**11**	**49**
+2.36mm	----	1	%		----	----	----	**8**	**36**
+4.75mm	----	1	%		----	----	----	**1**	**8**
+9.5mm	----	1	%		----	----	----	<1	<1
+19.0mm	----	1	%		----	----	----	<1	<1
+37.5mm	----	1	%		----	----	----	<1	<1
+75.0mm	----	1	%		----	----	----	<1	<1
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		**5.5**	**4.9**	**5.0**	**5.0**	**5.8**
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		**17**	**34**	**11**	**24**	**8**
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-		----	----	----	**Very Dark Grey**	**Grey**
Texture	----	-	-		----	----	----	**Silty Clay**	**Rock**
Emerson Class Number	EC/TC	-	-		----	----	----	**4**	**8**
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	----	----	**18**	**9**
Silt (2-60 µm)	----	1	%		----	----	----	**48**	**30**
Sand (0.06-2.00 mm)	----	1	%		----	----	----	**26**	**25**
Gravel (>2mm)	----	1	%		----	----	----	**8**	**36**
Cobbles (>6cm)	----	1	%		----	----	----	<1	<1
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		<0.1	<0.1	----	<0.1	<0.1
Exchangeable Magnesium	----	0.1	meq/100g		<0.1	<0.1	----	<0.1	**0.1**
Exchangeable Potassium	----	0.1	meq/100g		<0.1	<0.1	----	<0.1	<0.1
Exchangeable Sodium	----	0.1	meq/100g		<0.1	<0.1	----	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g		**0.2**	<0.1	----	**0.2**	**0.2**

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	EL-N-GC03 GC03-S10 13.1-13.5m	EL-N-GC03 GC03-S13 20-20.37m	EL-N-GC03 GC03-S13a 20.4-21m	EL-N-GC03 GC03-S14 21-21.5m	EL-N-GC03 GC03-S16 22.65-22.8m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
					EB1417699-011	EB1417699-012	EB1417699-013	EB1417699-014	EB1417699-015
ED008: Exchangeable Cations - Continued									
Exchangeable Sodium Percent	----	0.1	%		<0.1	<0.1	----	<0.1	<0.1
ED037: Alkalinity									
Total Alkalinity as CaCO3	----	1	mg/kg		34	17	17	17	26
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg		34	17	17	17	26
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg		<1	<1	<1	<1	<1
ED038A: Acidity									
Acidity	----	1	mg/kg		24	32	32	24	32
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		<10	<10	<10	<10	<10
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	10	mg/kg		20	40	10	30	<10
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		<10	<10	<10	<10	<10
Magnesium	7439-95-4	10	mg/kg		<10	<10	<10	<10	<10
Sodium	7440-23-5	10	mg/kg		<10	<10	<10	<10	<10
Potassium	7440-09-7	10	mg/kg		<10	20	<10	<10	<10
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		<50	<50	<50	<50	<50
Potassium	7440-09-7	50	mg/kg		2450	140	8890	190	210
Calcium	7440-70-2	50	mg/kg		<50	<50	900	<50	<50
Magnesium	7439-95-4	50	mg/kg		<50	<50	300	60	<50
EG005S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg		<1	<1	<1	<1	<1
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		3730	4430	6930	2980	2320
Antimony	7440-36-0	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		12	<5	59	5	<5
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		7	26	4	11	11
Cobalt	7440-48-4	2	mg/kg		74	3	142	3	<2

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	EL-N-GC03 GC03-S10 13.1-13.5m	EL-N-GC03 GC03-S13 20-20.37m	EL-N-GC03 GC03-S13a 20.4-21m	EL-N-GC03 GC03-S14 21-21.5m	EL-N-GC03 GC03-S16 22.65-22.8m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
					EB1417699-011	EB1417699-012	EB1417699-013	EB1417699-014	EB1417699-015
EG005T: Total Metals by ICP-AES - Continued									
Copper	7440-50-8	5	mg/kg		**28**	**33**	**172**	**13**	<5
Iron	7439-89-6	50	mg/kg		**12300**	**117000**	**18400**	**35400**	**6010**
Lead	7439-92-1	5	mg/kg		<5	**52**	**233**	**13**	**6**
Manganese	7439-96-5	5	mg/kg		**44300**	**2070**	**569000**	**30900**	**3990**
Molybdenum	7439-98-7	2	mg/kg		**4**	<2	<2	<2	**2**
Nickel	7440-02-0	2	mg/kg		**4**	**41**	**83**	**12**	<2
Selenium	7782-49-2	5	mg/kg		<5	<5	**47**	<5	<5
Silver	7440-22-4	2	mg/kg		<2	<2	**7**	<2	<2
Vanadium	7440-62-2	5	mg/kg		**97**	**160**	**284**	**178**	**108**
Zinc	7440-66-6	5	mg/kg		**45**	**29**	**180**	**11**	<5
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Barium	7440-39-3	0.01	mg/kg		<0.01	**0.03**	<0.01	**0.01**	<0.01
Beryllium	7440-41-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	7440-29-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg		**0.07**	**1.27**	**0.07**	**0.47**	<0.01
Molybdenum	7439-98-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	7440-02-0	0.01	mg/kg		<0.01	**0.02**	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG020T: Total Metals by ICP-MS									
Thorium	7440-29-1	0.1	mg/kg		**1.8**	**4.2**	**2.1**	**5.1**	**1.6**

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	EL-N-GC03 GC03-S10 13.1-13.5m	EL-N-GC03 GC03-S13 20-20.37m	EL-N-GC03 GC03-S13a 20.4-21m	EL-N-GC03 GC03-S14 21-21.5m	EL-N-GC03 GC03-S16 22.65-22.8m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00
					EB1417699-011	EB1417699-012	EB1417699-013	EB1417699-014	EB1417699-015
EG020T: Total Metals by ICP-MS - Continued									
Uranium	7440-61-1	0.1	mg/kg		**0.4**	**2.1**	**1.8**	**0.6**	**0.2**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	EL-N-GC02 GC02-S2 3.3-3.7m	EL-N-GC02 GC02-S5 4.5-4.85m	EL-N-GC01 GC01-S1 0-0.27m	EL-S-MB06 GW06 18m	EL-S-MB06 GW06 21m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	09-JAN-2014 15:00	09-JAN-2014 15:00
Compound	CAS Number	LOR	Unit		EB1417699-016	EB1417699-017	EB1417699-018	EB1417699-019	EB1417699-020
EA150: Particle Sizing									
+75µm	----	1	%		----	65	----	----	----
+150µm	----	1	%		----	52	----	----	----
+300µm	----	1	%		----	33	----	----	----
+425µm	----	1	%		----	26	----	----	----
+600µm	----	1	%		----	21	----	----	----
+1180µm	----	1	%		----	18	----	----	----
+2.36mm	----	1	%		----	11	----	----	----
+4.75mm	----	1	%		----	<1	----	----	----
+9.5mm	----	1	%		----	<1	----	----	----
+19.0mm	----	1	%		----	<1	----	----	----
+37.5mm	----	1	%		----	<1	----	----	----
+75.0mm	----	1	%		----	<1	----	----	----
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		5.5	5.6	5.8	----	----
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		13	12	36	----	----
EA026 : Chromium Reducible Sulfur									
Chromium Reducible Sulphur	----	0.005	%		----	----	----	0.319	0.628
EA058: Emerson Aggregate Test									
Color (Munsell)	----	-	-		----	Brown	----	----	----
Texture	----	-	-		----	Sandy Gravel	----	----	----
Emerson Class Number	EC/TC	-	-		----	8	----	----	----
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		----	26	----	----	----
Silt (2-60 µm)	----	1	%		----	8	----	----	----
Sand (0.06-2.00 mm)	----	1	%		----	55	----	----	----
Gravel (>2mm)	----	1	%		----	11	----	----	----
Cobbles (>6cm)	----	1	%		----	<1	----	----	----
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		<0.1	<0.1	1.0	----	----
Exchangeable Magnesium	----	0.1	meq/100g		0.3	0.6	0.5	----	----
Exchangeable Potassium	----	0.1	meq/100g		<0.1	<0.1	0.1	----	----
Exchangeable Sodium	----	0.1	meq/100g		<0.1	<0.1	<0.1	----	----

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	EL-N-GC02 GC02-S2 3.3-3.7m	EL-N-GC02 GC02-S5 4.5-4.85m	EL-N-GC01 GC01-S1 0-0.27m	EL-S-MB06 GW06 18m	EL-S-MB06 GW06 21m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	09-JAN-2014 15:00	09-JAN-2014 15:00
Compound	CAS Number	LOR	Unit		EB1417699-016	EB1417699-017	EB1417699-018	EB1417699-019	EB1417699-020
ED008: Exchangeable Cations - Continued									
Cation Exchange Capacity	----	0.1	meq/100g		0.4	0.7	1.6	----	----
Exchangeable Sodium Percent	----	0.1	%		<0.1	<0.1	<0.1	----	----
ED037: Alkalinity									
Total Alkalinity as CaCO3	----	1	mg/kg		34	26	43	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg		34	26	43	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg		<1	<1	<1	----	----
ED038A: Acidity									
Acidity	----	1	mg/kg		24	24	32	----	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		<10	<10	<10	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	10	mg/kg		<10	<10	<10	----	----
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		<10	<10	<10	----	----
Magnesium	7439-95-4	10	mg/kg		<10	<10	<10	----	----
Sodium	7440-23-5	10	mg/kg		<10	<10	<10	----	----
Potassium	7440-09-7	10	mg/kg		<10	<10	10	----	----
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		310	<50	210	----	----
Potassium	7440-09-7	50	mg/kg		11200	160	4930	----	----
Calcium	7440-70-2	50	mg/kg		220	<50	500	----	----
Magnesium	7439-95-4	50	mg/kg		140	100	210	----	----
EG005S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		<1	<1	<1	----	----
Iron	7439-89-6	1	mg/kg		<1	<1	<1	----	----
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		15900	6440	17200	----	----
Antimony	7440-36-0	5	mg/kg		<5	<5	<5	----	----
Arsenic	7440-38-2	5	mg/kg		20	11	11	----	----
Boron	7440-42-8	50	mg/kg		<50	<50	<50	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg		68	45	45	----	----
Cobalt	7440-48-4	2	mg/kg		101	<2	107	----	----

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID: EL-N-GC02 GC02-S2 3.3-3.7m	EL-N-GC02 GC02-S5 4.5-4.85m	EL-N-GC01 GC01-S1 0-0.27m	EL-S-MB06 GW06 18m	EL-S-MB06 GW06 21m
			Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	09-JAN-2014 15:00	09-JAN-2014 15:00
				EB1417699-016	EB1417699-017	EB1417699-018	EB1417699-019	EB1417699-020
EG005T: Total Metals by ICP-AES - Continued								
Copper	7440-50-8	5	mg/kg	**95**	**8**	**61**	----	----
Iron	7439-89-6	50	mg/kg	**53600**	**65500**	**63300**	----	----
Lead	7439-92-1	5	mg/kg	**117**	**20**	**51**	----	----
Manganese	7439-96-5	5	mg/kg	**379000**	**1930**	**114000**	----	----
Molybdenum	7439-98-7	2	mg/kg	<2	**3**	**4**	----	----
Nickel	7440-02-0	2	mg/kg	**22**	<2	**30**	----	----
Selenium	7782-49-2	5	mg/kg	**22**	<5	<5	----	----
Silver	7440-22-4	2	mg/kg	**4**	<2	<2	----	----
Vanadium	7440-62-2	5	mg/kg	**250**	**688**	**138**	----	----
Zinc	7440-66-6	5	mg/kg	**83**	<5	**62**	----	----
EG020S: Soluble Metals by ICPMS								
Arsenic	7440-38-2	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Barium	7440-39-3	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Beryllium	7440-41-7	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Chromium	7440-47-3	0.01	mg/kg	**0.01**	<0.01	<0.01	----	----
Thorium	7440-29-1	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Copper	7440-50-8	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Manganese	7439-96-5	0.01	mg/kg	**0.01**	**0.02**	**0.16**	----	----
Molybdenum	7439-98-7	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Antimony	7440-36-0	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.05	mg/kg	<0.05	<0.05	<0.05	----	----
Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Aluminium	7429-90-5	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
EG020T: Total Metals by ICP-MS								
Thorium	7440-29-1	0.1	mg/kg	**6.8**	**11.9**	**5.4**	----	----
Uranium	7440-61-1	0.1	mg/kg	**2.3**	**1.3**	**1.2**	----	----

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)				Client sample ID	EL-N-GC02 GC02-S2 3.3-3.7m	EL-N-GC02 GC02-S5 4.5-4.85m	EL-N-GC01 GC01-S1 0-0.27m	EL-S-MB06 GW06 18m	EL-S-MB06 GW06 21m
				Client sampling date / time	13-JUN-2014 05:00	13-JUN-2014 05:00	13-JUN-2014 05:00	09-JAN-2014 15:00	09-JAN-2014 15:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1417699-016**	**EB1417699-017**	**EB1417699-018**	**EB1417699-019**	**EB1417699-020**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		<1	<1	<1	----	----

Analytical Results

Sub-Matrix: **PULP** (Matrix: **SOIL**)			Client sample ID	**EL-S-MB05 GW05 36m**	**EL-S-MB05 GW05 39m**	----	----	----
			Client sampling date / time	15-MAY-2014 15:00	15-MAY-2014 15:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1417699-021**	**EB1417699-022**	**----**	**----**	**----**
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.559**	**0.094**	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1441384**	Page	: 1 of 6
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: 123 WYNNE ST SUNNYBANK HILLS QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61-7-3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 27-Aug-2014 18:45
Sampler	: MANDIE MATHESON	Issue Date	: 05-Sep-2014 18:32
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Greg Vogel	Laboratory Manager	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	GEMCO # 01	GEMCO # 02	GEMCO # 03	GEMCO # 04	GEMCO # 05
			Client sampling date / time	27-Aug-2014 15:00	27-Aug-2014 15:00	27-Aug-2014 15:00	27-Aug-2014 15:00	27-Aug-2014 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1441384-001**	**EB1441384-002**	**EB1441384-003**	**EB1441384-004**	**EB1441384-005**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.87**	**6.81**	**5.91**	**5.56**	**7.08**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**117**	**96**	**15**	**53**	**29**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**4**	**26**	**3**	**3**	**4**
Total Alkalinity as CaCO3	----	1	mg/L	**4**	**26**	**3**	**3**	**4**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**43**	**8**	**3**	**6**	**5**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**38**	<1	<1	<1	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**1**	**7**	**3**	**12**	**7**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**2**	**4**	<1	<1	<1
Magnesium	7439-95-4	1	mg/L	**4**	**2**	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**4**	**9**	**1**	**8**	**2**
Potassium	7440-09-7	1	mg/L	<1	**2**	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.10**	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	7440-39-3	0.001	mg/L	**0.001**	**0.007**	<0.001	<0.001	<0.001
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	**0.054**	<0.001	<0.001	<0.001	<0.001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.015**	**0.002**	<0.001	**0.002**	<0.001
Manganese	7439-96-5	0.001	mg/L	**2.49**	**0.157**	**0.002**	**0.023**	**0.075**
Nickel	7440-02-0	0.001	mg/L	**0.074**	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)				Client sample ID	GEMCO # 01	GEMCO # 02	GEMCO # 03	GEMCO # 04	GEMCO # 05
				Client sampling date / time	27-Aug-2014 15:00	27-Aug-2014 15:00	27-Aug-2014 15:00	27-Aug-2014 15:00	27-Aug-2014 15:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1441384-001**	**EB1441384-002**	**EB1441384-003**	**EB1441384-004**	**EB1441384-005**
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L		**0.090**	<0.005	<0.005	<0.005	<0.005
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Silver	7440-22-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Thorium	7440-29-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L		**1.33**	<0.05	<0.05	<0.05	<0.05
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG050G: Hexavalent Chromium by Discrete Analyser									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	**GEMCO # 06**	----	----	----	----
			Client sampling date / time	27-Aug-2014 15:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1441384-006**	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.00**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**34**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**3**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**3**	----	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**5**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**6**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	**4**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	----	----	----	----
Barium	7440-39-3	0.001	mg/L	<0.001	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.043**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)				Client sample ID	**GEMCO # 06**	----	----	----	----
				Client sampling date / time	27-Aug-2014 15:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1441384-006**	--------	--------	--------	--------
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	----	----	----	----
Silver	7440-22-4	0.001	mg/L		<0.001	----	----	----	----
Thorium	7440-29-1	0.001	mg/L		<0.001	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	----	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EG050G: Hexavalent Chromium by Discrete Analyser									
Hexavalent Chromium	18540-29-9	0.01	mg/L		<0.01	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB1443211**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61-7-3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 25-Sep-2014 19:00
C-O-C number	: ----	Date Analysis Commenced	: 26-Sep-2014
Sampler	: MANDIE MATHESON	Issue Date	: 07-Oct-2014 13:56
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	GEMCO # 01	GEMCO # 02	GEMCO # 03	GEMCO # 04	GEMCO # 05
			Client sampling date / time	25-Sep-2014 15:00	25-Sep-2014 15:00	25-Sep-2014 15:00	25-Sep-2014 15:00	25-Sep-2014 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1443211-001**	**EB1443211-002**	**EB1443211-003**	**EB1443211-004**	**EB1443211-005**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.10**	**6.69**	**6.19**	**5.85**	**5.34**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**699**	**29**	**16**	**28**	**23**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**4**	**4**	**2**	**1**	<1
Total Alkalinity as CaCO3	----	1	mg/L	**4**	**4**	**2**	**1**	<1
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**9**	<1	<1	**6**	**5**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**264**	**3**	**1**	**1**	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**1**	**2**	**3**	**7**	**6**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**67**	<1	<1	<1	<1
Magnesium	7439-95-4	1	mg/L	**23**	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**5**	**2**	**2**	**4**	**1**
Potassium	7440-09-7	1	mg/L	**1**	<1	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.09**	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	**0.0003**	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.008**	<0.001	<0.001	<0.001	**0.002**
Cobalt	7440-48-4	0.001	mg/L	**0.087**	<0.001	<0.001	<0.001	**0.003**
Nickel	7440-02-0	0.001	mg/L	**0.138**	<0.001	<0.001	<0.001	**0.004**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.166**	<0.005	<0.005	<0.005	**0.011**
Manganese	7439-96-5	0.001	mg/L	**4.12**	**0.073**	**0.014**	**0.013**	**0.297**
Molybdenum	7439-98-7	0.001	mg/L	**0.001**	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	**0.40**	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	**GEMCO # 06**	**----**	**----**	**----**	**----**
			Client sampling date / time	25-Sep-2014 15:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1443211-006**	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.75**	**----**	**----**	**----**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**18**	**----**	**----**	**----**	**----**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	**----**	**----**	**----**	**----**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	**----**	**----**	**----**	**----**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	**----**	**----**	**----**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	<1	**----**	**----**	**----**	**----**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2**	**----**	**----**	**----**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	**----**	**----**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**4**	**----**	**----**	**----**	**----**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	**----**	**----**	**----**	**----**
Magnesium	7439-95-4	1	mg/L	<1	**----**	**----**	**----**	**----**
Sodium	7440-23-5	1	mg/L	**2**	**----**	**----**	**----**	**----**
Potassium	7440-09-7	1	mg/L	<1	**----**	**----**	**----**	**----**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Antimony	7440-36-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Arsenic	7440-38-2	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**----**	**----**	**----**	**----**
Chromium	7440-47-3	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Copper	7440-50-8	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cobalt	7440-48-4	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Nickel	7440-02-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Lead	7439-92-1	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Zinc	7440-66-6	0.005	mg/L	<0.005	**----**	**----**	**----**	**----**
Manganese	7439-96-5	0.001	mg/L	**0.049**	**----**	**----**	**----**	**----**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Selenium	7782-49-2	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Iron	7439-89-6	0.05	mg/L	<0.05	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB1445223**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: C/- URS GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61-7-3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 28-Oct-2014 18:10
C-O-C number	: ----	Date Analysis Commenced	: 29-Oct-2014
Sampler	: MANDIE MATHESON	Issue Date	: 04-Nov-2014 16:36
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			*Client sample ID*	**GEMCO # 1**	**GEMCO # 2**	**GEMCO # 3**	**GEMCO # 4**	**GEMCO # 5**
			Client sampling date / time	[28-Oct-2014]	[28-Oct-2014]	[28-Oct-2014]	[28-Oct-2014]	[28-Oct-2014]
Compound	*CAS Number*	*LOR*	*Unit*	**EB1445223-001**	**EB1445223-002**	**EB1445223-003**	**EB1445223-004**	**EB1445223-005**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**4.89**	**6.27**	**5.85**	**5.37**	**4.69**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**890**	**23**	**10**	**16**	**21**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**2**	**2**	**1**	<1	<1
Total Alkalinity as CaCO3	----	1	mg/L	**2**	**2**	**1**	<1	<1
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**38**	**3**	**3**	**6**	**5**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**494**	**4**	**2**	**2**	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**3**	**2**	**2**	**4**	**5**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**61**	<1	<1	<1	<1
Magnesium	7439-95-4	1	mg/L	**75**	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**20**	**2**	**2**	**3**	**2**
Potassium	7440-09-7	1	mg/L	**8**	**1**	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.18**	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	**0.0013**	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.014**	<0.001	<0.001	<0.001	**0.001**
Cobalt	7440-48-4	0.001	mg/L	**0.240**	<0.001	<0.001	<0.001	**0.002**
Nickel	7440-02-0	0.001	mg/L	**0.372**	<0.001	<0.001	<0.001	**0.003**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.495**	<0.005	<0.005	<0.005	**0.008**
Manganese	7439-96-5	0.001	mg/L	**11.7**	**0.058**	**0.012**	**0.003**	**0.267**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	**0.23**	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	**GEMCO # 6**	----	----	----	----
			Client sampling date / time	[28-Oct-2014]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1445223-006**	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.29**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**14**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**3**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	**2**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.072**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB1447372**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61-7-3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 28-Nov-2014 14:00
C-O-C number	: ----	Date Analysis Commenced	: 01-Dec-2014
Sampler	: MANDIE MATHESON	Issue Date	: 08-Dec-2014 16:10
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	GEMCO # 01	GEMCO # 02	GEMCO # 03	GEMCO # 04	GEMCO # 05
			Client sampling date / time	[27-Nov-2014]	[27-Nov-2014]	[27-Nov-2014]	[27-Nov-2014]	[27-Nov-2014]
Compound	CAS Number	LOR	Unit	EB1447372-001	EB1447372-002	EB1447372-003	EB1447372-004	EB1447372-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	---	0.01	pH Unit	4.70	6.39	5.94	5.55	4.92
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	---	1	µS/cm	1180	26	13	20	23
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	5	4	4	<1
Total Alkalinity as CaCO3	---	1	mg/L	<1	5	4	4	<1
ED038A: Acidity								
Acidity as CaCO3	---	1	mg/L	115	3	3	8	3
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	595	3	2	3	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	4	2	2	3	5
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	27	<1	<1	<1	<1
Magnesium	7439-95-4	1	mg/L	117	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	34	2	2	3	1
Potassium	7440-09-7	1	mg/L	8	<1	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.19	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	0.0028	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.014	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	0.391	<0.001	<0.001	<0.001	0.001
Nickel	7440-02-0	0.001	mg/L	0.666	<0.001	<0.001	<0.001	0.002
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	0.823	<0.005	<0.005	<0.005	0.006
Manganese	7439-96-5	0.001	mg/L	19.6	0.046	0.012	0.002	0.241
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)			Client sample ID	**GEMCO # 06**	**----**	**----**	**----**	**----**
			Client sampling date / time	[27-Nov-2014]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1447372-006**	**--------**	**--------**	**--------**	**--------**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.28**	**----**	**----**	**----**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**17**	**----**	**----**	**----**	**----**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	**----**	**----**	**----**	**----**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	**----**	**----**	**----**	**----**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**3**	**----**	**----**	**----**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	**3**	**----**	**----**	**----**	**----**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**3**	**----**	**----**	**----**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	**----**	**----**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**3**	**----**	**----**	**----**	**----**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	**----**	**----**	**----**	**----**
Magnesium	7439-95-4	1	mg/L	<1	**----**	**----**	**----**	**----**
Sodium	7440-23-5	1	mg/L	**2**	**----**	**----**	**----**	**----**
Potassium	7440-09-7	1	mg/L	<1	**----**	**----**	**----**	**----**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Antimony	7440-36-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Arsenic	7440-38-2	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**----**	**----**	**----**	**----**
Chromium	7440-47-3	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Copper	7440-50-8	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cobalt	7440-48-4	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Nickel	7440-02-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Lead	7439-92-1	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Zinc	7440-66-6	0.005	mg/L	<0.005	**----**	**----**	**----**	**----**
Manganese	7439-96-5	0.001	mg/L	**0.077**	**----**	**----**	**----**	**----**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Selenium	7782-49-2	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Iron	7439-89-6	0.05	mg/L	<0.05	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB1449195**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61-7-3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 29-Dec-2014 16:55
C-O-C number	: ----	Date Analysis Commenced	: 30-Dec-2014
Sampler	: MANDIE MATHESON	Issue Date	: 08-Jan-2015 15:41
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Greg Vogel	Laboratory Manager	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			*Client sample ID*	**GEMCO # 01**	**GEMCO # 02**	**GEMCO # 03**	**GEMCO # 04**	**GEMCO # 05**
			Client sampling date / time	[29-Dec-2014]	[29-Dec-2014]	[29-Dec-2014]	[29-Dec-2014]	[29-Dec-2014]
Compound	*CAS Number*	*LOR*	*Unit*	**EB1449195-001**	**EB1449195-002**	**EB1449195-003**	**EB1449195-004**	**EB1449195-005**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.67**	**5.79**	**5.51**	**5.44**	**4.87**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**5990**	**28**	**14**	**18**	**21**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	**1**	<1	<1	<1
Total Alkalinity as CaCO3	----	1	mg/L	<1	**1**	<1	<1	<1
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**1120**	**1**	**1**	**2**	**3**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**4040**	**9**	**3**	**4**	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**6**	**2**	**2**	**2**	**4**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**178**	<1	<1	<1	<1
Magnesium	7439-95-4	1	mg/L	**690**	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**169**	**2**	**2**	**3**	**1**
Potassium	7440-09-7	1	mg/L	**9**	**1**	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**51.6**	**0.10**	<0.01	**0.01**	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.005	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	**0.016**	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	**0.0245**	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	**0.090**	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**1.81**	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	**5.13**	**0.001**	<0.001	<0.001	**0.001**
Nickel	7440-02-0	0.001	mg/L	**8.24**	<0.001	<0.001	<0.001	**0.001**
Lead	7439-92-1	0.001	mg/L	**0.067**	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**11.4**	<0.005	<0.005	<0.005	**0.005**
Manganese	7439-96-5	0.001	mg/L	**208**	**0.054**	**0.014**	**0.007**	**0.227**
Molybdenum	7439-98-7	0.001	mg/L	**0.008**	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	**0.11**	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	**93.4**	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	**GEMCO # 06**	**----**	**----**	**----**	**----**
			Client sampling date / time	[29-Dec-2014]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1449195-006**	**--------**	**--------**	**--------**	**--------**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.29**	**----**	**----**	**----**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**15**	**----**	**----**	**----**	**----**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	**----**	**----**	**----**	**----**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	**----**	**----**	**----**	**----**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	**----**	**----**	**----**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	<1	**----**	**----**	**----**	**----**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2**	**----**	**----**	**----**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	**----**	**----**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**2**	**----**	**----**	**----**	**----**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	**----**	**----**	**----**	**----**
Magnesium	7439-95-4	1	mg/L	<1	**----**	**----**	**----**	**----**
Sodium	7440-23-5	1	mg/L	**2**	**----**	**----**	**----**	**----**
Potassium	7440-09-7	1	mg/L	<1	**----**	**----**	**----**	**----**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Antimony	7440-36-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Arsenic	7440-38-2	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**----**	**----**	**----**	**----**
Chromium	7440-47-3	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Copper	7440-50-8	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cobalt	7440-48-4	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Nickel	7440-02-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Lead	7439-92-1	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Zinc	7440-66-6	0.005	mg/L	<0.005	**----**	**----**	**----**	**----**
Manganese	7439-96-5	0.001	mg/L	**0.067**	**----**	**----**	**----**	**----**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Selenium	7782-49-2	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Iron	7439-89-6	0.05	mg/L	<0.05	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB1511724**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61-7-3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 28-Jan-2015 18:30
C-O-C number	: ----	Date Analysis Commenced	: 30-Jan-2015
Sampler	: MANDIE MATHESON	Issue Date	: 06-Feb-2015 15:24
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

- **EG020-F (Dissolved Metals by ICP-MS): LOR raised for sample due to matrix interference.**

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	GEMCO #01	GEMCO #02	GEMCO #03	GEMCO #04	GEMCO #05
			Client sampling date / time	[28-Jan-2015]	[28-Jan-2015]	[28-Jan-2015]	[28-Jan-2015]	[28-Jan-2015]
Compound	*CAS Number*	*LOR*	*Unit*	**EB1511724-001**	**EB1511724-002**	**EB1511724-003**	**EB1511724-004**	**EB1511724-005**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.31**	**5.30**	**5.42**	**5.39**	**4.90**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**7290**	**26**	**12**	**18**	**17**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	**3**	**3**	**3**	**2**
Total Alkalinity as CaCO3	----	1	mg/L	<1	**3**	**3**	**3**	**2**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2300**	**7**	**3**	**4**	**4**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**5780**	**7**	<1	**4**	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**6**	**2**	**2**	**1**	**4**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**163**	<1	<1	<1	<1
Magnesium	7439-95-4	1	mg/L	**701**	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**154**	**2**	**2**	**3**	**1**
Potassium	7440-09-7	1	mg/L	<1	<1	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**78.9**	**0.08**	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.005	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	**0.046**	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	**0.0273**	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	**0.238**	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**2.44**	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	**7.57**	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	**9.50**	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.005	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**14.4**	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	**250**	**0.044**	**0.015**	**0.012**	**0.225**
Molybdenum	7439-98-7	0.001	mg/L	**0.011**	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	**0.06**	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	**292**	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	**GEMCO #06**	**----**	**----**	**----**	**----**
			Client sampling date / time	[28-Jan-2015]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1511724-006**	**--------**	**--------**	**--------**	**--------**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.24**	**----**	**----**	**----**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**13**	**----**	**----**	**----**	**----**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	**----**	**----**	**----**	**----**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	**----**	**----**	**----**	**----**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**3**	**----**	**----**	**----**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	**3**	**----**	**----**	**----**	**----**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**4**	**----**	**----**	**----**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	**----**	**----**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**2**	**----**	**----**	**----**	**----**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	**----**	**----**	**----**	**----**
Magnesium	7439-95-4	1	mg/L	<1	**----**	**----**	**----**	**----**
Sodium	7440-23-5	1	mg/L	**1**	**----**	**----**	**----**	**----**
Potassium	7440-09-7	1	mg/L	<1	**----**	**----**	**----**	**----**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Antimony	7440-36-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Arsenic	7440-38-2	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**----**	**----**	**----**	**----**
Chromium	7440-47-3	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Copper	7440-50-8	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Cobalt	7440-48-4	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Nickel	7440-02-0	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Lead	7439-92-1	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Zinc	7440-66-6	0.005	mg/L	<0.005	**----**	**----**	**----**	**----**
Manganese	7439-96-5	0.001	mg/L	**0.062**	**----**	**----**	**----**	**----**
Molybdenum	7439-98-7	0.001	mg/L	<0.001	**----**	**----**	**----**	**----**
Selenium	7782-49-2	0.01	mg/L	<0.01	**----**	**----**	**----**	**----**
Iron	7439-89-6	0.05	mg/L	<0.05	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB1513613**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 3344 1222	Facsimile	: +61-7-3243 7218
Project	: 121312 GEMCO Project	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 25-Feb-2015 18:35
C-O-C number	: ----	Date Analysis Commenced	: 26-Feb-2015
Sampler	: MANDIE MATHESON	Issue Date	: 09-Mar-2015 13:38
Site	: ----		
		No. of samples received	: 6
Quote number	: ----	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics
Greg Vogel	Laboratory Manager	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	GEMCO # 01	GEMCO # 02	GEMCO # 03	GEMCO # 04	GEMCO # 05
			Client sampling date / time	[25-Feb-2015]	[25-Feb-2015]	[25-Feb-2015]	[25-Feb-2015]	[25-Feb-2015]
Compound	*CAS Number*	*LOR*	*Unit*	**EB1513613-001**	**EB1513613-002**	**EB1513613-003**	**EB1513613-004**	**EB1513613-005**
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.27**	**5.30**	**5.35**	**5.30**	**4.92**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**7080**	**35**	**17**	**20**	**18**
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	**9**	**8**	**9**	**5**
Total Alkalinity as CaCO3	----	1	mg/L	<1	**9**	**8**	**9**	**5**
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2190**	**2**	**4**	**4**	**5**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**4040**	**6**	**2**	**4**	<1
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**6**	**2**	**2**	**1**	**3**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**142**	<1	<1	<1	<1
Magnesium	7439-95-4	1	mg/L	**582**	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**113**	**1**	**1**	**2**	<1
Potassium	7440-09-7	1	mg/L	<1	<1	<1	<1	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**57.0**	**0.07**	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	**0.027**	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	**0.0216**	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	**0.180**	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**1.74**	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	**4.90**	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	**7.28**	<0.001	<0.001	<0.001	**0.002**
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**10.6**	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	**181**	**0.044**	**0.012**	**0.007**	**0.200**
Molybdenum	7439-98-7	0.001	mg/L	**0.006**	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	**0.12**	<0.01	<0.01	<0.01	<0.01
Iron	7439-89-6	0.05	mg/L	**190**	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)			Client sample ID	**GEMCO # 06**	----	----	----	----
			Client sampling date / time	[25-Feb-2015]	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1513613-006**	--------	--------	--------	--------
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.24**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**14**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**7**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**7**	----	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**3**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**2**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	**1**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.069**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	----	----	----	----

ATTACHMENT C

Static Geochemical Results

LIST OF TABLES

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
OVERBURDEN															
1	EB141658605	EL-N-GC01	GC01-S1	overburden	0-0.27	Brown clay with plant material and minor Mn fragments	6.2	37	0.02		0.61	4.1	-3.49	6.69	NAF (Barren)
2	EB141658604	EL-N-GC02	GC02-S1	overburden	2.4-3.0	Brown iron-stained sandy soil. Consolidated loose sand (0.5-1mm) moderately well sorted.	6.2	14	0.02		0.61	0.6	0.01	0.98	NAF (Barren)
3	EB141658604	EL-N-GC02	GC02-S2	overburden	3.3-3.7	Red and yellow consolidated sandy soil with lithophorite and pyrolusite pisos.	5.7	11	0.02		0.61	2.4	-1.79	3.92	NAF (Barren)
4	EB141658604	EL-N-GC02	GC02-S3	overburden	3.7-3.9	Black cemented pisos and cemented fragments of manganese. Some weathering to iron. Continuous band.	6.0	10	0.02		0.61	2.4	-1.79	3.92	NAF (Barren)
5	EB141658604	EL-N-GC02	GC02-S4	overburden	3.9-4.2	Red-orange and yellow laterite. Clay dominated. Moderately weathered. Fe-pisolites (3mm).	5.9	10	0.02		0.61	1.9	-1.29	3.10	NAF (Barren)
6	EB141658604	EL-N-GC02	GC02-S5	overburden	4.5-4.85	Black mass magite with small clay bands (<20mm). Clay bands are geoethic and friable. Weathering evident on some of the fractures. Kaolin clay band 5mm thick.	6.0	11	0.02		0.61	0.6	0.01	0.98	NAF (Barren)
7	EB141658602	EL-N-GC03	GC03-S1	overburden	0.6-1.0	Brown soil, some geoethic yellow clay, bioditritus, wood and roots. Small laterite, claystone and quartzite fragments throughout (0.5-1mm) large moderately rounded fragments of lithophorite at the base 70mm of the unit (<60mm wide)	5.9	15	0.02		0.61	0.9	-0.29	1.47	NAF (Barren)
8	EB141658602	EL-N-GC03	GC03-S2	overburden	2.0-2.4	Black moderately angular fragments of silicious oxidised lithophorite. Very soft lateritic clay with small angular fragments of claystone throughout (2-5mm).	5.9	12	0.02		0.61	0.9	-0.29	1.47	NAF (Barren)
9	EB141658602	EL-N-GC03	GC03-S3	overburden	3.06-3.40	Pale yellow and yellow claystone. Foraminiferra present (0.2mm) (150mm core loss)	6.5	14	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
10	EB141658602	EL-N-GC03	GC03-S4	overburden	5.0-5.4	Brown-black manganese enriched quartzite.	5.3	22	0.02		0.61	1.5	-0.89	2.45	NAF (Barren)
11	EB141658603	EL-N-GC03	GC03-S5	overburden	5.6-5.9	Cream white quartzite	6.3	17	0.02		0.61	0.25	0.36	0.41	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
12	EB141658603	EL-N-GC03	GC03-S6	overburden	7.0-7.4	Brown-black manganese enriched quartzite. lateral Red and yellow quartzite at top and base of unit.	5.4	24	0.02		0.61	2.5	-1.89	4.08	NAF (Barren)
13	EB141658603	EL-N-GC03	GC03-S7	overburden	8.6-9.0	White kaolinite clay. Red and pink claystone. Red Vertical thin vein through unit	6.0	12	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
14	EB141658603	EL-N-GC03	GC03-S8	overburden	11.0-11.4	Yellow and grey claystone.	5.2	17	0.005		0.15	0.9	-0.75	5.88	NAF (Barren)
15	EB141658603	EL-N-GC03	GC03-S9	overburden	12.4-13.0	Yellow, purple and white claystone grading down to quartzite. Horizontal and vertical infilling with white clay and sand. Some vugs (2mm)	5.6	15	0.02		0.61	1.4	-0.79	2.29	NAF (Barren)
16	EB141658603	EL-N-GC03	GC03-S10	overburden	13.1-13.5	Brown black manganese enriched consolidated and unconsolidated quartzite. Lateral white streaks throughout.	5.6	16	0.02		0.61	1.8	-1.19	2.94	NAF (Barren)
17	EB141658603	EL-N-GC03	GC03-S11	overburden	14.0-14.4	Yellow, purple and grey claystone. Soft to very soft. (Core loss 450mm)	6.2	24	0.02		0.61	0.8	-0.19	1.31	NAF (Barren)
18	EB141658603	EL-N-GC03	GC03-S12	overburden	17.6-18.0	Black-yellow manganese fragments, clay and consolidated claystone 'choclate ore' (650mm core loss - Sands)	5.6	21	0.005		0.15	2.0	-1.85	13.06	NAF (Barren)
19	EB141658603	EL-N-GC03	GC03-S13	overburden	20-20.37	Purple and orange claystone. Well rounded manganese fragments (20mm). Laterite and lithophorite concretions (2-7mm)	5.0	31	0.02		0.61	1.0	-0.39	1.63	NAF (Barren)
20	EB141658601	EL-S-GC04	GC04-S1	overburden	0.0-0.4	Brown sandy soil, unconsolidate cryptomelane spherulites, biodetritus	5.9	31	0.02		0.61	2.6	-1.99	4.24	NAF (Barren)
21	EB141658601	EL-S-GC04	GC04-S2	overburden	0.6-1.0	Mottled red and brown manganiferous laterite, lithophorite, crytopmelane and goethic concretions, some vugs present, some biodetritus in top 500mm	6.1	19	0.02		0.61	2.0	-1.39	3.27	NAF (Barren)
22	EB141658602	EL-S-GC04	GC04-S3	overburden	3.0-3.5	Laminar brown and red ferrinous laterite, silicious manganese layers (30-60mm). Several vertical and horizontal fractures infilled with sand.	5.5	14	0.02		0.61	1.1	-0.49	1.80	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
23	EB141658602	EL-S-GC04	GC04-S4	overburden	5.6-6.0	Laminar white, brown and red ferrinous and laterite, reworked well rounded quartzite stones (20mm), silicious manganes layers (40mm thick).	5.8	10	0.02		0.61	0.6	0.01	0.98	NAF (Barren)
24	EB141658601	EL-S-GC05	GC05-S1	overburden	0.5-1.0	Brown sandy soil, biodetritus, suspended quartz granules	5.9	23	0.02		0.61	3.2	-2.59	5.22	NAF (Barren)
25	EB141658601	EL-S-GC05	GC05-S2	overburden	2.0-2.4	Mottled red and bown laterite with silicious manganese fragments and lateritic pebbles (5-10mm) suspended throughout. Some larger subrounded elongated Mn fragments (50mm) (~1%). Some biodetritus (<0.1%)	6.0	13	0.02		0.61	1.8	-1.19	2.94	NAF (Barren)
26	EB141658601	EL-S-GC05	GC05-S3	overburden	3.0-3.4	Brown clay with pesolites and subrounded silicious fragments of manganese throughout (10-70mm). Some biodetritus <(0.2%)	6.1	15	0.02		0.61	3.0	-2.39	4.90	NAF (Barren)
27	EB141658601	EL-S-GC05	GC05-S4	overburden	4.0-4.4	Brown and orange streaked sands. Well sorted loose and cemented. Thin lenses of silicious manganese (10mm)	5.8	16	0.02		0.61	1.4	-0.79	2.29	NAF (Barren)
28	EB141658601	EL-S-GC05	GC05-S5	overburden	5.0-5.4	Grey Black mass manganese fragments (5 -20mm). Brown and orange streaked sands. Well sorted Loose and cemented. Thin bands of silicious manganese (20-30mm thick)(40mm Core loss)	6.0	18	0.02		0.61	2.8	-2.19	4.57	NAF (Barren)
29	EB141658600	EL-S-GC06	GC06-S1	overburden	0.25-0.75	Brown sandy soil, biodetritus, lateritic pebbles. Minor siliceous black fragments throughout (20mm) <2%	6.3	36	0.02		0.61	4.0	-3.39	6.53	NAF (Barren)
30	EB141658600	EL-S-GC06	GC06-S2	overburden	0.75-1.1	Brown ferrignous loose clay and cemented claystone, minor silicious black manganese fragments throughout. Some vugs 20-50mm wide.	6.0	16	0.02		0.61	2.5	-1.89	4.08	NAF (Barren)
31	EB141658600	EL-S-GC06	GC06-S3	overburden	2.0-2.4	Solid mass magnite large fragments (20-60mm) in a breccia texture supported by a cemented clay and laterite matrix.	6.1	13	0.02		0.61	1.8	-1.19	2.94	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
32	EB141658600	EL-S-GC06	GC06-S4	overburden	2.9-3.2	Brown clay with small fragmented manganese pieces (5-10mm)	6.0	18	0.02		0.61	2.3	-1.69	3.76	NAF (Barren)
33	EB141658600	EL-S-GC06	GC06-S5	overburden	4.7-5.0	Small mangite fragments (5-10mm) supprted in a white and orange clay matrix. Thin manganese enriched bands (5-10mm) (100mm core loss)	6.3	19	0.02		0.61	2.0	-1.39	3.27	NAF (Barren)
34	EB141658600	EL-S-GC06	GC06-S6	overburden	6.35-6.65	Manganese fragments and oolites (10-40mm) supported in a white and purple clay matrix.	5.9	15	0.005		0.15	1.4	-1.25	9.14	NAF (Barren)
35	EB141650706	EL-N-MB01	GW01	overburden	3-6m	LATERITE: fine sand to medium sand, iron cemented, dark reddish brown, medium strength, minor clay in samples	6.8	39	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
36	EB141650706	EL-N-MB01	GW01	overburden	6-9m	CLAY: low plasticity, light grey, stiff	6.7	192	0.02		0.61	2.3	-1.69	3.76	NAF (Barren)
37	EB141650700	EL-N-MB01	GW01	overburden	12m	CLAY: low plasticity, light grey, stiff	6.6	130	0.03		0.92	4.4	-3.48	4.79	NAF (Barren)
38	EB141650700	EL-N-MB01	GW01	overburden	15m	CLAY: low plasticity, light grey, stiff, disseminated manganese throughout	6.9	90	0.02		0.61	4.5	-3.89	7.35	NAF (Barren)
39	EB141650700	EL-N-MB01	GW01	overburden	18m	CLAY: low plasticity, light grey, stiff, disseminated manganese throughout	6.9	85	0.02		0.61	8.4	-7.79	13.71	NAF (Barren)
40	EB141650700	EL-N-MB01	GW01	overburden	21m	CLAY: low plasticity, light grey, stiff, disseminated manganese throughout	6.7	102	0.02		0.61	7.7	-7.09	12.57	NAF (Barren)
41	EB141650700	EL-N-MB01	GW01	overburden	24m	CLAY: high plasticity, dark grey, firm	6.7	110	0.04		1.23	4.8	-3.58	3.92	NAF (Barren)
42	EB141650701	EL-N-MB02	GW02	overburden	3m	LATERITE: medium gravel, sub-angular to sub-rounded, lithic clasts, iron cemented, dark reddish brown, medium strength, probably a laterised gravel conglomerate, significant water loss during drilling	6.6	504	0.05		1.53	4	-2.47	2.61	NAF (Barren)
43	EB141650700	EL-N-MB03	GW03	overburden	6m	CLAY: high plasticity, mottled red / grey, firm, manganese mineralisation throughout	6.4	35	0.02		0.61	1.5	-0.89	2.45	NAF (Barren)
44	EB141650701	EL-N-MB03	GW03	overburden	9m	CLAY: high plasticity, light brown / grey, firm	5.7	38	0.005		0.15	0.25	-0.10	1.63	NAF (Barren)
45	EB141650701	EL-N-MB04	GW04	overburden	3m	SANDY CLAY: silty matrix, red, soft, lithic gravel clasts at base	8.9	352	0.02		0.61	4.3	-3.69	7.02	NAF (Barren)
46	EB141650701	EL-N-MB04	GW04	overburden	6m	SANDY CLAY: silty matrix, red, soft, lithic gravel clasts at base	8.2	65	0.02		0.61	0.25	0.36	0.41	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
47	EB141650701	EL-N-MB04	GW04	overburden	9m	SANDY CLAY: fine sand, quartz clasts, mottled yellow / red, soft	7.5	36	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
48	EB141650703	EL-S-MB05	GW05	overburden	3m	LATERITE: sub-rounded to rounded, lithic clasts, mottled red / white, low strength, clasts comprised of medium grained sandstone	6.7	124	0.03		0.92	1.3	-0.38	1.41	NAF (Barren)
49	EB141650703	EL-S-MB05	GW05	overburden	6m	LATERITE: sub-rounded to rounded, lithic clasts, mottled red / white, low strength, clasts comprised of medium grained sandstone	6.1	54	0.03		0.92	1.6	-0.68	1.74	NAF (Barren)
50	EB141650703	EL-S-MB05	GW05	overburden	9m	CLAY: low plasticity, mottled red / grey, low strength, soft, possibly weathered claystone	5.6	93	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
51	EB141650703	EL-S-MB05	GW05	overburden	12m	CLAY: high plasticity, orange / grey, low strength, soft	5.7	58	0.02		0.61	0.6	0.01	0.98	NAF (Barren)
52	EB141650703	EL-S-MB05	GW05	overburden	15m	CLAY: high plasticity, red / grey, low strength, soft	5.7	70	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
53	EB141650703	EL-S-MB05	GW05	overburden	18m	CLAY: high plasticity, yellow, low strength, soft	5.9	55	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
54	EB141650703	EL-S-MB05	GW05	overburden	21m	CLAY: high plasticity, grey, low strength, soft	6.1	46	0.02		0.61	1.1	-0.49	1.80	NAF (Barren)
55	EB141650703	EL-S-MB05	GW05	overburden	24m	CLAY: high plasticity, grey, low strength, soft	6.3	47	0.02		0.61	2.2	-1.59	3.59	NAF (Barren)
56	EB141650703	EL-S-MB05	GW05	overburden	27m	CLAY: high plasticity, grey, low strength, soft	6.4	63	0.02		0.61	1.4	-0.79	2.29	NAF (Barren)
57	EB141650703	EL-S-MB05	GW05	overburden	30m	CLAY: high plasticity, grey, low strength, soft	6.5	85	0.02		0.61	3.1	-2.49	5.06	NAF (Barren)
58	EB141650704	EL-S-MB05	GW05	overburden	33m	CLAY: medium plasticity, dark greenish grey, low strength, soft	6.6	73	0.02		0.61	3.4	-2.79	5.55	NAF (Barren)
59	EB141650704	EL-S-MB05	GW05	overburden	36m	CLAY: medium plasticity, dark greenish grey, low strength, soft	7.5	554	0.58	0.56	17.12	5.1	12.02	0.30	PAF
60	EB141650702	EL-S-MB06	GW06	overburden	12m	CLAY: mottled brown / cream, firm	5.8	144	0.02		0.61	3.8	-3.19	6.20	NAF (Barren)
61	EB141650702	EL-S-MB06	GW06	overburden	15m	CLAY: mottled cream / yellow, firm	5.8	63	0.02		0.61	3.7	-3.09	6.04	NAF (Barren)
62	EB141650702	EL-S-MB06	GW06	overburden	18m	CLAY: mottled cream / yellow, firm	3.4	2740	0.82	0.32	9.77	0.25	9.52	0.03	PAF
63	EB141650702	EL-S-MB06	GW06	overburden	21m	CLAY: grey, stiff	4.4	1120	0.87	0.63	19.23	0.6	18.63	0.03	PAF
64	EB141650702	EL-S-MB06	GW06	overburden	24m	CLAY: red, stiff	4.8	316	0.09		2.76	0.5	2.26	0.18	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
65	EB141650705	EL-S-MB06	GW06	overburden	4m	LATERITE: coarse sand, angular, lithic clasts, poorly graded, reddish brown, loose	6.5	39	0.02		0.61	1.8	-1.19	2.94	NAF (Barren)
66	EB141650706	EL-S-MB06	GW06	overburden	6m	LATERITE: coarse sand, angular, lithic clasts, poorly graded, reddish brown, loose	5.8	38	0.005		0.15	2.7	-2.55	17.63	NAF (Barren)
67	EB141650706	EL-S-MB06	GW06	overburden	9m	CLAY: mottled orange / cream, firm	6.0	118	0.04		1.23	1.4	-0.18	1.14	NAF (Barren)
68	EB141650704	EL-S-MB08	GW08	overburden	3m	LATERITE: fine sand, quartz clasts, silty matrix, reddish low strength	5.9	37	0.03		0.92	1.2	-0.28	1.31	NAF (Barren)
69	EB141650704	EL-S-MB08	GW08	overburden	6m	SILTY CLAY: high plasticity, silty matrix, mottled orange / white, low strength, soft, trace coarse sand component	6.0	29	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
70	EB141650705	EL-S-MB08	GW08	overburden	9m	CLAY: high plasticity, mottled reddish white, low strength, soft	5.7	33	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
71	EB141650705	EL-S-MB08	GW08	overburden	12m	CLAY: high plasticity, mottled reddish white, low strength, soft	5.8	34	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
72	EB141650704	EL-S-MB09	GW09	overburden	3m	CLAY: high plasticity, mottled cream / orange, low strength, soft	6.4	131	0.03		0.92	3.6	-2.68	3.92	NAF (Barren)
73	EB141650704	EL-S-MB09	GW09	overburden	6m	CLAY: high plasticity, orange, low strength, soft, red staining on planar surfaces	6.3	41	0.03		0.92	1.2	-0.28	1.31	NAF (Barren)
74	EB141650704	EL-S-MB09	GW09	overburden	9m	CLAY: high plasticity, mottled orange / grey, low strength, soft	5.4	67	0.02		0.61	2.3	-1.69	3.76	NAF (Barren)
75	EB141650704	EL-S-MB09	GW09	overburden	12m	CLAY: high plasticity, mottled orange / grey, low strength, soft	6.0	37	0.02		0.61	1.4	-0.79	2.29	NAF (Barren)
76	EB141650705	EL-S-MB10	GW10	overburden	3m	SILTY CLAY: low plasticity, coarse sand, rounded, quartz clasts, red, low strength, soft	6.2	38	0.02		0.61	0.8	-0.19	1.31	NAF (Barren)
77	EB141650705	EL-S-MB10	GW10	overburden	6m	LATERITE: fine sand, quartz clasts, silty matrix, yellow / red, medium strength, fine sandstone laterite	6.0	45	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
78	EB141650705	EL-S-MB10	GW10	overburden	9m	SILTY CLAY: fine sand, quartz clasts, mottled white / yellow, low strength, soft, probably weathered sandstone	6.2	36	0.02		0.61	0.25	0.36	0.41	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
INTERBURDEN															
79	EB141658605	EL-N-GC01	GC01-S4	interburden	3.11-3.5	White to light brown claystone - very fine grained.	6.2	6	0.01		0.31	0.25	0.06	0.82	NAF (Barren)
80	EB141658604	EL-N-GC03	GC03-S14	interburden	21-21.5	Lateral zone of Manganiferous clay, geoethitic clay and white kaolinite. Some oolitic textures present. Pale pink clay and brown and purple consolidated sand	5.2	21	0.005		0.15	1.4	-1.25	9.14	NAF (Barren)
81	EB141658604	EL-N-GC03	GC03-S16	interburden	22.65-22.8	White smectite clay - interburden	6.0	8	0.005		0.15	1.0	-0.85	6.53	NAF (Barren)
82	EB141658602	EL-S-GC04	GC04-S6	interburden	8.4-8.7	White, purple and red smectitic clay. Some Mn fragments	6.3	13	0.005		0.15	0.8	-0.65	5.22	NAF (Barren)
83	EB141658602	EL-S-GC04	GC04-S7	interburden	9.15-9.45	White, purple and red smectitic clay. Some Mn fragments	6.2	17	0.02		0.61	3.5	-2.89	5.71	NAF (Barren)
84	EB141658602	EL-S-GC04	GC04-S8	interburden	9.5-9.8	White, purple and red smectitic clay	6.5	18	0.005		0.15	2.0	-1.85	13.06	NAF (Barren)
85	EB141658601	EL-S-GC05	GC05-S7	interburden	8.0-8.35	Very soft cream white clays. Sparsely mottled pink black and pale yellow	6.2	37	0.005		0.15	4.0	-3.85	26.12	NAF (Barren)
86	EB141658600	EL-S-GC06	GC06-S8	interburden	7.3-7.65	Purple clay with white clay blobs (50mm) with white lateral veins (100mm core loss)	5.9	14	0.005		0.15	0.25	-0.10	1.63	NAF (Barren)
ORE															
87	EB141658605	EL-N-GC01	GC01-S2	ore (MID)	0.5-1.0	Geothitic clay and Mas Mgt with ool/piso textures. some sections the Mn textures (oolites) are completely geothitic (interberden). Large fragments <80mm of Mas Mgt throughout.	6.0	13	0.02		0.61	1.9	-1.29	3.10	NAF (Barren)
88	EB141658605	EL-N-GC01	GC01-S3	ore (MID)	2.5-3.0	Interval grades into more dense Mas Mgt with minor ool/pis textures. Minor to moderate visible clay replacement	6.3	8	0.02		0.61	2.6	-1.99	4.24	NAF (Barren)
89	EB141658605	EL-N-GC01	GC01-S5	ore (BOT)	3.5-3.9	Sil Mas Mgt and alternating geothite and Sil Mas Mgt. Thin geothitic bands at bottom half of interval. <2cm vugs at higher density of geothite before sharp contact	6.4	8	0.02		0.61	2.9	-2.29	4.73	NAF (Barren)
90	EB141658604	EL-N-GC02	GC02-S6	ore (BOT)	5.15-5.65	Black mass magite with small clay bands (<20mm). Clay bands are geoethic and friable. Weathering evident on some of the fractures. Kaolin clay band 5mm thick.	5.9	12	0.02		0.61	1.1	-0.49	1.80	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
91	EB141658604	EL-N-GC02	GC02-S7	ore (BOT)	5.9-6.3	Black silicious massive manganese with prominent red clay band and prominent orange sand band.	5.8	10	0.02		0.61	1.4	-0.79	2.29	NAF (Barren)
92	EB141658603	EL-N-GC03	GC03-S13a	ore (MID)	20.4-21	Black mass mangite fragments. At the top and bottom of the column is black clay-like manganese with veins of white throughout.	5.6	8	0.005		0.15	2.0	-1.85	13.06	NAF (Barren)
93	EB141658604	EL-N-GC03	GC03-S15	ore (BOT)	21.9-22.4	Black discontinuous massive mangite. Relict piso structures	6.0	8	0.005		0.15	3.4	-3.25	22.20	NAF (Barren)
94	EB141658602	EL-S-GC04	GC04-S5	ore (MID)	6.5-7.0	White, brown and red geoethic clay.Discontinuous and fractured mass mangite bands thoughout (10-50mm)	5.9	11	0.02		0.61	1.2	-0.59	1.96	NAF (Barren)
95	EB141658601	EL-S-GC05	GC05-S6	ore	6.5-7.0	Black angular and subangular fragments of manganese (5-15mm) supported by very soft cream white clays	6.0	15	0.005		0.15	4.8	-4.65	31.35	NAF (Barren)
96	EB141658601	EL-S-GC05	GC05-S8	ore	8.35-8.75	Black angular and subangular fragments of manganese (2-5mm). Mass mangite bands (10mm-25mm thick). Supported by white and yellow geoethitic clays (150mm core loss)	6.0	22	0.02		0.61	5.2	-4.59	8.49	NAF (Barren)
97	EB141658600	EL-S-GC06	GC06-S7	ore	6.75-7.0	Silicoious massive mangite, yellow, brown and cream clay	6.1	22	0.02		0.61	3.1	-2.49	5.06	NAF (Barren)
98	EB141658600	EL-S-GC06	GC06-S9	ore	7.87-8.34	Black mass mangite, fragmented large pieces >50mm, veins of silica ~2mm thick throughout. Sharp contact between interburdern overlying layer.	6.1	12	0.005		0.15	1.5	-1.35	9.80	NAF (Barren)
99	EB141650700	EL-N-MB01	GW01	ore	27m	CLAY: low plasticity, orange, firm, occasional manganese layers throughout	6.8	50	0.02		0.61	3.3	-2.69	5.39	NAF (Barren)
100	EB141650701	EL-N-MB02	GW02	ore	5m	CLAY: medium plasticity, white, firm, manganese throughout as layers within clay unit	6.9	40	0.02		0.61	0.5	0.11	0.82	NAF (Barren)
101	EB141650701	EL-N-MB03	GW03	ore	11.5m	MANGANESE & CLAY: black, high strength manganese layers alternating with high plasticity, white, soft clay	6.0	36	0.02		0.61	2	-1.39	3.27	NAF (Barren)

Table C-1: Acid Base Account (ABA) Test Results for Overburden and Ore Samples

Sample No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
102	EB141650701	EL-N-MB04	GW04	ore	11m	MANGANESE: black, very high strength	7.2	32	0.02		0.61	1.6	-0.99	2.61	NAF (Barren)
103	EB141650701	EL-N-MB04	GW04	ore	12m	MANGANESE: black, very high strength	6.6	27	0.02		0.61	1.2	-0.59	1.96	NAF (Barren)
104	EB141650704	EL-S-MB05	GW05	ore	39m	MANGANESE & CLAY: black, high strength manganese with significant clay throughout	6.9	209	0.31	0.09	2.88	6.0	-3.12	2.08	NAF (Barren)
105	EB141650702	EL-S-MB06	GW06	ore	27m	MANGANESE: black, medium strength	5.5	99	0.03		0.92	7.6	-6.68	8.27	NAF (Barren)
106	EB141650702	EL-S-MB07	GW07	ore	3m	MANGANESE: black, high strength, generally massive manganese, pisolites at base	6.6	162	0.04		1.23	2.7	-1.48	2.20	NAF (Barren)
107	EB141650702	EL-S-MB07	GW07	ore	6m	CLAY: high plasticity, mottled greyish orange, low strength, soft, disseminated manganese throughout	5.2	35	0.02		0.61	2.1	-1.49	3.43	NAF (Barren)
108	EB141650705	EL-S-MB08	GW08	ore	15m	MANGANESE: black, high strength, clay dispersed throughout	6.1	24	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
109	EB141650705	EL-S-MB08	GW08	ore	16.6m	MANGANESE: black, high strength, clay dispersed throughout	6.1	42	0.005		0.15	1.8	-1.65	11.76	NAF (Barren)
110	EB141650704	EL-S-MB09	GW09	ore	14.5-15m	CLAY: high plasticity, red, low strength, stiff, manganese disseminated thoughout	6.2	79	0.02		0.61	1.6	-0.99	2.61	NAF (Barren)
111	EB141650705	EL-S-MB10	GW10	ore	12m	SANDY CLAY & MANGANESE: dark medium strength, alternating layers of clay and manganese	6.2	41	0.02		0.61	0.7	-0.09	1.14	NAF (Barren)
112	EB141650705	EL-S-MB10	GW10	ore	15m	CLAY: light grey, low strength, soft, manganese throughout forming alternating layers of clay and manganese	6.5	30	0.02		0.61	0.25	0.36	0.41	NAF (Barren)

Notes:
* MID = high-grade ore consisting mostly of cemented and loose pisolites; * BOT = low-grade ore rich in silica.
1. Current pH and EC provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; and NAPP = Net Acid Producing Potential.
3. Sample classification detail provided in report text.

Table C-2: Overburden and Ore Samples Selected for Additional Multi-Element Tests

RGS ME No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
OVERBURDEN															
1	EB1416586050	EL-N-GC01	GC01-S1	overburden	0-0.27	Brown clay with plant material and minor Mn fragments	6.2	37	0.02		0.61	4.1	-3.49	6.69	NAF (Barren)
2	EB1416586044	EL-N-GC02	GC02-S2	overburden	3.3-3.7	Red and yellow consolidated sandy soil with lithophorite and pyrolusite pisos.	5.7	11	0.02		0.61	2.4	-1.79	3.92	NAF (Barren)
3	EB1416586047	EL-N-GC02	GC02-S5	overburden	4.5-4.85	Black mass magite with small clay bands (<20mm). Clay bands are geoethic and friable. Weathering evident on some of the fractures. Kaolin clay band 5mm thick.	6.0	11	0.02		0.61	0.6	0.01	0.98	NAF (Barren)
4	EB1416586032	EL-N-GC03	GC03-S7	overburden	8.6-9.0	White kaolinite clay. Red and pink claystone. Red Vertical thin vein through unit	6.0	12	0.02		0.61	0.25	0.36	0.41	NAF (Barren)
5	EB1416586035	EL-N-GC03	GC03-S10	overburden	13.1-13.5	Brown black manganese enriched consolidated and unconsolidated quartzite. Lateral white streaks throughout.	5.6	16	0.02		0.61	1.8	-1.19	2.94	NAF (Barren)
6	EB1416586038	EL-N-GC03	GC03-S13	overburden	20-20.37	Purple and orange claystone. Well rounded manganese fragments (20mm). Laterite and lithophorite concretions (2-7mm)	5.0	31	0.02		0.61	1.0	-0.39	1.63	NAF (Barren)
7	EB1416586019	EL-S-GC04	GC04-S2	overburden	0.6-1.0	Mottled red and brown manganiferous laterite, lithophorite, crytopmelane and goethic concretions, some vugs present, some biodetritus in top 500mm	6.1	19	0.02		0.61	2.0	-1.39	3.27	NAF (Barren)
8	EB1416586021	EL-S-GC04	GC04-S4	overburden	5.6-6.0	Laminar white, brown and red ferrinous and laterite, reworked well rounded quartzite stones (20mm), silicious manganes layers (40mm thick).	5.8	10	0.02		0.61	0.6	0.01	0.98	NAF (Barren)
9	EB1416586011	EL-S-GC05	GC05-S2	overburden	2.0-2.4	Mottled red and bown laterite with silicious manganese fragments and lateritic pebbles (5-10mm) suspended throughout. Some larger subrounded elongated Mn fragments (50mm) (~1%). Some biodetritus (<0.1%)	6.0	13	0.02		0.61	1.8	-1.19	2.94	NAF (Barren)

Table C-2: Overburden and Ore Samples Selected for Additional Multi-Element Tests

RGS ME No.	ALS Laboratory No.	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Lithological Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
10	EB1416586014	EL-S-GC05	GC05-S5	overburden	5.0-5.4	Grey Black mass manganese fragments (5 -20mm). Brown and orange streaked sands. Well sorted Loose and cemented. Thin bands of silicious manganese (20-30mm thick)(40mm Core loss)	6.0	18	0.02		0.61	2.8	-2.19	4.57	NAF (Barren)
11	EB1416586002	EL-S-GC06	GC06-S2	overburden	0.75-1.1	Brown ferrignous loose clay and cemented claystone, minor silicious black manganese fragments throughout. Some vugs 20-50mm wide.	6.0	16	0.02		0.61	2.5	-1.89	4.08	NAF (Barren)
12	EB1416586005	EL-S-GC06	GC06-S5	overburden	4.7-5.0	Small mangite fragments (5-10mm) supprted in a white and orange clay matrix. Thin manganese enriched bands (5-10mm) (100mm core loss)	6.3	19	0.02		0.61	2.0	-1.39	3.27	NAF (Barren)
INTERBURDEN															
13	EB1416586040	EL-N-GC03	GC03-S14	interburden	21-21.5	Lateral zone of Manganiferous clay, geoethitic clay and white kaolinite. Some oolitic textures present. Pale pink clay and brown and purple consolidated sand	5.2	21	0.005		0.15	1.4	-1.25	9.14	NAF (Barren)
14	EB1416586042	EL-N-GC03	GC03-S16	interburden	22.65-22.8	White smectite clay - interburden	6.0	8	0.005		0.15	1.0	-0.85	6.53	NAF (Barren)
15	EB1416586023	EL-S-GC04	GC04-S6	interburden	8.4-8.7	White, purple and red smectitic clay. Some Mn fragments	6.3	13	0.005		0.15	0.8	-0.65	5.22	NAF (Barren)
16	EB1416586025	EL-S-GC04	GC04-S8	interburden	9.5-9.8	White, purple and red smectitic clay	6.5	18	0.005		0.15	2.0	-1.85	13.06	NAF (Barren)
ORE															
17	EB1416586039	EL-N-GC03	GC03-S13a	ore (MID)	20.4-21	Black mass mangite fragments. At the top and bottom of the column is black clay-like manganese with veins of white throughout.	5.6	8	0.005		0.15	2.0	-1.85	13.06	NAF (Barren)
18	EB1416586015	EL-N-GC05	GC05-S6	ore	6.5-7.0	Black angular and subangular fragments of manganese (5-15mm) supported by very soft cream white clays	6.0	15	0.005		0.15	4.8	-4.65	31.35	NAF (Barren)

Notes:
* MID = high-grade ore consisting mostly of cemented and loose pisolites; * BOT = low-grade ore rich in silica.
1. Current pH and EC provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; and NAPP = Net Acid Producing Potential.
3. Sample classification detail provided in report text.

Table C-3: Multi-Element Results for Selected Overburden and Ore Samples

RGS-ME Number →			1	2	3	4	5	6	7	8	9
ALS Laboratory ID →			EB1417699018	EB1417699016	EB1417699017	EB1417699010	EB1417699011	EB1417699012	EB1417699006	EB1417699007	EB1417699003
Sample Type →			Overburden								
Depth Interval Range →			0.0-0.27m	3.3-3.7m	4.50-4.85m	8.6-9.0m	13.1-13.5m	20-20.37m	0.6-1.0m	5.6-6.0m	2.0-2.4m
Drillhole Location/Sample ID →			EL-N-GC01	EL-N-GC02		EL-N-GC03			EL-S-GC04		EL-S-GC05
Parameters	Detection Limit	NEPC[1] Health-Based Investigation Level HIL-(C)	GC01-S1	GC02-S2	GC02-S5	GC03-S7	GC03-S10	GC03-S13	GC04-S2	GC04-S4	GC05-S2
Major Elements	All units mg/kg										
Aluminium (Al)	50	-	17,200	15,900	6,440	4,820	3,730	4,430	22,800	4,950	20,900
Calcium (Ca)	50	-	500	220	<50	<50	<50	<50	100	<50	180
Iron (Fe)	50	-	63,300	53,600	65,500	23,300	12,300	117,000	126,000	20,300	100,000
Magnesium (Mg)	50	-	210	140	100	<50	<50	<50	320	110	360
Manganese (Mn)	5	19,000	114,000	379,000	1,930	400	44,300	2,070	36,100	21,700	58,100
Potassium (K)	50	-	4,930	11,200	160	200	2,450	140	610	610	1,650
Sodium (Na)	50	-	210	310	<50	<50	<50	<50	90	<50	<50
Minor Elements	All units mg/kg										
Antimony (Sb)	5	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic (As)	5	300	11	20	11	<5	12	<5	6	11	8
Boron (B)	50	20,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	1	90	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium (Cr) - hexavalent	2	300 **	45	68	45	26	7	26	116	6	80
Cobalt (Co)	2	300	107	101	<2	<2	74	3	111	92	119
Copper (Cu)	5	17,000	61	95	8	<5	28	33	40	36	33
Lead (Pb)	5	600	51	117	20	<5	<5	52	56	<5	52
Molybdenum (Mo)	2	-	4	<2	3	<2	4	<2	4	8	2
Nickel (Ni)	2	1,200	30	22	<2	<2	4	41	58	5	80
Selenium (Se)	5	700	<5	22	<5	<5	<5	<5	<5	<5	<5
Silver (Ag)	2	-	<2	4	<2	<2	<2	<2	<2	<2	<2
Thorium (Th)	0.1	-	5.4	6.8	11.9	1.3	1.8	4.2	7.4	1.2	5.7
Uranium (U)	0.1	-	1.2	2.3	1.3	0.1	0.4	2.1	3.6	1	2.6
Vanadium (V)	5	-	138	250	688	45	97	160	304	126	269
Zinc (Zn)	5	30,000	62	83	<5	<5	45	29	12	34	23
Exchangeable Cations	All units in meq/100g (except for ESP)										
Exch. Calcium (Ca)	0.1	-	1.0	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.6
Exch. Magnesium (Mg)	0.1	-	0.5	0.3	0.6	0.2	<0.1	<0.1	1.2	0.6	1.3
Exch. Potassion (K)	0.1	-	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1
Exch. Sodium (Na)	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Effective Cation Exchange Capacity (eCEC)	0.1	-	1.6	0.4	0.7	0.3	0.2	<0.1	1.6	0.7	2.0
Exchangeable Sodium Percentage (ESP)	0.1%	-	<0.1	<0.1	<0.1	3.5	<0.1	<0.1	2.2	<0.1	1.2
Calcium/Magnesium Ratio	0.1	-	2.00	0.33	0.17	0.5	1.00	1.00	0.17	0.17	0.46

Notes < indicates less than the analytical detection limit. Shaded cells greater than background range or applied guideline limit.

** Guideline level for hexavalent chromium [Cr(VI)] = 300 mg/kg. Guideline level for Cr(III) = 24% of total Cr.

1. NEPC (2013). National Environmental Protection Council (NEPC). *National Environmental Protection (Assessment of Site Contamination) Measure (NEPM)*, Amendment of Schedule B1-B7 of 1999 version. *Guideline on Investigation Levels for Soil and Groundwater. Health-Based Investigation Level - HIL(C); generic land use including recreational open spaces*.

Table C-3: Multi-Element Results for Selected Overburden and Ore Samples

RGS-ME Number →			10	11	12	13	14	15	16	17	18
ALS Laboratory ID →			EB1417699004	EB1417699001	EB1417699002	EB1417699014	EB1417699015	EB1417699008	EB1417699009	EB1417699013	EB1417699005
Sample Type →			Overburden			Interburden				Ore	
Depth Interval Range →			5.0-5.4m	0.75-1.10m	4.7-5.0m	21-21.50m	22.65-22.80m	8.4-8.7m	9.5-9.8m	20.4-21.0m	6.5-7.0m
Drillhole Location/Sample ID →			EL-S-GC05	EL-S-GC06		EL-N-GC03		EL-S-GC04		EL-N-GC03	EL-S-GC05
Parameters	Detection Limit	NEPC[1] Health-Based Investigation Level HIL-(C)	GC05-S5	GC06-S2	GC06-S5	GC03-S14	GC03-S16	GC04-S6	GC04-S8	GC03-S13a	GC05-S6
Major Elements	All units mg/kg										
Aluminium (Al)	50	-	9,880	16,600	18,700	2,980	2,320	8,500	10,100	6,930	15,800
Calcium (Ca)	50	-	860	300	140	<50	<50	550	500	900	820
Iron (Fe)	50	-	135,000	102,000	138,000	35,400	6,010	56,500	56,400	18,400	36,800
Magnesium (Mg)	50	-	500	370	320	60	<50	2,610	2,150	300	2,420
Manganese (Mn)	5	19,000	344,000	29,100	30,800	30,900	3,990	11,000	51,200	569,000	208,000
Potassium (K)	50	-	4,840	320	1,490	190	210	1,860	3,200	8,890	8,700
Sodium (Na)	50	-	2,000	<50	130	<50	<50	110	210	<50	1,500
Minor Elements	All units mg/kg										
Antimony (Sb)	5	-	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic (As)	5	300	6	<5	31	5	<5	<5	7	59	6
Boron (B)	50	20,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	1	90	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chromium (Cr) - hexavalent	2	300 **	15	121	95	11	11	31	35	4	6
Cobalt (Co)	2	300	75	79	27	3	<2	12	37	142	48
Copper (Cu)	5	17,000	130	51	32	13	<5	18	53	172	50
Lead (Pb)	5	600	105	84	135	13	6	13	42	233	56
Molybdenum (Mo)	2	-	<2	<2	<2	<2	2	<2	<2	<2	<2
Nickel (Ni)	2	1,200	139	101	16	12	<2	13	20	83	126
Selenium (Se)	5	700	19	<5	<5	<5	<5	<5	<5	47	7
Silver (Ag)	2	-	3	<2	<2	<2	<2	<2	<2	7	2
Thorium (Th)	0.1	-	4.3	9.3	7.5	5.1	1.6	6.1	4.5	2.1	5.3
Uranium (U)	0.1	-	1.2	2.7	1.5	0.6	0.2	0.2	0.6	1.8	0.7
Vanadium (V)	5	-	208	261	346	178	108	222	147	284	123
Zinc (Zn)	5	30,000	190	<5	20	11	<5	40	59	180	170
Exchangeable Cations	All units in meq/100g (except for ESP)										
Exch. Calcium (Ca)	0.1	-	0.2	1.1	0.4	<0.1	<0.1	2.3	1.6	-	-
Exch. Magnesium (Mg)	0.1	-	0.6	1.3	1.4	<0.1	0.1	11.9	8.5	-	-
Exch. Potassion (K)	0.1	-	<0.1	0.1	0.2	<0.1	<0.1	0.7	0.6	-	-
Exch. Sodium (Na)	0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	-	-
Effective Cation Exchange Capacity (eCEC)	0.1	-	0.9	2.6	2.1	0.2	0.2	15.2	10.9	-	-
Exchangeable Sodium Percentage (ESP)	0.1%	-	3.5	1.0	1.9	<0.1	<0.1	1.4	1.6	-	-
Calcium/Magnesium Ratio	0.1	-	0.33	0.85	0.29	1.00	1.00	0.19	0.19	-	-

Notes < indicates less than the analytical detection limit. Shaded cells greater than background range or applied guideline limit.

** Guideline level for hexavalent chromium [Cr(VI)] = 300 mg/kg. Guideline level for Cr(III) = 24% of total Cr.

1. NEPC (2013). National Environmental Protection Council (NEPC). *National Environmental Protection (Assessment of Site Contamination) Measure (NEPM)*, Amendment of Schedule B1-B7 of 1999 version. *Guideline on Investigation Levels for Soil and Groundwater. Health-Based Investigation Level - HIL(C); generic land use including recreational open spaces*.

Table C-4: Particle Size Distribution and Emerson Aggregate Test Results for Selected Overburden Samples

ALS Laboratory Number →			EB1417699017	EB1417699010	EB1417699014	EB1417699015	EB1417699008	EB1417699009
Drill hole Location/Sample ID →			EL-N-GC02-S5	EL-N-GC03-S7	EL-N-GC03-S14	EL-N-GC03-S16	EL-S-GC04-S6	EL-S-GC04-S8
Sample Type →			**Overburden**		**Interburden**			
Depth Range (m) →			4.50-4.85	8.6-9.0	21.0-21.5	22.65-22.80	8.4-8.7	9.5-9.8
RGS - ME number →			**3**	**4**	**13**	**14**	**15**	**16**
Dominant Clay Mineral →			Kaolinite	Kaolinite	Kaolinite	Smectite	Smectite	Smectite
Emerson Aggregate	Units	LOR						
Color (Munsell)	-		Brown	Light Brown	Very Dark Grey	Grey	Reddish Brown	Light Yellowish Brown
Texture	-		Sandy Gravel	Rock	Silty Clay	Rock	Silty Clay	Silty Clay
Emerson Class Number	-		8	8	4	8	4	4
Particle Sizing	Units	LOR						
+75µm	%	1	65	20	32	61	19	27
+150µm	%	1	52	19	21	58	7	18
+300µm	%	1	33	19	18	58	7	16
+425µm	%	1	26	18	15	57	7	16
+600µm	%	1	21	18	14	55	6	15
+1180µm	%	1	18	16	11	49	5	12
+2.36mm	%	1	11	10	8	36	3	8
+4.75mm	%	1	<1	2	1	8	<1	2
+9.50mm	%	1	<1	<1	<1	<1	<1	<1
+19.0mm	%	1	<1	<1	<1	<1	<1	<1
+37.5mm	%	1	<1	<1	<1	<1	<1	<1
+75.0mm	%	1	<1	<1	<1	<1	<1	<1
Soil Classification	Units	LOR						
Clay (<2 µm)	%	1	26	27	18	9	45	43
Silt (2-60 µm)	%	1	8	51	48	30	32	29
Sand (0.06-2.00 mm)	%	1	55	12	26	25	20	20
Gravel (>2mm)	%	1	11	10	8	36	3	8
Cobbles (>6cm)	%	1	<1	<1	<1	<1	<1	<1

Table C-5: Multi-Element Results for Water Extracts from Selected Overburden and Ore Samples

		RGS-ME Number →	1	2	3	4	5	6	7	8	9
		ALS Laboratory ID →	EB1417699018	EB1417699016	EB1417699017	EB1417699010	EB1417699011	EB1417699012	EB1417699006	EB1417699007	EB1417699003
		Sample Type →	Overburden								
		Depth Interval Range →	0.0-0.27m	3.3-3.7m	4.50-4.85m	8.6-9.0m	13.1-13.5m	20-20.37m	0.6-1.0m	5.6-6.0m	2.0-2.4m
		Drill Hole Location/Sample ID →	EL-N-GC01	EL-N-GC02		EL-N-GC03			EL-S-GC04		EL-S-GC05
Parameters	Detection Limit	Water Quality Guidelines: Aquatic Ecosystems (freshwater)[1]	Water Quality Guidelines: Livestock Drinking Water [2]	GC01-S1	GC02-S2	GC02-S5	GC03-S7	GC03-S10	GC03-S13	GC04-S2	GC04-S4	GC05-S2
pH	0.01 pH unit	6 to 9	-	5.8	5.5	5.6	5.6	5.5	4.9	5.8	5.6	5.7
Electrical Conductivity	1 µS/cm	<1,000#	3,580^	36	13	12	12	17	34	20	11	13
Acidity ($mgCaCO_3/L$)	0.2 mg/L	-	-	6	5	5	5	5	6	5	5	5
Total Alkalinity ($mgCaCO_3/L$)	0.2 mg/L	-	-	9	7	5	5	7	3	7	5	7
Bicarbonate Alkalinity ($mgCaCO_3/L$)	0.2 mg/L	-	-	9	7	5	5	7	3	7	5	7
Carbonate Alkalinity ($mgCaCO_3/L$)	0.2 mg/L	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Major Ions	All units mg/L											
Calcium (Ca)	2	-	1,000	<2	<2	<2	<2	<2	<2	<2	<2	<2
Magnesium (Mg)	2	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2
Potassium (K)	2	-	-	2	<2	<2	<2	<2	4	<2	<2	<2
Sodium (Na)	2	-	-	<2	<2	<2	<2	<2	<2	4	<2	<2
Chloride (Cl)	2	-	-	<2	<2	<2	2	4	8	<2	2	<2
Fluoride (F)	0.2	-	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sulfate (SO_4)	2	-	1,000	<2	<2	<2	<2	<2	<2	<2	<2	<2
Trace Metals/Metalloids	All units mg/L											
Aluminium (Al)	0.02	0.055	5	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Antimony (Sb)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Arsenic (As) - pentavalent	0.002	0.013 **	0.5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Barium (Ba)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	0.006	<0.002	0.002	<0.002
Beryllium (Be)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	0.2	0.37	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium (Cd)	0.002	0.0002	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr) - total or (VI)*	0.002	0.0010 (hex)*	1 (total)	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt (Co)	0.002	-	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper (Cu)	0.002	0.0014	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Lead (Pb)	0.002	0.0034	0.1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Manganese (Mn)	0.002	1.90	-	0.032	0.002	0.004	0.008	0.014	0.254	0.008	0.008	0.002
Mercury (Hg)	0.0001	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum (Mo)	0.002	-	0.15	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	0.002	0.011	1	<0.002	<0.002	<0.002	<0.002	<0.002	0.004	<0.002	<0.002	<0.002
Selenium (Se)	0.02	0.011	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Silver (Ag)	0.002	0.00005	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Thorium (Th)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	0.002	-	0.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Vanadium (V)	0.02	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc (Zn)	0.01	0.008	20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

* Cr (VI) = hexavalent. ** 0.024 mg/Lfor trivalent Arsenic (III).

for still water bodies only, moving rivers at low flow rates should not exceed 2200µS/cm. ^ calculated based on total dissolved solids (TDS) conversion rate of 0.67% of EC. TDS is an approximate measure of inorganic dissolved salts and should not exceed 2400mg/L for livestock drinking water.

Notes: < indicates concentration less than the LoR. Shaded cells indicate values which exceed applied guideline values.

1. ANZECC & ARMCANZ (2000). Trigger values for aquatic ecosystems (95% species protection level)

2. ANZECC & ARMCANZ (2000). Recommended guideline limits for Livestock Drinking Water.

1 + 2. both taken from the "Australian and New Zealand Guidelines for Fresh and Marine Water Quality", National Water Quality Management Strategy, 2000, compilation by ANZECC and ARMCANZ.

Table C-5: Multi-Element Results for Water Extracts from Selected Overburden and Ore Samples

		RGS-ME Number →	10	11	12	13	14	15	16	17	18
		ALS Laboratory ID →	EB1417699004	EB1417699001	EB1417699002	EB1417699014	EB1417699015	EB1417699008	EB1417699009	EB1417699013	EB1417699005
		Sample Type →	Overburden			Interburden				Ore	
		Depth Interval Range →	5.0-5.4m	0.75-1.10m	4.7-5.0m	21-21.50m	22.65-22.80m	8.4-8.7m	9.5-9.8m	20.4-21.0m	6.5-7.0m
		Drill Hole Location/Sample ID →	EL-S-GC05	EL-S-GC06		EL-N-GC03		EL-S-GC04		EL-N-GC03	EL-S-GC05
Parameters	Detection Limit	Water Quality Guidelines: Aquatic Ecosystems (freshwater)[1]	Water Quality Guidelines: Livestock Drinking Water [2]	GC05-S5	GC06-S2	GC06-S5	GC03-S14	GC03-S16	GC04-S6	GC04-S8	GC03-S13a	GC05-S6
pH	0.01 pH unit	6 to 9	-	5.6	6.0	5.9	5.0	5.8	6.0	6.2	5.0	5.8
Electrical Conductivity	1 µS/cm	<1,000#	3,580^	17	19	19	24	8	8	17	11	15
Acidity ($mgCaCO_3/L$)	0.2 mg/L	-	-	6	3	5	5	6	14	13	6	8
Total Alkalinity ($mgCaCO_3/L$)	0.2 mg/L	-	-	5	9	5	3	5	7	14	3	7
Bicarbonate Alkalinity ($mgCaCO_3/L$)	0.2 mg/L	-	-	5	9	5	3	5	7	14	3	7
Carbonate Alkalinity ($mgCaCO_3/L$)	0.2 mg/L	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Major Ions	All units mg/L											
Calcium (Ca)	2	-	1,000	<2	<2	<2	<2	<2	<2	<2	<2	<2
Magnesium (Mg)	2	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2
Potassium (K)	2	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sodium (Na)	2	-	-	2	2	2	<2	<2	<2	<2	<2	2
Chloride (Cl)	2	-	-	<2	<2	<2	6	<2	<2	<2	2	<2
Fluoride (F)	0.2	-	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2
Sulfate (SO_4)	2	-	1,000	2	<2	<2	<2	<2	<2	<2	<2	<2
Trace Metals/Metalloids	All units mg/L											
Aluminium (Al)	0.02	0.055	5	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Antimony (Sb)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Arsenic (As) - pentavalent	0.002	0.013 **	0.5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Barium (Ba)	0.002	-	-	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Beryllium (Be)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	0.2	0.37	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium (Cd)	0.002	0.0002	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr) - total or (VI)*	0.002	0.0010 (hex)*	1 (total)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.004
Cobalt (Co)	0.002	-	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper (Cu)	0.002	0.0014	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Lead (Pb)	0.002	0.0034	0.1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Manganese (Mn)	0.002	1.90	-	<0.002	0.004	0.006	0.094	<0.002	<0.002	0.004	0.014	0.010
Mercury (Hg)	0.0001	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum (Mo)	0.002	-	0.15	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	0.002	0.011	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	0.02	0.011	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Silver (Ag)	0.002	0.00005	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Thorium (Th)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	0.002	-	0.2	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Vanadium (V)	0.02	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc (Zn)	0.01	0.008	20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

* Cr (VI) = hexavalent. ** 0.024 mg/Lfor trivalent Arsenic (III).

for still water bodies only, moving rivers at low flow rates should not exceed 2200µS/cm. ^ calculated based on total dissolved solids (TDS) conversion rate of 0.67% of EC. TDS is an approximate measure of inorganic dissolved salts and should not exceed 2400mg/L for livestock drinking water.

Notes: < indicates concentration less than the LoR. Shaded cells indicate values which exceed applied guideline values.

1. ANZECC & ARMCANZ (2000). Trigger values for aquatic ecosystems (95% species protection level)

2. ANZECC & ARMCANZ (2000). Recommended guideline limits for Livestock Drinking Water.

1 + 2. both taken from the "Australian and New Zealand Guidelines for Fresh and Marine Water Quality", National Water Quality Management Strategy, 2000, compilation by ANZECC and ARMCANZ.

Table C-6: Acid Base Account (ABA) Test Results for Middlings Samples

ALS Laboratory Nunber	Client Sample ID	Sample Type	pH[1]	EC[1]	Total Sulfur	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	AMD risk Classification[3]
				µS/cm	%		kg H_2SO_4/t				
MIDDLINGS											
EB1416586050	Sample 1	Middlings	5.5	19	0.005	-	0.15	3.8	-3.6	24.8	NAF (Barren)
EB1416586043	Sample 2	Middlings	5.5	23	0.005	-	0.15	1.8	-1.6	11.8	NAF (Barren)
EB1416586044	Sample 3	Middlings	5.5	20	0.005	-	0.15	2.7	-2.5	17.6	NAF (Barren)
EB1416586045	Sample 4	Middlings	5.3	18	0.005	-	0.15	3.2	-3.0	20.9	NAF (Barren)

1. Current pH and EC provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; and NAPP = Net Acid Producing Potential.
3. Sample classification detail provided in report text.

Table C-7: Multi-element results for middlings samples

Parameters	NEPC Health-Based Investigation Level HIL(C)[1]	Sample 1	Sample 2	Sample 3	Sample 4
Major Elements		**All units mg/kg**			
Aluminium (Al)	-	8,770	9,100	8,860	10,500
Calcium (Ca)	-	180	190	190	100
Iron (Fe)	-	139,000	141,000	147,000	168,000
Magnesium (Mg)	-	580	560	420	120
Manganese (Mn)	19,000	166,000	146,000	136,000	103,000
Potassium (K)	-	3,460	3,760	4,390	3,090
Sodium (Na)	-	760	700	670	390
Minor Elements		**All units mg/kg**			
Antimony (Sb)	-	<5	<5	<5	<5
Arsenic (As)	300	12	33	12	12
Barium (Ba)	-	9,970	6,090	5,600	3,520
Beryllium (Be)	90	1	2	1	<1
Boron (B)	20,000	<50	<50	<50	<50
Cadmium (Cd)	90	1	1	2	1
Chromium (Cr)	300 **	101	141	121	133
Cobalt (Co)	300	49	52	47	25
Copper (Cu)	17,000	24	33	27	17
Lead (Pb)	600	44	84	83	46
Mercury (Hg) - inorganic	80	<0.1	<0.1	<0.1	<0.1
Molybdenum (Mo)	-	11	9	7	6
Nickel (Ni)	1,200	66	69	60	22
Selenium (Se)	700	<5	<5	<5	<5
Silver (Ag)	-	<2	<2	<2	<2
Thorium (Th)	-	5.8	6.8	6.7	6.4
Uranium (U)	-	1.6	2.1	1.6	1.8
Vanadium (V)	-	389	434	390	436
Zinc (Zn)	30,000	87	102	74	34

Notes:

** guideline level for hexavalent Cr (VI) = 300 mg/kg, for trivalent Cr (III) = 24% of total Cr.

1. NEPC (2013). National Environmental Protection Council (NEPC). *National Environmental Protection (Assessment of Site Contamination) Measure (NEPM)* , Amendment of Schedule B1-B7 of 1999 version. *Guideline on Investigation Levels for Soil and Groundwater. Health-Based Investigation Level - HIL(C); recreational open spaces* . Shaded cells exceed guideline value.

Table C-8: Multi-element results for water extracts from middlings samples

Parameters	Aquatic Ecosystems (freshwater)[1]	Livestock Drinking Water [2]	Sample 1	Sample 2	Sample 3	Sample 4
pH	6 to 9	-	5.5	5.5	5.5	5.3
EC (µS/cm)	1,000	3,580^	19	23	20	18
Total Alkalinity ($CaCO_3$ mg/L)	-	-	15.4	12.8	7.6	5.2
Bicarbonate Alkalinity ($CaCO_3$ mg/L)	-	-	15.4	12.8	7.6	5.2
Carbonate Alkalinity ($CaCO_3$ mg/L)	-	-	<0.2	<0.2	<0.2	<0.2
Major Ions	**All units mg/L**					
Calcium (Ca)	-	1,000	<2	<2	<2	<2
Magnesium (Mg)	-	-	<2	<2	<2	<2
Potassium (K)	-	-	<2	<2	<2	<2
Sodium (Na)	-	-	2	4	2	2
Chloride (Cl)	-	-	4	4	4	2
Sulfate (SO_4)	-	1,000	<2	<2	<2	<2
Trace Metals/Metalloids	**All units mg/L**					
Aluminium (Al)	0.055	5	<0.02	<0.02	<0.02	<0.02
Antimony (Sb)	-	-	<0.002	<0.002	<0.002	<0.002
Arsenic (As)	0.013 **	0.5	<0.002	<0.002	<0.002	<0.002
Barium (Ba)	-	-	<0.002	<0.002	<0.002	<0.002
Beryllium (Be)	-	-	<0.002	<0.002	<0.002	<0.002
Boron (B)	0.37	5	<0.2	<0.2	<0.2	<0.2
Cadmium (Cd)	0.0002	0.01	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	0.0010 (hex)*	1 (total)	<0.002	<0.002	<0.002	<0.002
Cobalt (Co)	-	1	<0.002	<0.002	<0.002	<0.002
Copper (Cu)	0.0014	1	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	-	-	<0.2	<0.2	<0.2	<0.2
Lead (Pb)	0.0034	0.1	<0.002	<0.002	<0.002	<0.002
Manganese (Mn) ***	1.9	-	0.014	0.014	0.016	0.040
Mercury (Hg)	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum (Mo)	-	0.15	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	0.011	1	<0.002	<0.002	<0.002	<0.002
Selenium (Se)	0.011	0.02	<0.02	<0.02	<0.02	<0.02
Silver (Ag)	0.00005	-	<0.002	<0.002	<0.002	<0.002
Thorium (Th)	-	-	<0.002	<0.002	<0.002	<0.002
Uranium (U)	-	0.2	<0.002	<0.002	<0.002	<0.002
Vanadium (V)	-	-	<0.02	<0.02	<0.02	<0.02
Zinc (Zn)	0.008	20	<0.01	<0.01	<0.01	<0.01

Notes:

1. ANZECC & ARMCANZ (2000). Trigger values for aquatic ecosystems - freshwater (95% species protection level)

2. ANZECC & ARMCANZ (2000). Recommended guideline limits for Livestock Drinking Water.

1 + 2. both taken from the "Australian and New Zealand Guidelines for Fresh and Marine Water Quality", National Water Quality Management Strategy, 2000, compilation by ANZECC and ARMCANZ.

* Cr (VI) = hexavalent; ** 0.024 mg/Lfor trivalent Arsenic (III)

^ calculated based on total dissolved solids (TDS) conversion rate of 0.67% of EC. TDS is an approximate measure of inorganic dissolved salts and should not exceed 2,400mg/L for livestock drinking water.

Table C-9: Composite Overburden, Ore and Middlings Samples Selected for KLC Tests

KLC number	ALS Laboratory Sample Number	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Weight used in column (kg)
KLC1	EB1416507-041	ELSMB-05D	GW05	overburden	36m	0.982
	EB1416507-024	ELSMB-06D	GW06	overburden	18m	0.429
	EB1416507-025	ELSMB-06D	GW06	overburden	21m	0.462
KLC2	EB1416586-050	ELN/GC01	GC01-S1	overburden	0-0.27	1.025
	EB1416586-053	ELN/GC01	GC01-S4	interburden	3.11-3.5	0.988
KLC3	EB1416586-020	ELS/GC04	GC04-S3	overburden	3.0-3.5	1.196
	EB1416586-021	ELS/GC04	GC04-S4	overburden	5.6-6.0	1.027
KLC4	EB1416586-005	ELS/GC06	GC06-S5	overburden	4.7-5.0	1.037
	EB1416586-006	ELS/GC06	GC06-S6	overburden	6.35-6.65	1.012
KLC5	EB1416586-039	ELN/GC03	GC03-S13a	ore (MID)	20.4-21	1.173
	EB1416586-041	ELN/GC03	GC03-S15	ore (BOT)	21.9-22.4	1.508
KLC6	EB1415988-007	Process Plant	1	middlings	-	1.240
	EB1415988-009	Process Plant	3	middlings	-	1.058
	EB1415988-010	Process Plant	4	middlings	-	0.747

Notes:

* MID = high-grade ore consisting mostly of cemented and loose pisolites
* BOT = low-grade ore rich in silica

Table C-10: Acid-Base Results for Samples Selected for Kinetic Leach Column (KLC) Tests

RGS KLC No.	ALS Laboratory Number	Drill Hole Location/ID	Client Sample ID	Sample Type *	Depth Interval (m)	Description	pH[1]	EC[1]	Total S	Scr[2]	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	AMD risk Classification[3]
								µS/cm	%		kg H_2SO_4/t				
Overburden + Interburden															
1	EB1416507041	EL-S-MB05	GW05	overburden	36	CLAY: medium plasticity, dark greenish grey, low strength, soft	7.5	554	0.58	0.56	17.12	5.1	12.02	0.30	PAF
	EB1416507024	EL-S-MB06	GW06	overburden	18	CLAY: mottled cream / yellow, firm	3.4	2,740	0.82	0.32	9.77	0.25	9.52	0.03	PAF
	EB1416507025	EL-S-MB06	GW06	overburden	21	CLAY: grey, stiff	4.4	1,120	0.87	0.63	19.23	0.6	18.63	0.03	PAF
2	EB1416586050	EL-N-GC01	GC01-S1	overburden	0-0.27	Brown clay with plant material and minor Mn fragments	6.2	37	0.02		0.61	4.1	-3.49	6.69	NAF (Barren)
	EB1416586053	EL-N-GC01	GC01-S4	interburden	3.11-3.5	White to light brown claystone - very fine grained.	6.2	6	0.01		0.31	0.25	0.06	0.82	NAF (Barren)
3	EB1416586020	EL-S-GC04	GC04-S3	overburden	3.0-3.5	Laminar brown and red ferrinous laterite, silicious manganese layers (30-60mm). Several vertical and horizontal fractures infilled with sand.	5.5	14	0.02		0.61	1.1	-0.49	1.80	NAF (Barren)
	EB1416586021	EL-S-GC04	GC04-S4	overburden	5.6-6.0	Laminar white, brown and red ferrinous and laterite, reworked well rounded quartzite stones (20mm), silicious manganes layers (40mm thick).	5.8	10	0.02		0.61	0.6	0.01	0.98	NAF (Barren)
4	EB1416586005	EL-S-GC06	GC06-S5	overburden	4.7-5.0	Small mangite fragments (5-10mm) supprted in a white and orange clay matrix. Thin manganese enriched bands (5-10mm) (100mm core loss)	6.3	19	0.02		0.61	2.0	-1.39	3.27	NAF (Barren)
	EB1416586006	EL-S-GC06	GC06-S6	overburden	6.35-6.65	Manganese fragments and oolites (10-40mm) supported in a white and purple clay matrix.	5.9	15	0.005		0.15	1.4	-1.25	9.14	NAF (Barren)
Ore															
5	EB1416586039	EL-N-GC03	GC03-S13a	ore (MID)	20.4-21	Black mass mangite fragments. At the top and bottom of the column is black clay-like manganese with veins of white throughout.	5.6	8	0.005		0.15	2.0	-1.85	13.06	NAF (Barren)
	EB1416586041	EL-N-GC03	GC03-S15	ore (BOT)	21.9-22.4	Black discontinuous massive mangite. Relict piso structures	6.0	8	0.005		0.15	3.4	-3.25	22.20	NAF (Barren)
Process Residue															
6	EB1415988-007	Process Plant	Sample 1	Middlings	-	Middlings waste stream	5.5	19	0.005		0.15	3.8	-3.65	24.82	NAF (Barren)
	EB1415988-009	Process Plant	Sample 3	Middlings	-	Middlings waste stream	5.5	20	0.005		0.15	2.7	-2.55	17.63	NAF (Barren)
	EB1415988-010	Process Plant	Sample 4	Middlings	-	Middlings waste stream	5.3	18	0.005		0.15	3.2	-3.05	20.90	NAF (Barren)

Notes:
* MID = high-grade ore consisting mostly of cemented and loose pisolites; * BOT = low-grade ore rich in silica.
1. Current pH and EC provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; and NAPP = Net Acid Producing Potential.
3. Sample classification detail provided in report text.

ATTACHMENT D

Kinetic Geochemical Test Results

RGS-KLC1 : GEMCO Project

KLC Test Results: PAF Overburden

	Weight (kg)	1.02	**Total S (%)**	0.757	**ANC**	1.98	
	pH (1:5)	3.8	**Scr (%)**	0.502	**NAPP**	13.39	
	EC (µS/cm)	1,471	**MPA**	15.37	**ANC:MPA**	0.13	

Date		**27-Aug-14**	**25-Sep-14**	**28-Oct-14**	**27-Nov-14**	**29-Dec-14**	**28-Jan-15**	**25-Feb-15**
Week		**0**	**4**	**9**	**13**	**18**	**22**	**26**
Leach Number		**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number		EB1441384	EB1443211	EB1445223	EB1447372	EB1449195	EB1511724	EB1513613
Volume Collected (L)		0.967	0.905	0.746	0.635	0.595	0.633	0.537
Cum. Volume (L)		0.97	1.87	2.62	3.25	3.85	4.48	5.02
Pore Volumes		0.7	1.4	1.9	2.4	2.9	3.3	3.7
pH		4.19	4.87	4.49	4.70	2.80	2.30	2.30
EC (µS/cm)		109	271	572	1,095	5,760	7,290	6,870
Acidity (mg/L)*		4	4	38	115	1,120	2,300	2190
Alkalinity (mg/L)*		43	9	2	<1	<1	<1	<1
Net Alkalinity (mg/L)*		39	5	-36	-115	-1,120	-2,300	-2190
Dissolved elements (mg/L)	**Guideline Limits #**							
Silver (Ag)	-	<0.001	-	-	-	-	-	-
Aluminium (Al)	5	0.10	0.09	0.18	0.19	51.6	78.9	57.0
Arsenic (As)	0.5	<0.001	<0.001	<0.001	0.001	0.016	0.046	0.027
Boron (B)	5	<0.05	-	-	-	-	-	-
Barium (Ba)	-	0.001	-	-	-	-	-	-
Beryllium (Be)	-	<0.001	-	-	-	-	-	-
Calcium (Ca)	1,000	2	67	61	27	178	163	142
Cadmium (Cd)	0.01	<0.0001	0.0003	0.0013	0.0028	0.0245	0.0273	0.0216
Chloride (Cl)	-	1	1	3	4	6	6	6
Cobalt (Co)	1	0.054	0.087	0.240	0.391	5.13	7.57	4.90
Chromium (Cr)	1	<0.001	<0.001	<0.001	<0.001	0.090	0.238	0.180
Copper (Cu)	1	0.015	0.008	0.014	0.014	1.81	2.44	1.74
Iron (Fe)	-	1.33	0.40	0.23	<0.05	93.4	292	190
Mercury (Hg)	0.002	<0.0001	-	-	-	-	-	-
Potassium (K)	-	<1	1	8	8	9	<1	<1
Magnesium (Mg)	-	4	23	75	117	690	701	582
Manganese (Mn)	-	2.49	4.12	11.7	19.6	208	250	181
Molybdenum (Mo)	0.15	<0.001	0.001	<0.001	<0.001	0.008	0.011	0.006
Sodium (Na)	-	4	5	20	34	169	154	113
Nickel (Ni)	1	0.074	0.138	0.372	0.666	8.24	9.50	7.28
Phosphorus (P)	-	<0.01	-	-	-	-	-	-
Lead (Pb)	0.1	<0.001	<0.001	<0.001	<0.001	0.067	<0.005	<0.001
Sulfate (SO_4)	1,000	38	264	494	595	4,040	5,780	4,040
Antimony (Sb)	-	<0.001	<0.001	<0.001	<0.001	<0.005	<0.005	<0.001
Selenium (Se)	0.02	<0.01	<0.01	<0.01	<0.01	0.11	0.06	0.12
Thorium (Th)	-	<0.001	-	-	-	-	-	-
Uranium (U)	0.2	<0.001	-	-	-	-	-	-
Vanadium (V)	-	<0.01	-	-	-	-	-	-
Zinc (Zn)	20	0.09	0.166	0.495	0.823	11.4	14.4	10.6
Calculations**								
SO_4 Release Rate		36	235	362	371	2360	3592	2130
Cumulative SO_4 Release		36	271	632	1003	3364	6956	9086
Ca Release Rate		1.9	59.5	44.7	16.8	104.0	101.3	74.9
Cumulative Ca Release		1.9	61.4	106.1	122.9	226.9	328.2	403.1
Mg Release Rate		3.8	20.4	54.9	72.9	403.1	435.7	306.9
Cumulative Mg Release		3.8	24.2	79.2	152.1	555.2	990.9	1297.7
Residual ANC (%)		99.0	87.5	70.8	53.8	0	0	0
Residual Sulfur (%)		99.8	98.8	97.2	95.6	85.2	69.3	59.9
SO_4/(Ca+Mg) molar ratio		1.84	1.05	1.12	1.13	1.28	1.83	1.53

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential

ANZECC & ARCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water (low risk trigger levels).

RGS-KLC2 : GEMCO Project

KLC Test Results: NAF Overburden + Interburden

	Weight (kg)	2.01	**Total S (%)**	0.015	**ANC**	2.18	
	pH (1:5)	6.2	**Scr (%)**	-	**NAPP**	-1.72	
	EC (µS/cm)	22	**MPA**	0.46	**ANC:MPA**	4.73	

Date		**27-Aug-14**	**25-Sep-14**	**28-Oct-14**	**27-Nov-14**	**29-Dec-14**	**28-Jan-15**	**25-Feb-15**
Week		**0**	**4**	**9**	**13**	**18**	**22**	**26**
Leach Number		**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number		EB1441384	EB1443211	EB1445223	EB1447372	EB1449195	EB1511724	EB1513613
Volume Collected (L)		0.683	0.648	0.635	0.656	0.598	0.572	0.586
Cum. Volume (L)		0.68	1.33	1.97	2.62	3.22	3.79	4.38
Pore Volumes		0.5	1.0	1.5	1.9	2.4	2.8	3.2
pH		6.29	6.67	6.57	6.93	6.13	5.30	5.98
EC (µS/cm)		99	33	28	26	43	26	23
Acidity (mg/L)*		26	4	3	3	1	7	2
Alkalinity (mg/L)*		8	<1	2	5	1	3	9
Net Alkalinity (mg/L)*		-18	-4	-1	2	0	-4	7
Dissolved elements (mg/L)	**Guideline Limits #**							
Silver (Ag)	-	<0.001	-	-	-	-	-	-
Aluminium (Al)	5	<0.01	<0.01	<0.01	<0.01	0.10	0.08	0.07
Arsenic (As)	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	5	<0.05	-	-	-	-	-	-
Barium (Ba)	-	0.007	-	-	-	-	-	-
Beryllium (Be)	-	<0.001	-	-	-	-	-	-
Calcium (Ca)	1,000	4	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chloride (Cl)	-	7	2	2	2	2	2	2
Cobalt (Co)	1	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Chromium (Cr)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	1	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg)	0.002	<0.0001	-	-	-	-	-	-
Potassium (K)	-	2	<1	1	<1	1	<1	<1
Magnesium (Mg)	-	2	<1	<1	<1	<1	<1	<1
Manganese (Mn)	-	0.157	0.073	0.058	0.046	0.054	0.044	0.044
Molybdenum (Mo)	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sodium (Na)	-	9	2	2	2	2	2	1
Nickel (Ni)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus (P)	-	<0.01	-	-	-	-	-	-
Lead (Pb)	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfate (SO_4)	1,000	1	3	4	3	9	7	6
Antimony (Sb)	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium (Th)	-	<0.001	-	-	-	-	-	-
Uranium (U)	0.2	<0.001	-	-	-	-	-	-
Vanadium (V)	-	<0.01	-	-	-	-	-	-
Zinc (Zn)	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**								
SO_4 Release Rate		0.2	1.0	1.3	1.0	2.7	2.0	1.7
Cumulative SO_4 Release		0.2	1.1	2.4	3.4	6.0	8.0	9.8
Ca Release Rate		1.4	0.2	0.2	0.2	0.1	0.1	0.1
Cumulative Ca Release		1.4	1.5	1.7	1.8	2.0	2.1	2.3
Mg Release Rate		0.7	0.2	0.2	0.2	0.1	0.1	0.1
Cumulative Mg Release		0.7	0.8	1.0	1.2	1.3	1.5	1.6
Residual ANC (%)		99.7	99.7	99.6	99.6	99.5	99.5	99.4
Residual Sulfur (%)		100.0	99.7	99.5	99.2	98.7	98.2	97.8
SO_4/(Ca+Mg) molar ratio		0.03	0.95	1.26	0.95	2.84	2.21	1.89

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential

ANZECC & ARCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water (low risk trigger levels).

RGS-KLC3 : GEMCO Project

KLC Test Results: NAF Overburden

	Weight (kg)	2.22	**Total S (%)**	0.020	**ANC**	0.85	
	pH (1:5)	5.6	**Scr (%)**	-	**NAPP**	-0.24	
	EC (µS/cm)	12	**MPA**	0.61	**ANC:MPA**	1.39	

Date		**27-Aug-14**	**25-Sep-14**	**28-Oct-14**	**27-Nov-14**	**29-Dec-14**	**28-Jan-15**	**25-Feb-15**
Week		**0**	**4**	**9**	**13**	**18**	**22**	**26**
Leach Number		**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number		EB1441384	EB1443211	EB1445223	EB1447372	EB1449195	EB1511724	EB1513613
Volume Collected (L)		0.704	0.632	0.639	0.667	0.625	0.579	0.598
Cum. Volume (L)		0.70	1.34	1.98	2.64	3.27	3.85	4.44
Pore Volumes		0.5	1.0	1.5	2.0	2.4	2.8	3.3
pH		6.50	7.26	6.88	6.84	5.75	5.42	6.09
EC (µS/cm)		26	25	19	17	17	12	23
Acidity (mg/L)*		3	2	3	3	1	3	4
Alkalinity (mg/L)*		3	<1	1	4	<1	3	8
Net Alkalinity (mg/L)*		0	-2	-2	1	-1	0	4
Dissolved elements (mg/L)	**Guideline Limits #**							
Silver (Ag)	-	<0.001	-	-	-	-	-	-
Aluminium (Al)	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (As)	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	5	<0.05	-	-	-	-	-	-
Barium (Ba)	-	<0.001	-	-	-	-	-	-
Beryllium (Be)	-	<0.001	-	-	-	-	-	-
Calcium (Ca)	1,000	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chloride (Cl)	-	3	3	2	2	2	2	2
Cobalt (Co)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg)	0.002	<0.0001	-	-	-	-	-	-
Potassium (K)	-	<1	<1	<1	<1	<1	<1	<1
Magnesium (Mg)	-	<1	<1	<1	<1	<1	<1	<1
Manganese (Mn)	-	0.002	0.014	0.012	0.012	0.014	0.015	0.012
Molybdenum (Mo)	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sodium (Na)	-	1	2	2	2	2	2	1
Nickel (Ni)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus (P)	-	<0.01	-	-	-	-	-	-
Lead (Pb)	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfate (SO_4)	1,000	1	1	2	2	3	0.5	2
Antimony (Sb)	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium (Th)	-	<0.001	-	-	-	-	-	-
Uranium (U)	0.2	<0.001	-	-	-	-	-	-
Vanadium (V)	-	<0.01	-	-	-	-	-	-
Zinc (Zn)	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**								
SO_4 Release Rate		0.2	0.3	0.6	0.6	0.8	0.1	0.5
Cumulative SO_4 Release		0.2	0.4	1.0	1.6	2.5	2.6	3.1
Ca Release Rate		0.2	0.1	0.1	0.2	0.1	0.1	0.1
Cumulative Ca Release		0.2	0.3	0.4	0.6	0.7	0.9	1.0
Mg Release Rate		0.2	0.1	0.1	0.2	0.1	0.1	0.1
Cumulative Mg Release		0.2	0.3	0.4	0.6	0.7	0.9	1.0
Residual ANC (%)		99.9	99.8	99.7	99.5	99.4	99.3	99.2
Residual Sulfur (%)		100.0	99.9	99.8	99.7	99.6	99.6	99.5
SO_4/(Ca+Mg) molar ratio		0.16	0.32	0.63	0.63	0.95	0.16	0.63

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential

ANZECC & ARCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water (low risk trigger levels).

RGS-KLC4 : GEMCO Project

KLC Test Results: NAF Overburden

	Weight (kg)	2.05	**Total S (%)**	0.013	**ANC**	1.70	
	pH (1:5)	6.1	**Scr (%)**	-	**NAPP**	-1.32	
	EC (µS/cm)	17	**MPA**	0.38	**ANC:MPA**	4.44	

Date		**27-Aug-14**	**25-Sep-14**	**28-Oct-14**	**27-Nov-14**	**29-Dec-14**	**28-Jan-15**	**25-Feb-15**
Week		**0**	**4**	**9**	**13**	**18**	**22**	**26**
Leach Number		**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number		EB1441384	EB1443211	EB1445223	EB1447372	EB1449195	EB1511724	EB1513613
Volume Collected (L)		0.730	0.622	0.627	0.733	0.585	0.649	0.467
Cum. Volume (L)		0.73	1.35	1.98	2.71	3.30	3.95	4.41
Pore Volumes		0.5	1.0	1.5	2.0	2.4	2.9	3.3
pH		5.88	6.41	6.15	6.24	5.72	5.39	5.54
EC (µS/cm)		61	41	21	20	21	18	29
Acidity (mg/L)*		3	1	6	8	2	4	4
Alkalinity (mg/L)*		6	6	<1	4	<1	3	9
Net Alkalinity (mg/L)*		3	5	-6	-4	-2	-1	5
Dissolved elements (mg/L)	**Guideline Limits #**							
Silver (Ag)	-	<0.001	-	-	-	-	-	-
Aluminium (Al)	5	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Arsenic (As)	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	5	<0.05	-	-	-	-	-	-
Barium (Ba)	-	<0.001	-	-	-	-	-	-
Beryllium (Be)	-	<0.001	-	-	-	-	-	-
Calcium (Ca)	1,000	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chloride (Cl)	-	12	7	4	3	2	1	1
Cobalt (Co)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	1	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg)	0.002	<0.0001	-	-	-	-	-	-
Potassium (K)	-	<1	<1	<1	<1	<1	<1	<1
Magnesium (Mg)	-	<1	<1	<1	<1	<1	<1	<1
Manganese (Mn)	-	0.023	0.013	0.003	0.002	0.007	0.012	0.007
Molybdenum (Mo)	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sodium (Na)	-	8	4	3	3	3	3	2
Nickel (Ni)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus (P)	-	<0.01	-	-	-	-	-	-
Lead (Pb)	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfate (SO_4)	1,000	1	1	2	3	4	4	4
Antimony (Sb)	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium (Th)	-	<0.001	-	-	-	-	-	-
Uranium (U)	0.2	<0.001	-	-	-	-	-	-
Vanadium (V)	-	<0.01	-	-	-	-	-	-
Zinc (Zn)	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**								
SO_4 Release Rate		0.2	0.3	0.6	1.1	1.1	1.3	0.9
Cumulative SO_4 Release		0.2	0.5	1.1	2.2	3.3	4.6	5.5
Ca Release Rate		0.2	0.2	0.2	0.2	0.1	0.2	0.1
Cumulative Ca Release		0.2	0.3	0.5	0.7	0.8	1.0	1.1
Mg Release Rate		0.2	0.2	0.2	0.2	0.1	0.2	0.1
Cumulative Mg Release		0.2	0.3	0.5	0.7	0.8	1.0	1.1
Residual ANC (%)		99.9	99.9	99.8	99.7	99.7	99.6	99.6
Residual Sulfur (%)		100.0	99.9	99.7	99.4	99.1	98.8	98.5
SO_4/(Ca+Mg) molar ratio		0.16	0.32	0.63	0.95	1.26	1.26	1.26

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential

ANZECC & ARCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water (low risk trigger levels).

RGS-KLC5 : GEMCO Project

KLC Test Results: NAF Ore (high + low grade)

Weight (kg)	2.68	**Total S (%)**	0.005	**ANC**	2.70		
pH (1:5)	5.8	**Scr (%)**	-	**NAPP**	-2.55		
EC (µS/cm)	8	**MPA**	0.15	**ANC:MPA**	17.63		

Date		**27-Aug-14**	**25-Sep-14**	**28-Oct-14**	**27-Nov-14**	**29-Dec-14**	**28-Jan-15**	**25-Feb-15**
Week		**0**	**4**	**9**	**13**	**18**	**22**	**26**
Leach Number		**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number		EB1441384	EB1443211	EB1445223	EB1447372	EB1449195	EB1511724	EB1513613
Volume Collected (L)		0.791	0.653	0.741	0.840	0.774	0.677	0.685
Cum. Volume (L)		0.79	1.44	2.19	3.03	3.80	4.48	5.16
Pore Volumes		0.6	1.1	1.6	2.2	2.8	3.3	3.8
pH		6.74	6.13	4.91	5.01	4.95	4.90	4.93
EC (µS/cm)		30	31	29	23	23	17	22
Acidity (mg/L)*		4	<1	5	3	3	4	5
Alkalinity (mg/L)*		5	5	<1	<1	<1	2	5
Net Alkalinity (mg/L)*		1	5	-5	-3	-3	-2	0
Dissolved elements (mg/L)	**Guideline Limits #**							
Silver (Ag)	-	<0.001	-	-	-	-	-	-
Aluminium (Al)	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (As)	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	5	<0.05	-	-	-	-	-	-
Barium (Ba)	-	<0.001	-	-	-	-	-	-
Beryllium (Be)	-	<0.001	-	-	-	-	-	-
Calcium (Ca)	1,000	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chloride (Cl)	-	7	6	5	5	4	4	3
Cobalt (Co)	1	<0.001	0.003	0.002	0.001	0.001	<0.001	<0.001
Chromium (Cr)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	1	<0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg)	0.002	<0.0001	-	-	-	-	-	-
Potassium (K)	-	<1	<1	<1	<1	<1	<1	<1
Magnesium (Mg)	-	<1	<1	<1	<1	<1	<1	<1
Manganese (Mn)	-	0.075	0.297	0.267	0.241	0.227	0.225	0.200
Molybdenum (Mo)	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sodium (Na)	-	2	1	2	1	1	1	<1
Nickel (Ni)	1	<0.001	0.004	0.003	0.002	0.001	<0.001	0.002
Phosphorus (P)	-	<0.01	-	-	-	-	-	-
Lead (Pb)	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfate (SO_4)	1,000	1	1	0.5	0.5	0.5	0.5	0.5
Antimony (Sb)	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium (Th)	-	<0.001	-	-	-	-	-	-
Uranium (U)	0.2	<0.001	-	-	-	-	-	-
Vanadium (V)	-	<0.01	-	-	-	-	-	-
Zinc (Zn)	20	<0.005	0.011	0.008	0.006	0.005	<0.005	<0.005
Calculations**								
SO_4 Release Rate		0.1	0.1	0.1	0.2	0.1	0.1	0.1
Cumulative SO_4 Release		0.1	0.3	0.4	0.6	0.7	0.8	1.0
Ca Release Rate		0.1	0.1	0.1	0.2	0.1	0.1	0.1
Cumulative Ca Release		0.1	0.3	0.4	0.6	0.7	0.8	1.0
Mg Release Rate		0.1	0.1	0.1	0.2	0.1	0.1	0.1
Cumulative Mg Release		0.1	0.3	0.4	0.6	0.7	0.8	1.0
Residual ANC (%)		100.0	99.9	99.9	99.9	99.8	99.8	99.8
Residual Sulfur (%)		99.9	99.8	99.7	99.6	99.5	99.4	99.4
SO_4/(Ca+Mg) molar ratio		0.16	0.16	0.16	0.16	0.16	0.16	0.16

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential

ANZECC & ARCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water (low risk trigger levels).

RGS-KLC6 : GEMCO Project

KLC Test Results: NAF Process Residue (Middlings)

	Weight (kg)	3.05	**Total S (%)**	0.005	**ANC**	3.23	
	pH (1:5)	5.4	**Scr (%)**	-	**NAPP**	-3.08	
	EC (µS/cm)	19	**MPA**	0.15	**ANC:MPA**	21.12	

Date		**27-Aug-14**	**25-Sep-14**	**28-Oct-14**	**27-Nov-14**	**29-Dec-14**	**28-Jan-15**	**25-Feb-15**
Week		**0**	**4**	**9**	**13**	**18**	**22**	**26**
Leach Number		**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number		EB1441384	EB1443211	EB1445223	EB1447372	EB1449195	EB1511724	EB1513613
Volume Collected (L)		0.776	0.643	0.750	0.764	0.724	0.670	0.692
Cum. Volume (L)		0.78	1.42	2.17	2.93	3.66	4.33	5.02
Pore Volumes		0.6	1.1	1.6	2.2	2.7	3.2	3.7
pH		6.85	6.74	5.97	5.86	5.67	5.24	5.85
EC (µS/cm)		41	30	34	21	16	13	19
Acidity (mg/L)*		3	<1	2	3	2	4	3
Alkalinity (mg/L)*		5	2	<1	3	<1	3	7
Net Alkalinity (mg/L)*		2	2	-2	0	-2	-1	4
Dissolved elements (mg/L)	**Guideline Limits #**							
Silver (Ag)	-	<0.001	-	-	-	-	-	-
Aluminium (Al)	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (As)	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	5	<0.05	-	-	-	-	-	-
Barium (Ba)	-	<0.001	-	-	-	-	-	-
Beryllium (Be)	-	<0.001	-	-	-	-	-	-
Calcium (Ca)	1,000	<1	<1	<1	<1	<1	<1	<1
Cadmium (Cd)	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chloride (Cl)	-	6	4	3	3	2	2	2
Cobalt (Co)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury (Hg)	0.002	<0.0001	-	-	-	-	-	-
Potassium (K)	-	<1	<1	<1	<1	<1	<1	<1
Magnesium (Mg)	-	<1	<1	<1	<1	<1	<1	<1
Manganese (Mn)	-	0.043	0.049	0.072	0.077	0.067	0.062	0.069
Molybdenum (Mo)	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sodium (Na)	-	4	2	2	2	2	1	1
Nickel (Ni)	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus (P)	-	<0.01	-	-	-	-	-	-
Lead (Pb)	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulfate (SO_4)	1,000	1	1	0.5	0.5	0.5	0.5	0.5
Antimony (Sb)	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium (Th)	-	<0.001	-	-	-	-	-	-
Uranium (U)	0.2	<0.001	-	-	-	-	-	-
Vanadium (V)	-	<0.01	-	-	-	-	-	-
Zinc (Zn)	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**								
SO_4 Release Rate		0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cumulative SO_4 Release		0.1	0.2	0.4	0.5	0.6	0.7	0.8
Ca Release Rate		0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cumulative Ca Release		0.1	0.2	0.4	0.5	0.6	0.7	0.8
Mg Release Rate		0.1	0.1	0.1	0.1	0.1	0.1	0.1
Cumulative Mg Release		0.1	0.2	0.4	0.5	0.6	0.7	0.8
Residual ANC (%)		100.0	100.0	99.9	99.9	99.9	99.9	99.8
Residual Sulfur (%)		99.9	99.8	99.8	99.7	99.6	99.5	99.4
SO_4/(Ca+Mg) molar ratio		0.16	0.16	0.16	0.16	0.16	0.16	0.16

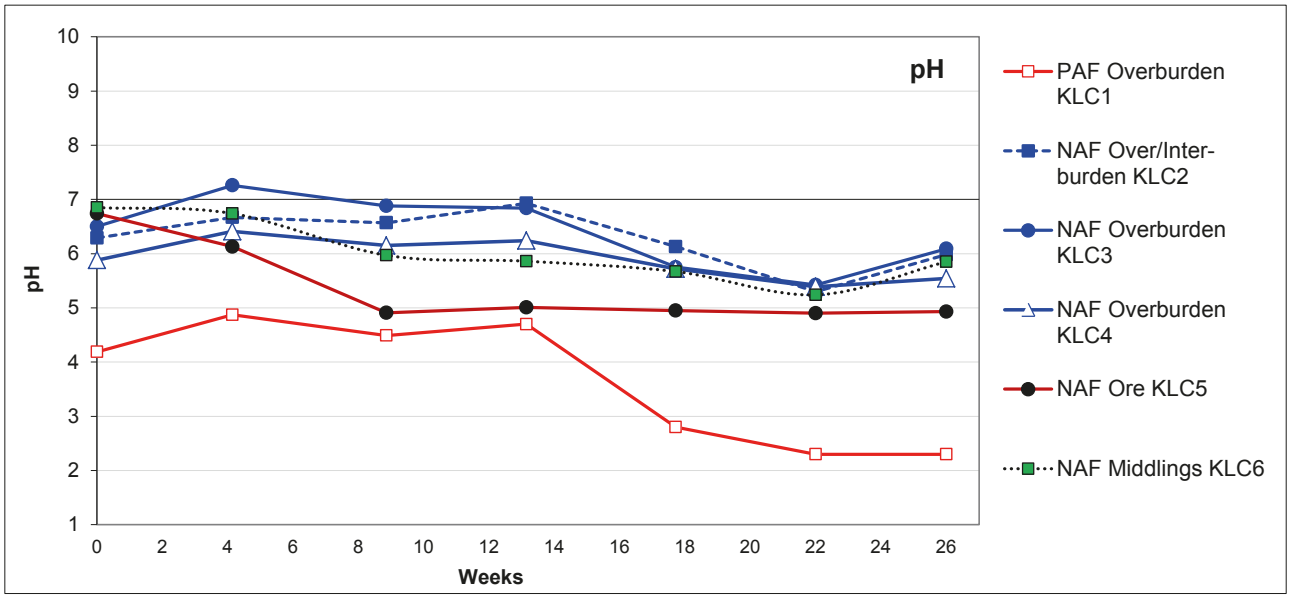
< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

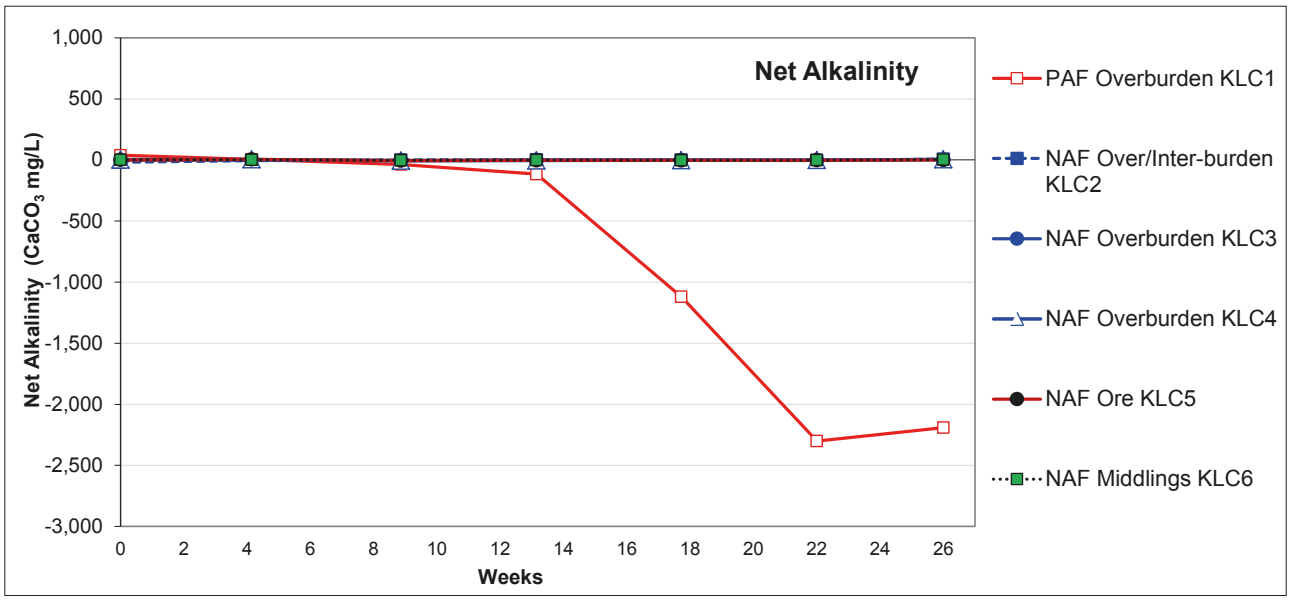
** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

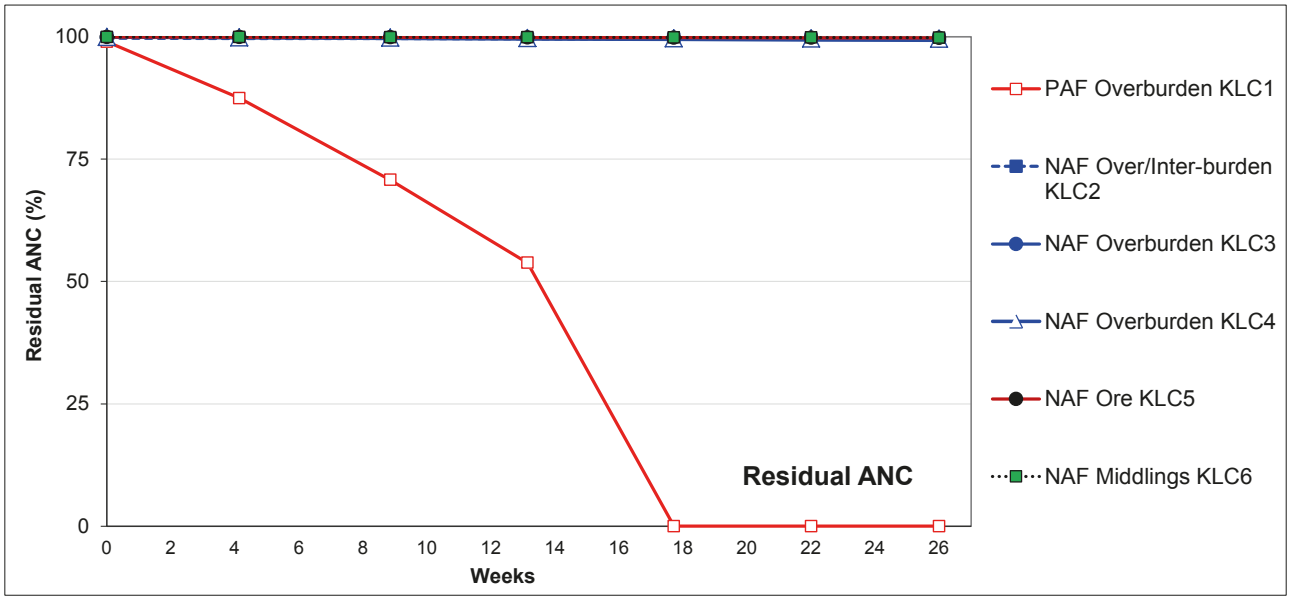
Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity

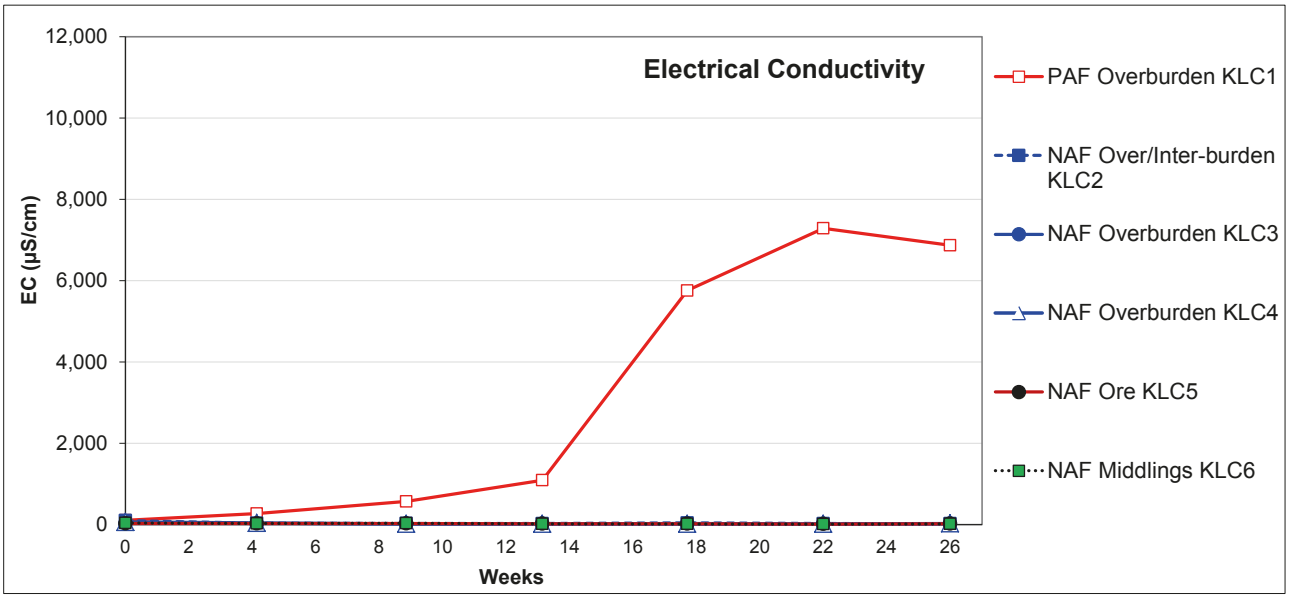
MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential

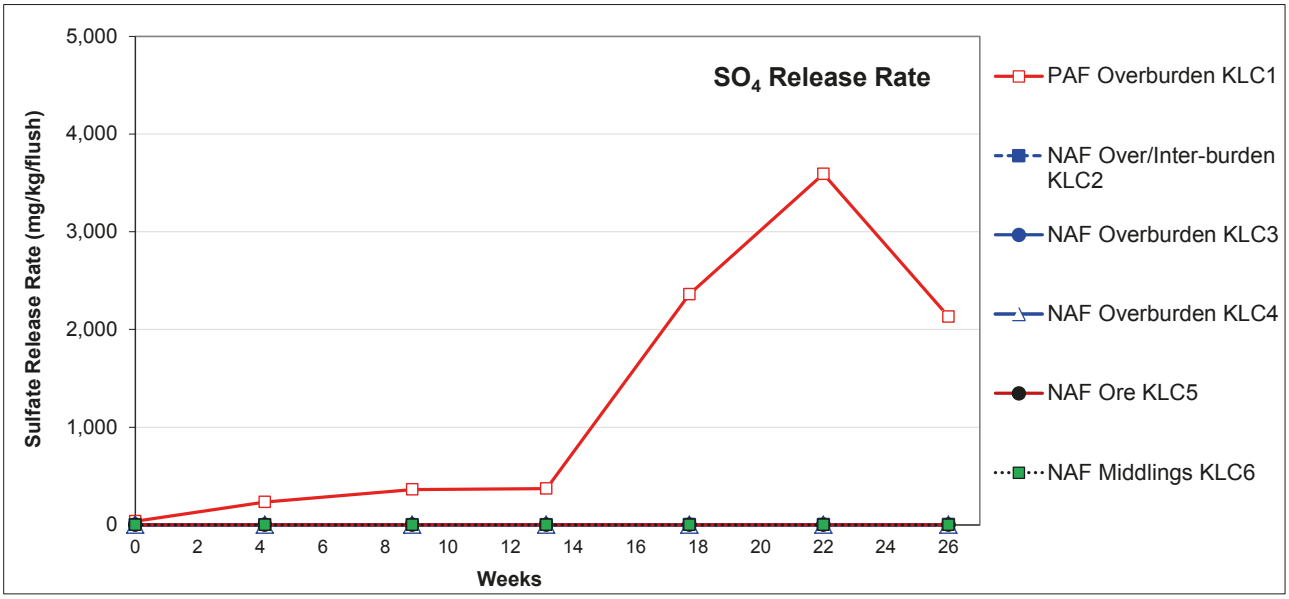
ANZECC & ARCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water (low risk trigger levels).

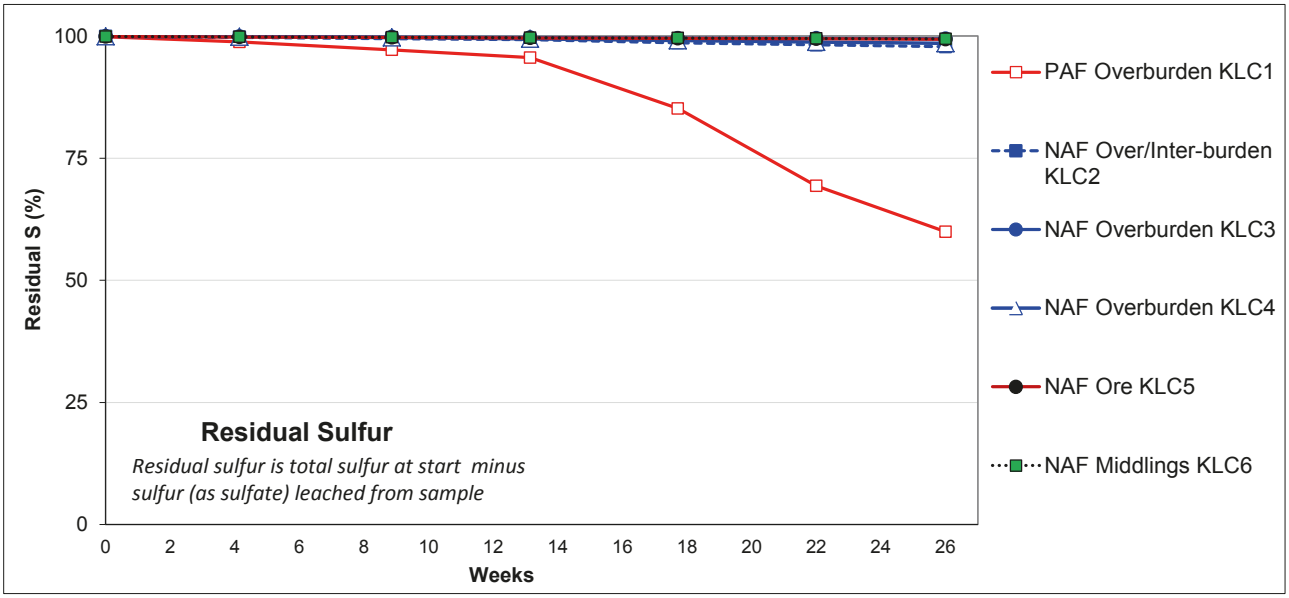

pH
pH
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

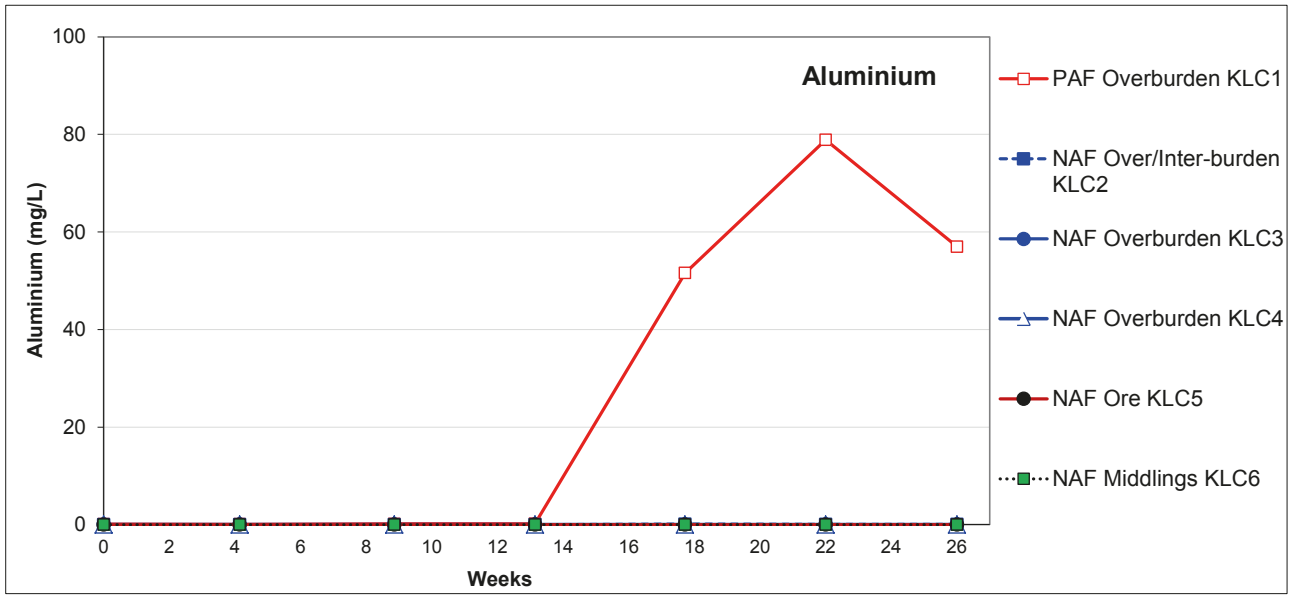

Net Alkalinity
Net Alkalinity (CaCO3 mg/L)
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

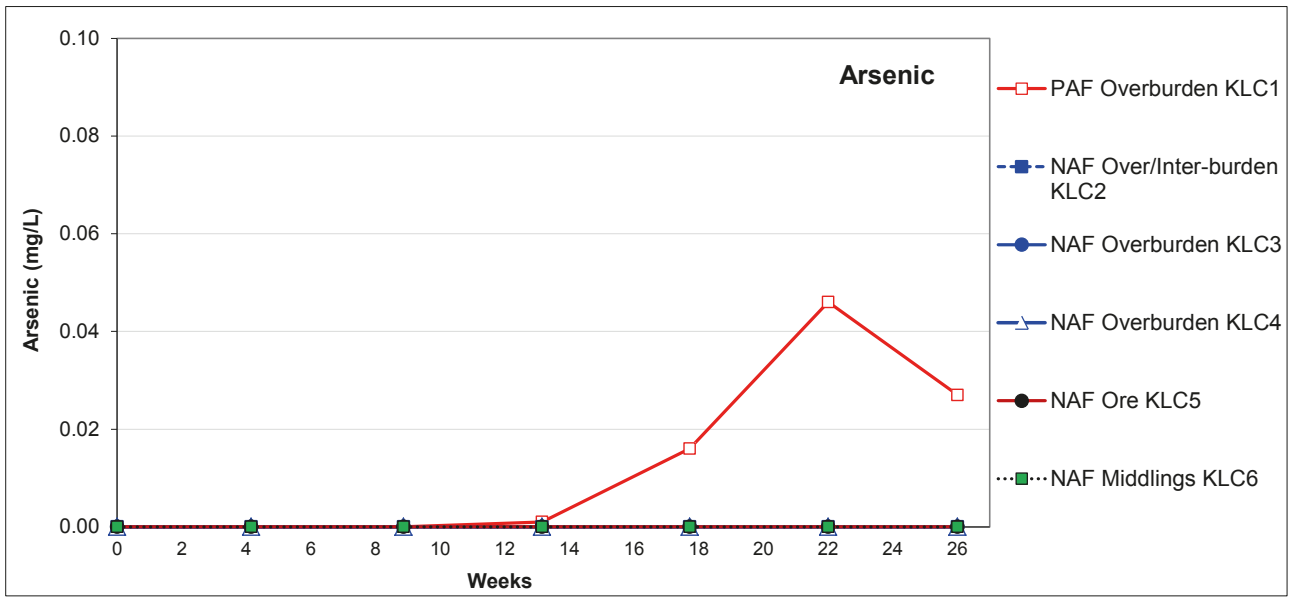

Residual ANC
Residual ANC (%)
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

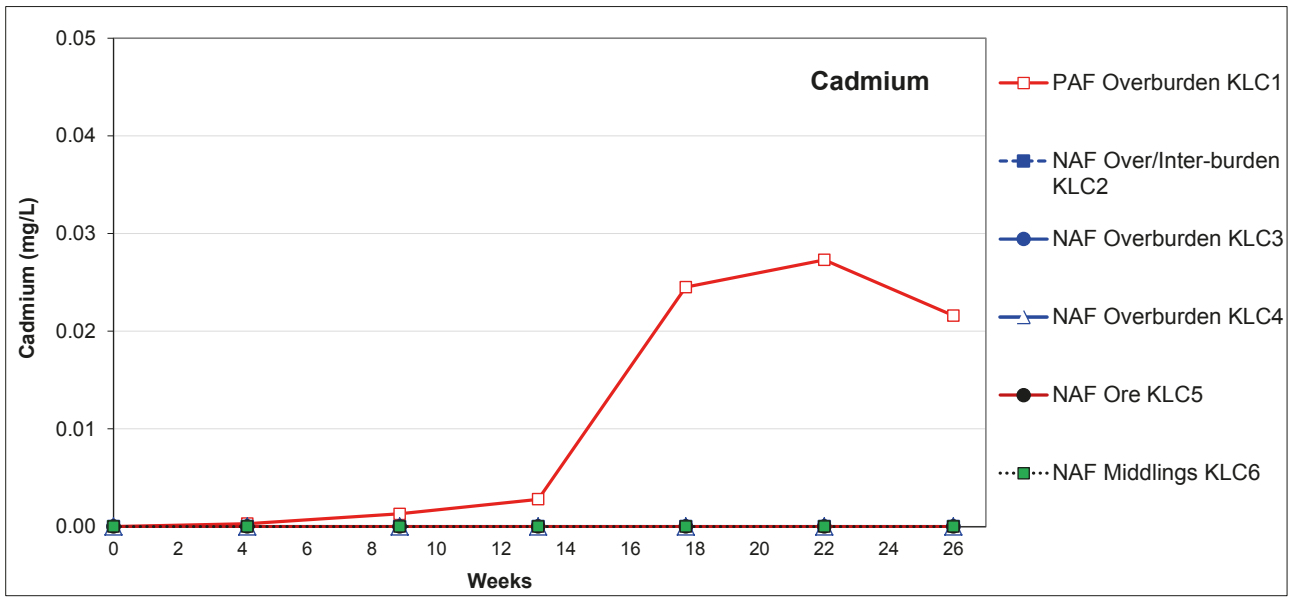

Electrical Conductivity
EC (µS/cm)
12,000
10,000
8,000
6,000
4,000
2,000
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

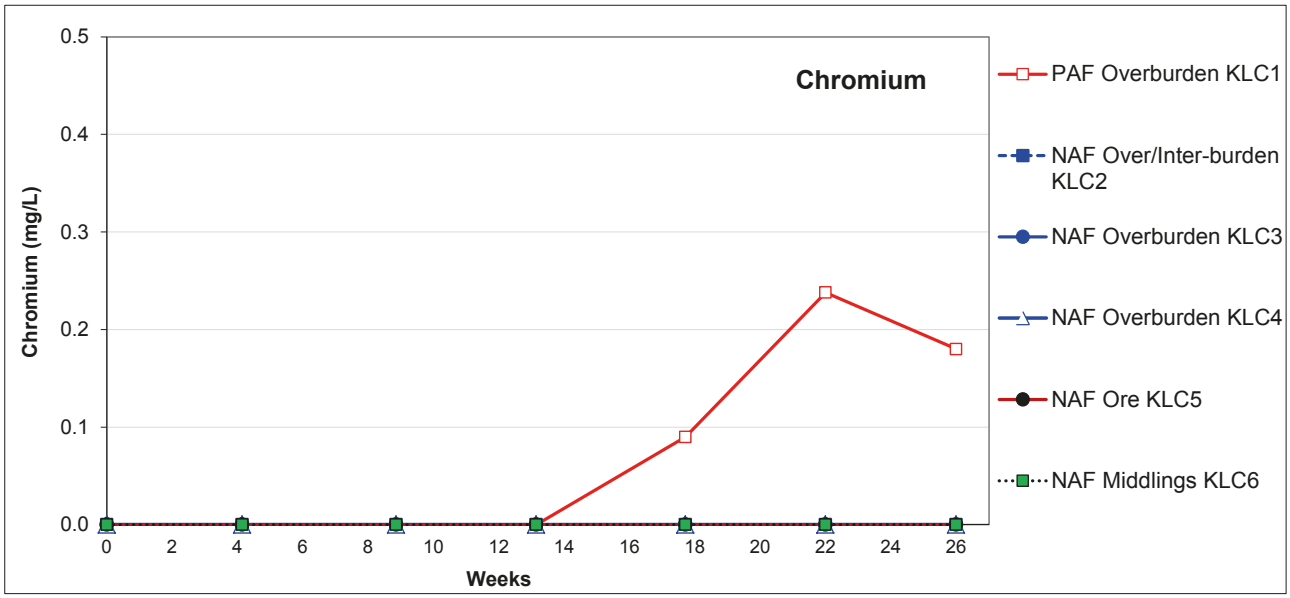

SO_4 Release Rate
Sulfate Release Rate (mg/kg/flush)
5,000
4,000
3,000
2,000
1,000
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

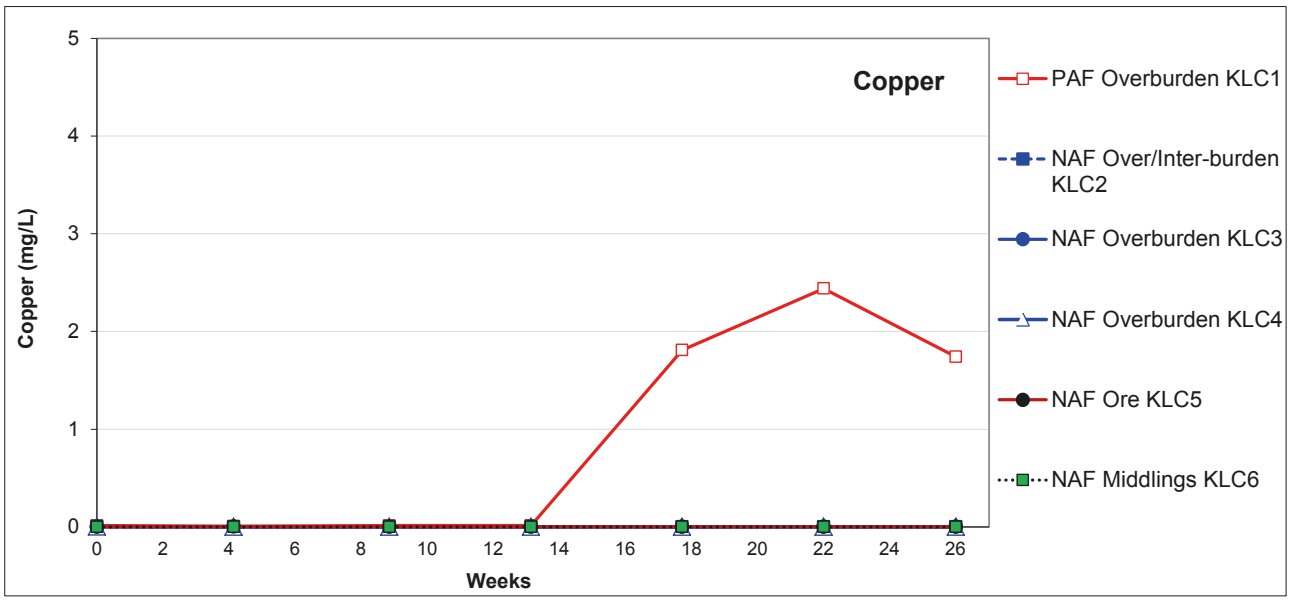

Residual Sulfur
Residual sulfur is total sulfur at start minus sulfur (as sulfate) leached from sample
Residual S (%)
100
75
50
25
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

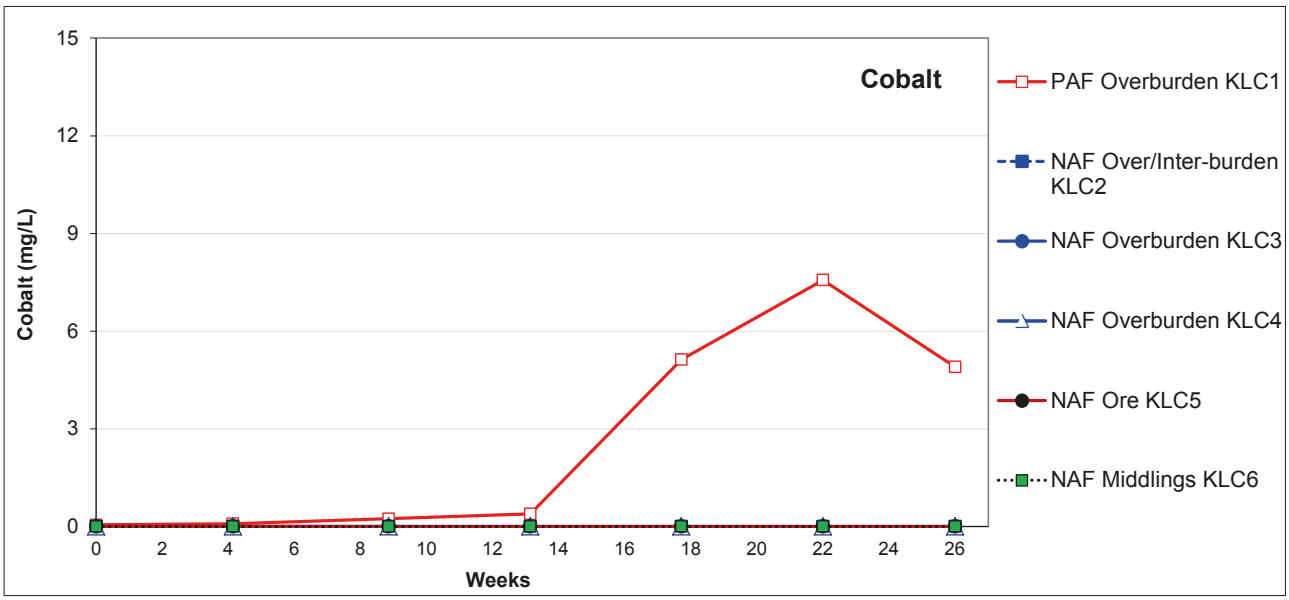

Aluminium
Aluminium (mg/L)
100
80
60
40
20
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

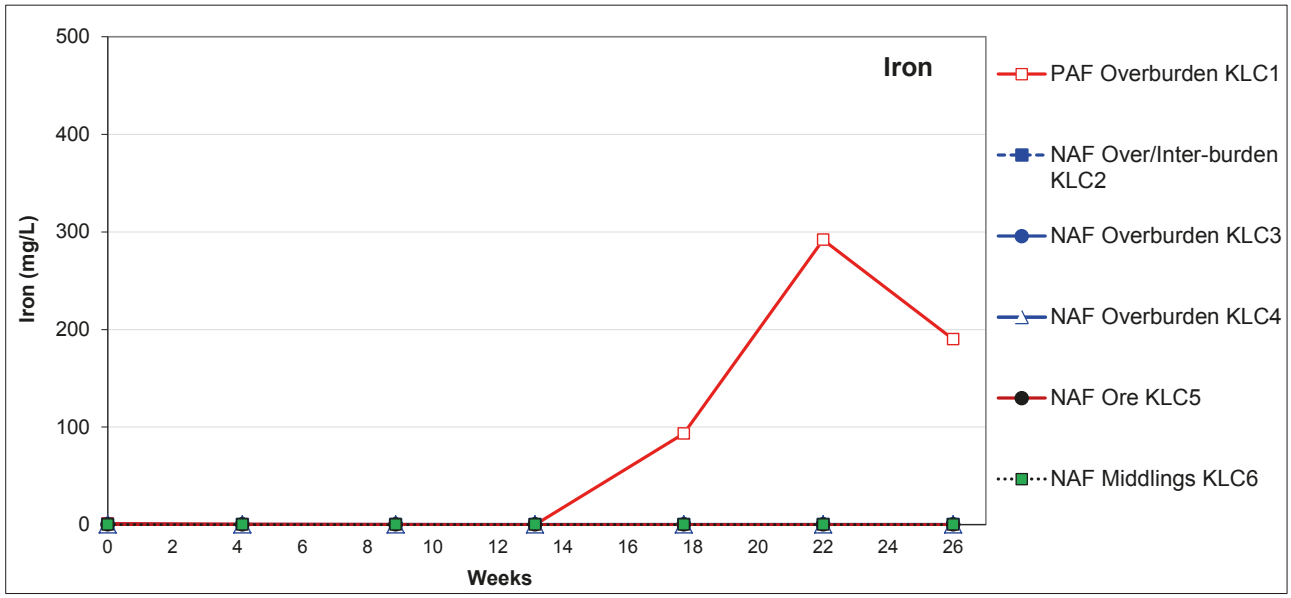

Arsenic
Arsenic (mg/L)
0.10
0.08
0.06
0.04
0.02
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

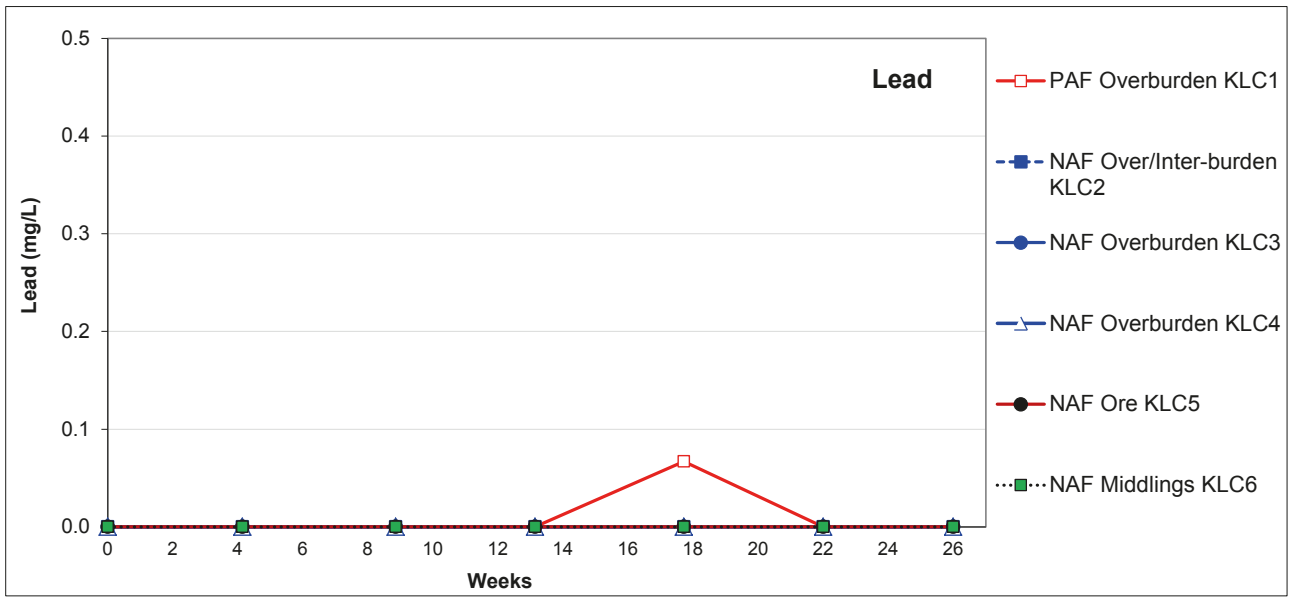

Cadmium
Cadmium (mg/L)
0.05
0.04
0.03
0.02
0.01
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

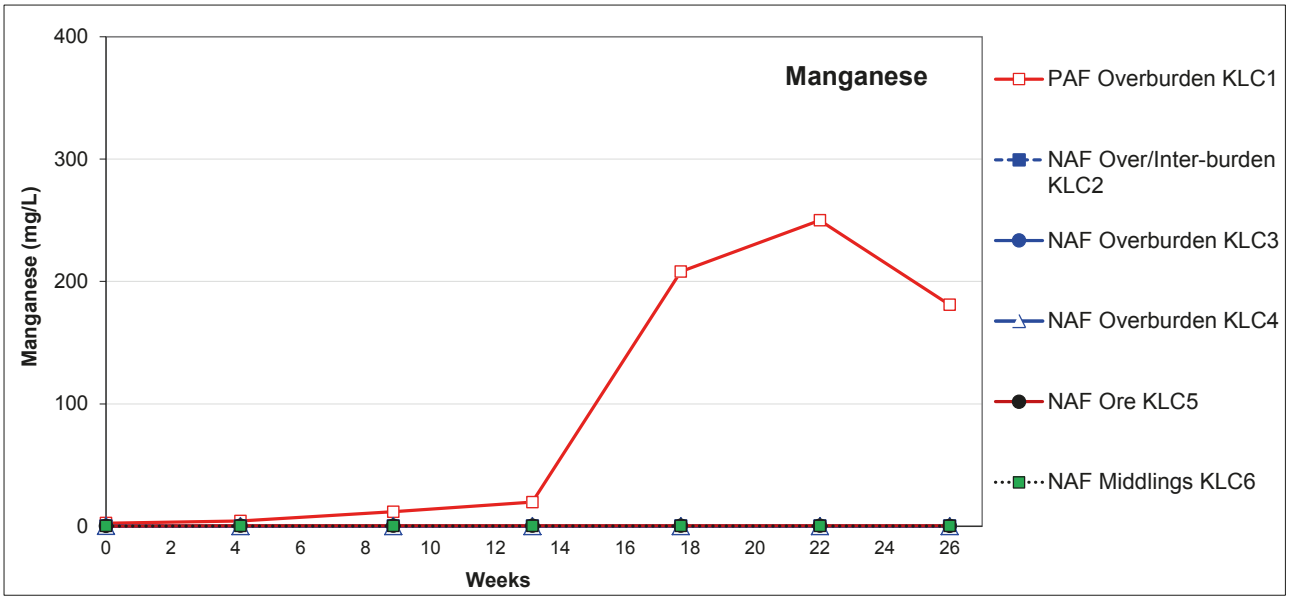

Chromium
Chromium (mg/L)
0.5
0.4
0.3
0.2
0.1
0.0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

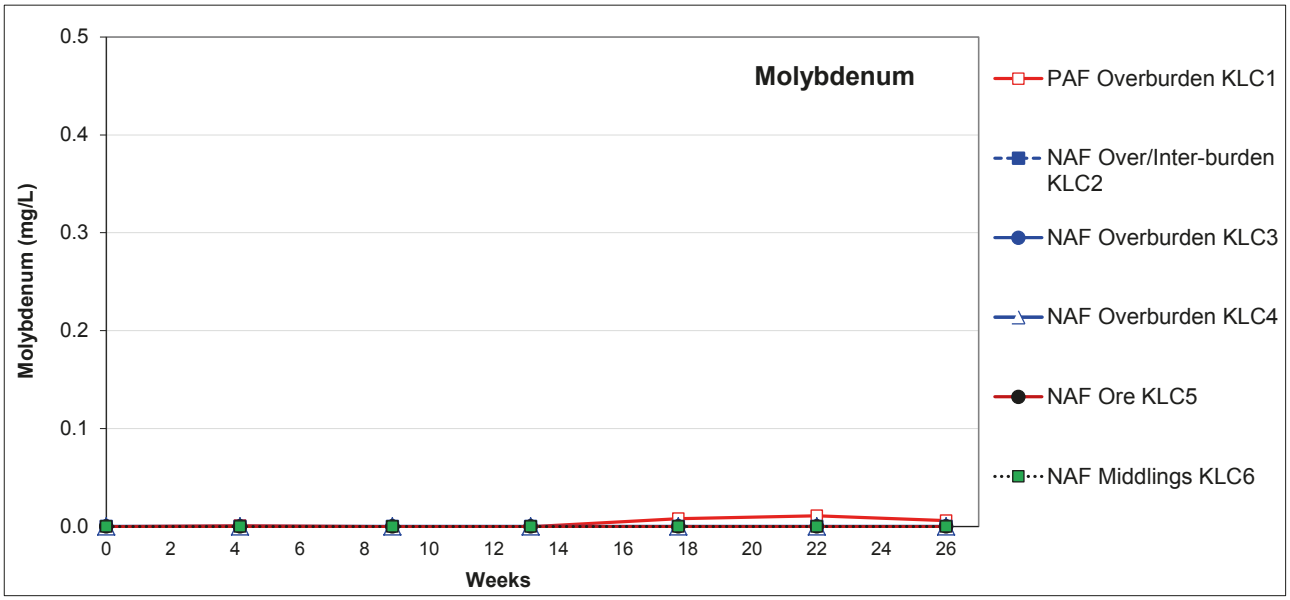

Copper
Copper (mg/L)
5
4
3
2
1
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

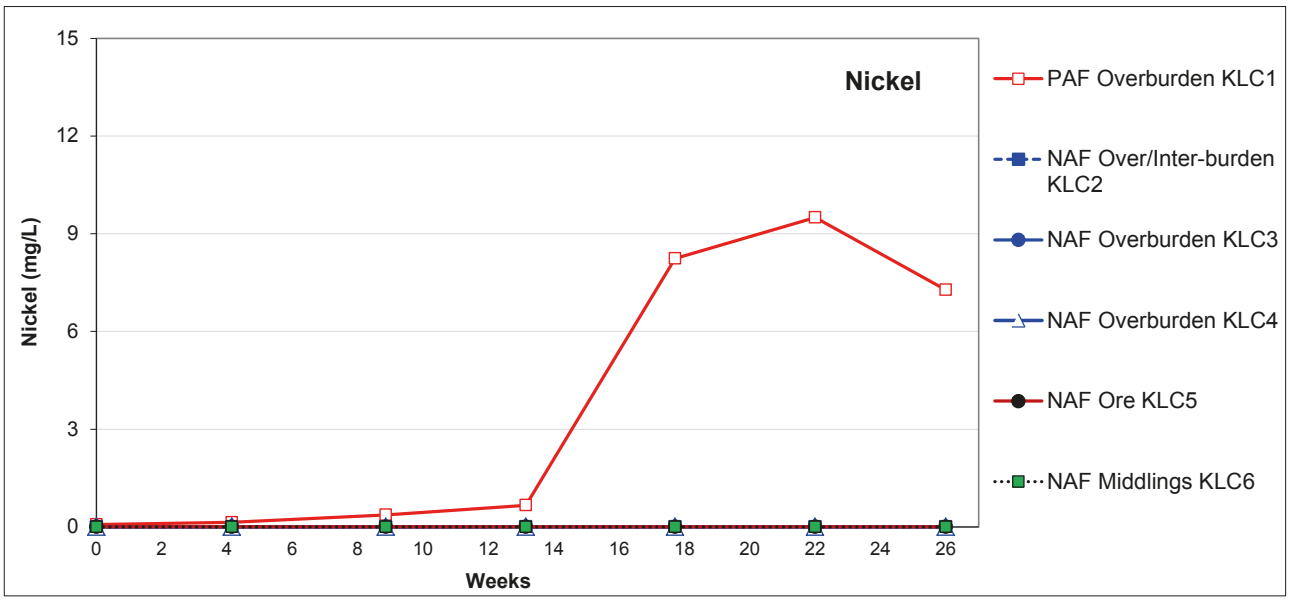

Cobalt
Cobalt (mg/L)
15
12
9
6
3
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

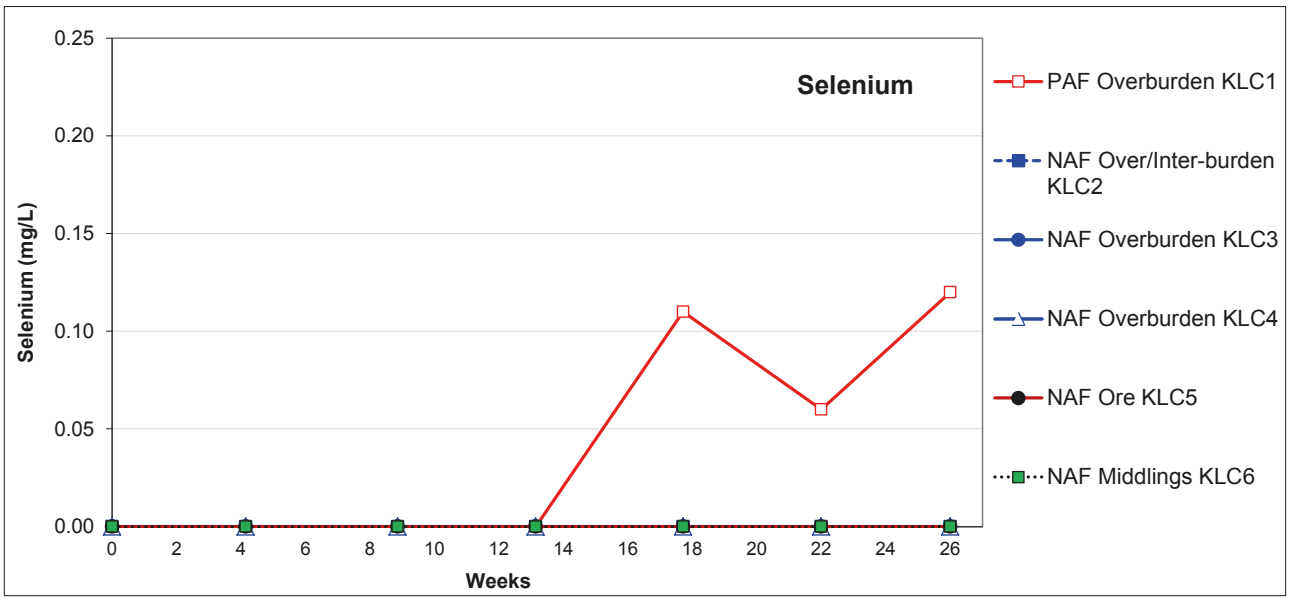

Iron
Iron (mg/L)
500
400
300
200
100
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6

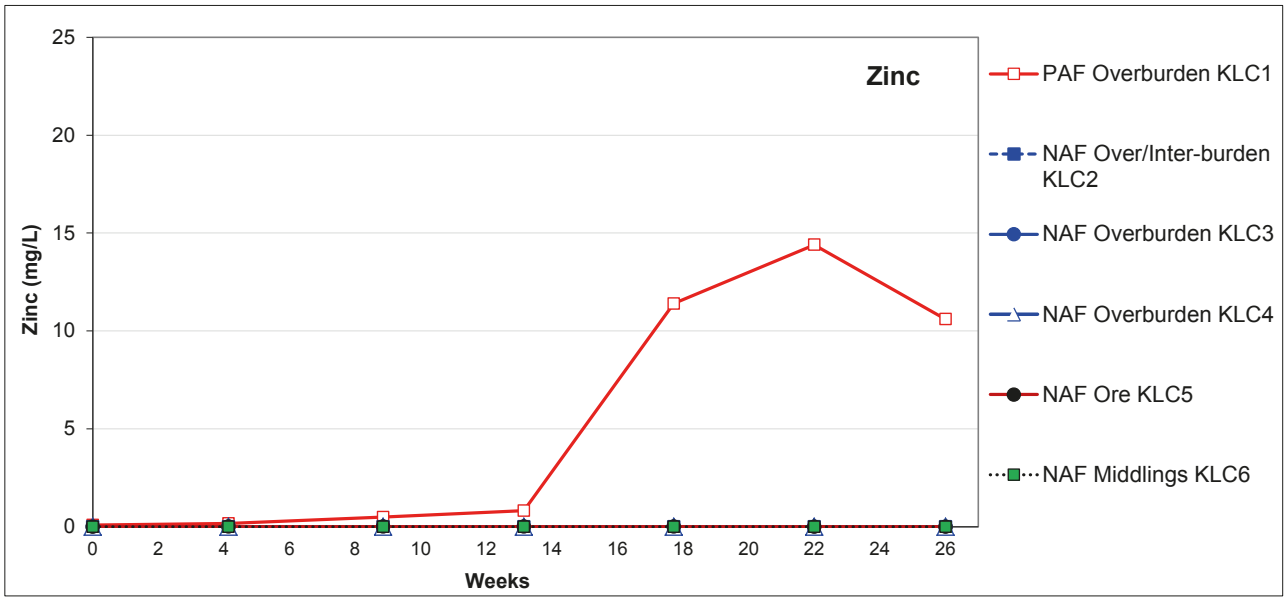

Lead
Lead (mg/L)
0.5
0.4
0.3
0.2
0.1
0.0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6


Manganese
Manganese (mg/L)
400
300
200
100
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6


Molybdenum
Molybdenum (mg/L)
0.5
0.4
0.3
0.2
0.1
0.0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6


Nickel
Nickel (mg/L)
15
12
9
6
3
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6


Selenium
Selenium (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Weeks
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6


Zinc
Zinc (mg/L)
Weeks
0
5
10
15
20
25
0
2
4
6
8
10
12
14
16
18
20
22
24
26
PAF Overburden KLC1
NAF Over/Inter-burden KLC2
NAF Overburden KLC3
NAF Overburden KLC4
NAF Ore KLC5
NAF Middlings KLC6