Gemini Project

Geochemical Assessment of Mining Waste Materials

Report prepared for:

Magnetic South Pty Ltd

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LEADERS IN MINING GEOCHEMISTRY

EXECUTIVE SUMMARY

ES1 Background

Magnetic South Pty Ltd (Magnetic South) is the project proponent and the applicant for Mining Lease (ML) and Environmental Authority (EA) to develop the Gemini Coal Project (the Project), a greenfield open cut mine to produce pulverised coal injection (PCI) coal and Coking Coal products for export for steel production. The Project term is anticipated to be 25 years from grant of the ML with this term including initial construction, mine operation and rehabilitation activities.

The Project is located on EPC 881 in the Bowen Basin, Central Queensland. Located 20 km east of Bluff and 6 km west of Dingo, the tenement straddles the Capricorn Highway and the Blackwater-Gladstone rail network (**Figure 1**, **Attachment A**).

The main activities associated with the Project that are related to mining waste geochemistry include:

- Exploration activities continuing in order to support mine planning.
- Construction and operation of a Coal Handling Preparation Plant (CHPP) and coal handling facilities adjacent to the MIA (including Run-of-Mine (ROM) coal, product stockpiles and reject stockpiles [coarse and fine rejects]).
- Development and mining of mine areas (open cut pits) and out-of-pit spoil emplacements.
- Progressive placement of spoil (overburden/interburden) in:
  - Emplacements, adjacent to and near the open cut voids.
  - Mine voids, behind the advancing open cut mining operations.
- Progressive rehabilitation of waste rock emplacement areas and mined voids.
- Progressive establishment of soil stockpiles, laydown area and borrow pits (for road base and civil works). Material will be sourced from local quarries where required.
- Disposal of CHPP rejects (coarse and fine rejects) in out of pit waste rock emplacements, and in-pit behind the mining void.

Existing local and regional infrastructure, facilities and services will be used to support Project activities. These include the SunWater water distribution network, the Aurizon rail network, Ergon's electricity network, the Capricorn Highway, and Gladstone export coal terminals.

The proposed mine will target the Rangal coal measures. Up to seven seams/plies are targeted, ranging in thickness from 0.5 m to 3.0 m. The seams are impacted by faulting and seam splitting and are typically overlain by overburden ranging in depth from 45 m to 60 m.

As the mine is planned to be an open cut mine, there will be spoil generated from removal of the overburden and interburden to access to the target coal seams. This spoil will report to the overburden emplacement facility and therefore needs to be geochemically characterised. Similarly, coal and coal reject (coarse reject and tailings) likely to be generated from washing of the target coal seams at the CHPP may also report to surface storage facilities and needs to be geochemically characterised, although the geochemical characterisation of coal reject materials is the subject of a separate report (RGS, 2019).

ES2 Scope of Work

As part of the technical studies being completed for input into the environmental approvals process for the Project, RGS Environmental Pty Ltd (RGS) was commissioned by Magnetic South to complete a geochemical assessment of mining waste (overburden and interburden) materials at the Project.

The objective of the scope of work was to complete a geochemical assessment of representative samples of mining waste materials in accordance with relevant legislation, guidelines and policies and with a level of rigour consistent with the Queensland EIS approvals process. The scope of work included:

- Review of available geochemical and geological data and drill hole database (including plans, drill hole logs and drill core photographs) associated with the Project;
- Design of a geochemical assessment program, including sampling for and testing of representative overburden and potential coal reject materials within the Project boundary. The program utilised exploration drill core/drill chip samples from drilling programs;
- Coordination of the material sampling and geochemical characterisation programs;
- Geochemical characterisation of overburden from the proposed open pit area and potential coal reject material from strata in and around the target seams;
- Development of any necessary environmental management measures related to overburden and potential coal reject emplacement and rehabilitation; and
- Preparation of a Geochemical Assessment Report based on existing information, sample analyses and discussion regarding any acid and metalliferous drainage (AMD) potential or other salinity and sodicity issues related to the Project.

The outcome of completion of the above scope of work is this stand-alone technical report (suitable for inclusion as an appendix to the regulatory approvals documentation), which provides an overview of the proposed Project; a description of the sampling and geochemical testing methodology; presentation and discussion of the results and findings; and develops conclusions and recommendations.

ES3 Methodology

The sampling strategy and subsequent geochemical characterisation strategy for mining waste materials from the proposed Project was guided by Australian (DME, 1995, DEHP, 2013; and COA, 2016) and international (INAP, 2009) technical guidelines for the geochemical assessment of mining wastes. The more recent guidelines favour a risk-based approach to determine the sampling frequency at a proposed mining operation. The sampling strategy at the Project identified representative (fresh drill core/drill chip) samples of mining waste materials from the exploration drilling program.

The results of the sampling and geochemical testing program provided important information to assist with the planning and management of operational and mine closure issues. In particular, the characterisation of mine waste materials potentially intended for use in mine rehabilitation activities was completed so that the geochemical characteristics of these materials were sufficiently well understood to ensure performance according to operational and mine closure planning expectations.

A total of 70 mining waste samples were collected from three drill holes at the proposed Project. The samples represented the main overburden, interburden and potential coal reject materials likely to be encountered during development at the proposed Project from surface down through the stratigraphic profile (including economic and uneconomic coal seams) to the base of the open pit.

The number of samples was selected to provide a good statistical representation of the amount and types of mining waste materials expected to be generated at the Project, whilst accounting for the risk profile indicated from the geology at the Project and a working knowledge of the Rangal Coal Measures.

A range of static and kinetic geochemical tests were completed on the samples. The geochemical tests were used to assess the presence and degree of risk from oxidation of reactive sulfides, potential for acid generation, and leaching of soluble metals/metalloids and salts. The assessment also included some characterisation of chemical parameters related to sodicity and material stability.

ES4 Conclusions

The main findings of the geochemical assessment are as follows:

- All of the mining waste samples tested are Non-Acid Forming (NAF), have excess Acid Neutralising Capacity (ANC) and typically have low sulfur content. The sulfur content of coal and carbonaceous siltstone can be elevated compared to typical background concentrations, but is mainly present in a non-sulfidic form, which does not contribute to acid generation. Overall, these materials have a low risk of acid generation and a high factor of safety with respect to potential for AMD.
- Initial and ongoing surface runoff and seepage from mining waste materials is expected to be moderately alkaline and have a moderate level of salinity.
- Kinetic leach column (KLC) test results indicate that mining waste materials are unlikely to generate acid conditions and are more likely to generate pH neutral to alkaline conditions.
- Metal/metalloid enrichment in mining wastes, compared to median crustal abundance in unmineralised soils, is limited to cobalt in a single carbonaceous siltstone sample. The nature of a coal deposit means some metals/metalloids are expected to be slightly elevated in some materials.
- Most metals/metalloids are sparingly soluble at the neutral to alkaline pH of leachate expected from bulk mining waste materials. Dissolved metal/metalloid concentrations in surface runoff and leachate from bulk mining waste materials are therefore expected to be low and unlikely to pose a significant risk to the quality of surface and groundwater resources at relevant storage facilities.
- Mining waste materials should be amenable to revegetation as part of rehabilitation activities, although, gypsum and fertiliser addition may need to be considered for sodic materials to limit dispersion and erosion and to provide a reasonable growth medium for revegetation and rehabilitation.
- As most mining materials appear to be susceptible to dispersion and erosion, additional testing including field trials, may be needed when the mine is operational and bulk materials are being generated. Such tests would help to determine the most appropriate management option for progressive rehabilitation of these materials during operations at mine closure.

ES5 Recommendations

As a result of the geochemical assessment work completed on mining waste materials at the Project, a number of recommendations are provided for these materials to minimise the risk of any significant environmental harm to the immediate and downstream environment.

- Placement of any carbonaceous mining waste material encountered during mining at the surface and outer batters of spoil emplacement areas should be avoided.
- Additional overburden/interburden testing and rehabilitation field trials should be completed during operations when bulk materials become available to confirm the most appropriate management option for progressive rehabilitation of these materials during operations and at mine closure.
- Surface water and seepage from the proposed mining and mining waste storage areas should be monitored to ensure that key water quality parameters remain within appropriate criteria. Water quality monitoring parameters should include pH, EC, total suspended solids (TSS) on a quarterly basis and the suite of water quality analyses described in **Table B4** (**Attachment B**) of this report opportunistically and at least on an annual basis.

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GLOSSARY OF TERMS AND ACRONYMS

Acidity	A measure of hydrogen ion (H+) concentration; generally expressed as pH.
Acid Base Account	Evaluation of the balance between acid generation and acid neutralisation processes. Generally determines the maximum potential acidity (MPA) and the inherent acid neutralising capacity (ANC), as defined below.
AMD	Acid and metalliferous drainage caused by exposure of sulfide minerals in mining 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.
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.
pH	Measure of the hydrogen ion (H+) activity in a sample solution, expressed in pH units.
EC	Electrical Conductivity, expressed as µS/cm.
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.
KLC test	Kinetic leach column tests are procedures used to measure the geochemical/ weathering behaviour of a sample of mine material over time.
MPA	Maximum Potential Acidity calculated by multiplying the total sulfur content of a sample by 30.6 (stoichiometric factor) and expressed as kg H_2SO_4 per tonne.
NAF	Non-acid forming. 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. Calculated by subtracting the ANC from the MPA.
Overburden	Material that overlays a coal resource and must be removed to mine the coal.
PAF	Potentially acid forming. Geochemical classification criterion for a sample that has the potential to generate acid conditions.
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.
Total Sulfur	Total sulfur content of a sample generally measured using a 'Leco' analyser expressed as % S.
Uncertain	Geochemical classification criterion for a sample where the potential to generate acid conditions remains uncertain and may require further analysis.

1.0 INTRODUCTION

1.1 Project Description

Magnetic South Pty Ltd (Magnetic South) is the project proponent and the applicant for Mining Lease (ML) and Environmental Authority (EA) to develop the Gemini Project (the Project), a greenfield open cut mine to produce pulverised coal injection (PCI) coal and Coking Coal products for export for steel production. The Project term is anticipated to be 25 years from grant of the ML with this term including initial construction, mine operation and rehabilitation activities.

The Project is located on EPC 881 in the Bowen Basin, Central Queensland. Located 20 km east of Bluff and 6 km west of Dingo, the tenement straddles the Capricorn Highway and the Blackwater-Gladstone rail network (**Figure 1**, **Attachment A**).

The main activities associated with the Project include:

- Exploration activities continuing in order to support mine planning.
- Development of a Mine Infrastructure Area (MIA) including mine offices, bathhouse, crib rooms, warehouse/stores, workshop, fuel storage, refuelling facilities, explosives magazine and sewage, effluent and liquid waste storage.
- Construction and operation of a Coal Handling Preparation Plant (CHPP) and coal handling facilities adjacent to the MIA (including Run-of-Mine (ROM) coal, product stockpiles and reject stockpiles [coarse and fine rejects]).
- Construction and operation of a surface conveyor from the product stockpiles to a Train Load Out (TLO) facility and rail loop connecting to the Blackwater-Gladstone Branch Rail to transport product coal to coal terminals at Gladstone for export.
- Construction of access roads from the Capricorn Highway to the MIA, and to the TLO facility.
- Installation of a raw water supply pipeline to connect to the Blackwater Pipeline network.
- Construction of a 66 kV transmission line and switching/substation to connect to the existing regional network.
- Other associated minor infrastructure, plant, equipment and activities.
- Development of mine areas (open cut pits) and out-of-pit waste rock emplacements.
- Drilling and blasting of competent waste material.
- Mine operations using conventional surface mining equipment (excavators, front end loaders, rear dump trucks, dozers).
- Mining up to 1.9 Mtpa ROM Coal – average 1.8 Mtpa for an operational mine life of approximately 20 years.
- Progressive placement of waste rock (overburden/interburden) in:
  - Emplacements, adjacent to and near the open cut voids.
  - Mine voids, behind the advancing open cut mining operations.
- Progressive rehabilitation of waste rock emplacement areas and mined voids.
- Progressive establishment of soil stockpiles, laydown area and borrow pits (for road base and civil works). Material will be sourced from local quarries where required.

- Disposal of CHPP rejects (coarse and fine rejects) in out of pit waste rock emplacements, and in-pit behind the mining void.
- Progressive development of internal roads and haul roads including a causeway over Charlevue Creek to enable coal haulage and pit access.
- Development of water storage dams and sediment dams, and the installation of pumps, pipelines, and other water management equipment and structures including temporary levees, diversions and drains.

Existing local and regional infrastructure, facilities and services will be used to support Project activities. These include the SunWater water distribution network, the Aurizon rail network, Ergon's electricity network, the Capricorn Highway, and Gladstone export coal terminals.

The proposed mine will target the Rangal coal measures. Up to seven seams/plies are targeted, ranging in thickness from 0.5 m to 3.0 m. The seams are impacted by faulting and seam splitting and are typically overlain by overburden ranging in depth from 45 m to 60 m.

As the mine is planned to be an open cut mine, there will be spoil generated from removal of the overburden and interburden to access to the target coal seams. This spoil will report to the overburden emplacement facility and therefore needs to be geochemically characterised. Similarly, coal and coal reject (coarse reject and tailings) likely to be generated from washing of the target coal seams at the CHPP may also report to surface storage facilities and needs to be geochemically characterised, although the geochemical characteristics of coal reject materials are the subject of a separate report (RGS, 2019).

1.2 Scope of Work

As part of the technical studies being completed for input into the environmental approvals process for the Project, RGS Environmental Pty Ltd (RGS) was commissioned by Magnetic South to complete a geochemical assessment of mining waste (overburden and interburden) materials at the Project.

The scope of work is based upon that described in RGS Proposal No. 2017002, dated 17th January, 2017 (RGS, 2017a). The objective of the scope of work was to complete a geochemical assessment of representative samples of mining waste materials in accordance with relevant legislation, guidelines and policies and with a level of rigour consistent with the Queensland EIS approvals process.

The scope of work included:

- Review of available geochemical and geological data and drill hole database (including plans, drill hole logs and drill core photographs) associated with the Project;
- Design of a geochemical assessment program, including sampling for and testing of representative overburden and potential coal reject materials within the Project boundary. The program utilised exploration drill core/drill chip samples from drilling programs;
- Coordination of the material sampling and geochemical characterisation programs;
- Geochemical characterisation of overburden from the proposed open pit area and potential coal reject material from strata in and around the target seams;
- Development of any necessary environmental management measures related to overburden and potential coal reject emplacement and rehabilitation; and
- Preparation of a Geochemical Assessment Report based on existing information, sample analyses and discussion regarding any acid and metalliferous drainage (AMD) potential or other salinity and sodicity issues related to the Project.

The outcome of completion of the scope of work is this stand-alone technical report (suitable for inclusion as an appendix to the regulatory approvals documentation), which provides an overview of the proposed

Project; a description of the sampling and geochemical testing methodology; presentation and discussion of the results and findings; and develops conclusions and recommendations.

The focus of this report is the acquisition and interpretation of the results of a static geochemical testing program of mining waste materials and the report also evaluates the results of a subsequent six-month kinetic geochemical testing program.

2.0 REGIONAL AND LOCAL GEOLOGY

2.1 Resource Description

The Project is located in one of the principal geological structural units of the Bowen Basin, the Dawson Fold Zone, which overlays part of the western extent of the Taroom Trough. The area comprises sediments from the Rewan, Rangal, Burngrove and Fairhill Formations, and is bound in the west by the Yarrabee Fault.

The Project contains the Aries, Castor, Pollux, Orion and Pisces Seams of the Rangal Coal Measures. A representation of the typical stratigraphic profile in the Project area is provided in **Figure A2** (**Attachment A**). The Rangal Coal Measures conformably overlie the Burngrove Formation and consist primarily of siltstones, sandstones and coal seams. The sediments are consistent with a deltaic depositional environment.

The Rangal coal seams form the dominant resource across several areas of the central Bowen Basin. The Aries, Castor and Pollux seams are minable entities at most of the local mines in the Blackwater area and commonly coalesce and split from each other. These relationships are controlled structurally by differential subsidence in different areas during deposition.

Recoverable coal will come from the Rangal coal seams but may also target the Upper Burngrove formation. The Burngrove Formation contains several coal seams and is generally considered of lesser importance due to moderate to high ash levels. It is possible that some seams may have potential to produce domestic or export thermal products, depending on wash plant density cut points and acceptable yields.

The relatively shallow depth of the targeted seams and the cumulative thickness of 3.5 to 4.5 m from the Pollux and overlying seams make the Gemini area suitable for open cut mining.

3.0 METHODOLOGY

3.1 Material Sampling

The sampling strategy and subsequent geochemical characterisation strategy for overburden and potential coal reject materials from the proposed Project was guided by Australian (DME, 1995, DEHP, 2013; and COA, 2016) and international (INAP, 2009) technical guidelines for the geochemical assessment of mining wastes. The more recent guidelines favour a risk-based approach to determine the sampling frequency at a proposed mining operation. The sampling strategy at the Gemini Project identified and collected representative (fresh drill core/drill chip) samples of overburden and potential coal reject materials from the exploration drilling program.

The results of the sampling and geochemical testing program provided important information to assist with the planning and management of operational and mine closure issues. In particular, characterisation of overburden materials potentially intended for use in mine rehabilitation activities was completed so that the geochemical characteristics of these materials were sufficiently well understood to ensure performance according to operational and mine closure planning expectations.

A total of 70 waste rock samples were collected from three drill holes at the proposed Project (DW7002, DW7003 and DW7012). The location of the drill holes used for drill core/drill chip sampling and geochemical testing with respect to the proposed open pit areas is provided in **Figure A3 (Attachment A).**

The samples represented the main overburden, interburden, potential coal reject materials likely to be encountered during development at the proposed Project from surface down through the stratigraphic profile (including economic and uneconomic coal seams) to the base of the open pit. The number of samples was selected to provide a good statistical representation of the amount and types of mining waste materials expected to be generated at the Project, whilst accounting for the risk profile indicated from the geology at the Project and a working knowledge of the Rangal Coal Measures. The samples were collected by JC Irvine Pty Ltd geological personnel (with some guidance from RGS), who also dispatched the samples to ALS Environmental Brisbane laboratory (ALS Brisbane) for geochemical characterisation.

The maximum drill hole depth and number of samples at each hole is provided at **Table 3-1**. The samples were selected for the geochemical assessment program to reflect the occurrence and distribution of the overburden and interburden materials that occur within the open pit.

Table 3-1: Drill Hole Maximum Sample Depth and Number of Samples

Drill Hole ID	Total Depth (m)	Number of Samples
DW7002	158.00	22
DW7003	120.00	22
DW7012	148.00	26
	TOTAL	**70**

3.2 Geochemical Characterisation

All geochemical test work completed in this project was based on industry recognised procedures for the geochemical characterisation and assessment of mine materials (Parker and Robertson, 1999; AMIRA, 2002; INAP, 2009 and COA, 2016). A summary of those parameters involved in completing a static and kinetic geochemical characterisation and assessment of mine materials is provided in **Attachment C**.

3.2.1 Static Tests

Static geochemical tests provide a 'snapshot' of the characteristics of a sample material at a single point in time. These tests were completed to screen all samples before selecting individual samples for more detailed static test and kinetic geochemical tests.

All 70 samples received by ALS were crushed, sub-sampled and pulverised before being subjected to a series of static geochemical tests on the pulverised (<75 µm) sample fractions. The geochemical test program was coordinated by RGS personnel and designed to assess the degree of risk from potential oxidation of sulfides, acid generation, and the presence of (and leaching of) soluble metals/metalloids and salts. Each solid sample underwent static geochemical testing for:

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

Selected samples (19 samples) were also tested for:

- Sulfide (chromium reducible sulfur – Scr) [AS 4969.7-2008 method].

From the total sulfur (or Scr where available) and ANC results, maximum potential acidity (MPA) and net acid producing potential (NAPP) values were calculated. Where available, the MPA and NAPP of these samples were calculated using the Scr data instead of total sulfur data. The use of Scr data (for fresh samples) provides a more accurate representation of the MPA that could theoretically be generated, as acid generation primarily occurs from reactive sulfide, whereas total sulfur can include other sulfur forms such as elemental sulfur, sulfate and organic sulfur.

After the results of the initial static geochemical tests were received and reviewed, 10 samples of mining waste materials were selected, prepared and subjected to whole rock multi-element tests. The samples were tested for:

- Total metals/metalloids (Al, As, B, Cd, Cr, Co, Cu, Fe, P, Pb, Mn, Ni, Sb, Se and Zn) in solids [HCl and HNO_3 acid digest followed by ICP-AES/MS];
- Total cations (Ca, Mg, Na and K) [HCl and HNO_3 acid digest followed by ICP-AES];
- Soluble metals/metalloids (Al, As, B, Cd, Cr, Co, Cu, Fe, P, Pb, Mn, Mo, Ni, Sb, Se, Si, V and Zn) [ICP-AES/MS (1:5 w:v water extracts)];
- Major cations (Ca, Mg, Na and K) [ICP-AES/MS (1:5 w:v water extracts)];
- Major anions (Cl, F, and SO_4) [ICP-AES/MS and PC Titrator (1:5 w:v water extracts)];

Ten (10) individual mining waste samples were also tested for:

- Exchangeable cations [ICP-AES].

The results were then used to calculate:

- Cation Exchange Capacity (eCEC); and
- Exchangeable Sodium Percentage (ESP).

A copy of the static geochemical results received from ALS is provided in **Attachment E**.

3.2.2 Kinetic 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 samples (passing a 10mm sieve size). The KLC tests comprised composite mining samples representing the main lithological rock types likely to be generated at the proposed open pit as well as some carbonaceous material and uneconomic coal. The KLC tests were completed over a period of six months from July 2017 to January 2018, under a monthly watering and leaching cycle.

1.5 kg of each selected sample was accurately weighed and used in the KLC tests. 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 (essentially an assumed 'worst case' scenario for sulfide oxidation and potential acid/salt generation). Further details and a schematic of the KLC test arrangement are provided in **Attachment D**.

All leachate samples collected from the KLC tests were tested at ALS Brisbane for:

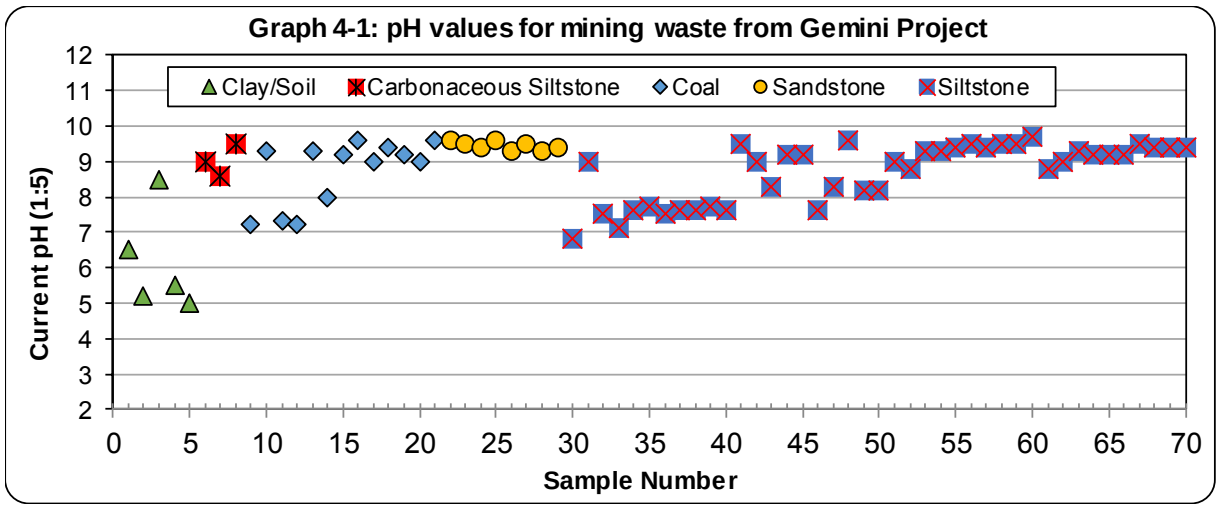
- pH and EC;
- Acidity and alkalinity [Automatic titrator];
- Dissolved metals/metalloids (Al, As, B, Cd, Cr, Co, Cu, F, Fe, Pb, Mn, Mo, Ni, Sb, Se, Si, V and Zn) [ICP-AES];
- Dissolved major cations (Ca, Mg, Na and K) [ICP-AES]; and
- Dissolved major anions (Cl, SO_4) [ICP-AES].

4.0 GEOCHEMICAL TEST RESULTS

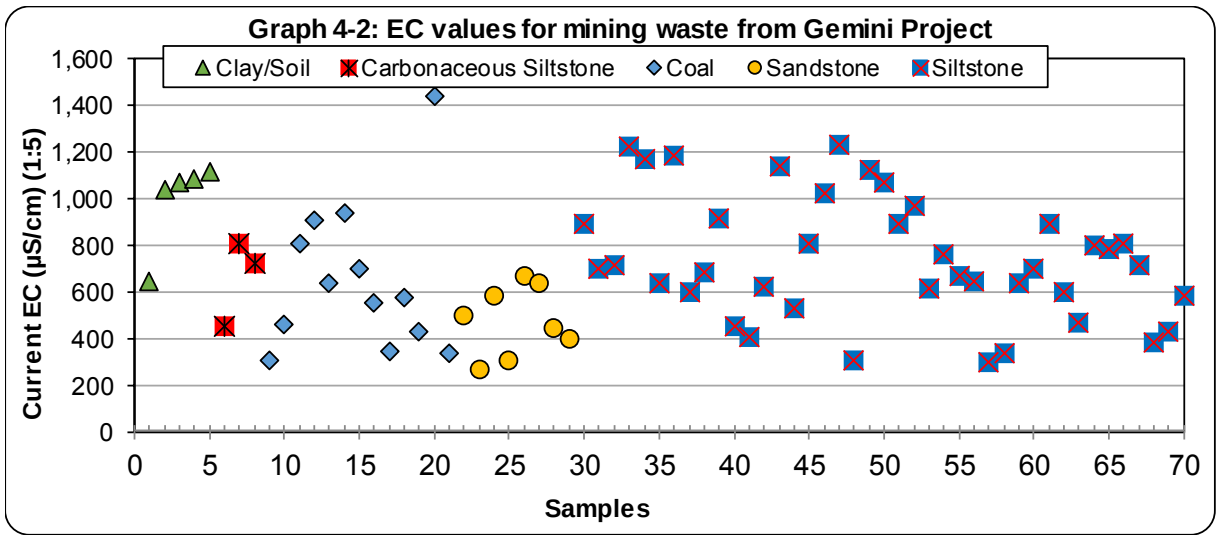
4.1 Acid Base Account

Acid Base Account results for the 70 mining waste samples from the Project are presented in **Table B1** (**Attachment B**) and summarised below. Results are shown by lithology to facilitate interpretation.

- **pH**: The $pH_{(1:5)}$ of the 70 samples across all sample types ranges from 5.0 to 9.7 and has a median value of 9.2 (**Graph 4-1**). The typical range of the deionised water used in these tests ranges from pH 5 to 6.5. The samples with the lowest pH values (pH 5.0 to 5.5) represent clay and soil material.

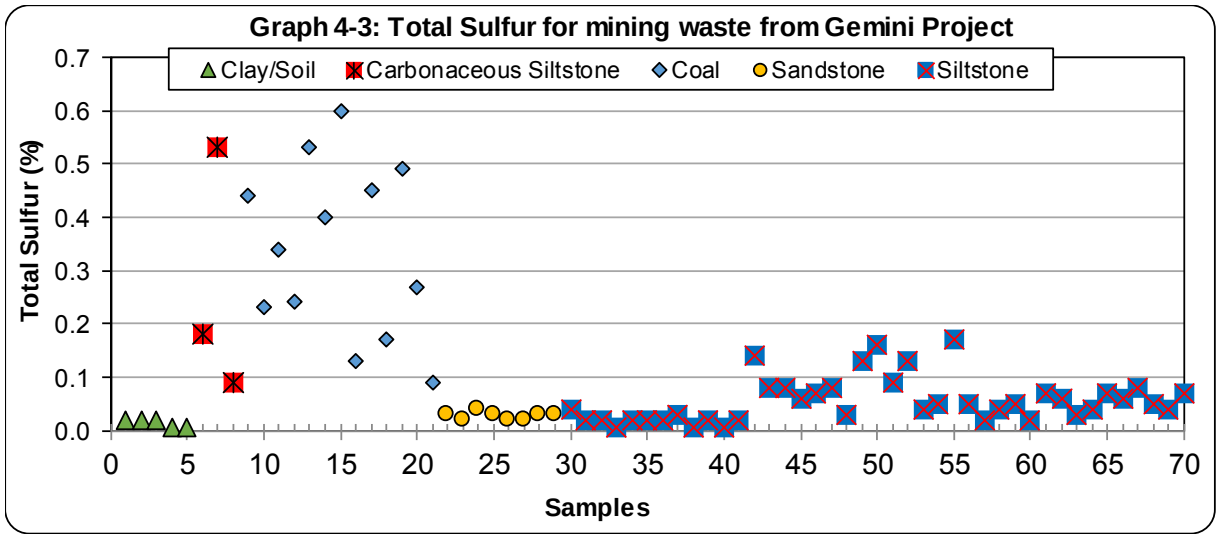


- **EC**: The current $EC_{(1:5)}$ for the 70 samples ranges from 270 to 1,440 µS/cm (**Graph 4-2**) and is typically moderate (median 646 µS/cm). The weathered material tends to have a higher EC value than the fresh material.



The pH and EC tests were completed on pulverised samples (≤ 75 µm) with a large surface area in contact with the leaching solution, thereby providing greater potential for dissolution and reaction, and represent an assumed 'worst case' scenario. It is also expected that the salinity of leachate from these low sulfur mining waste materials will diminish with time as salts are flushed from the rock matrix and a state of equilibrium develops. At that point, the salinity of seepage/runoff should stabilise at a lower asymptotic concentration relative to the weathering/erosion of the materials.

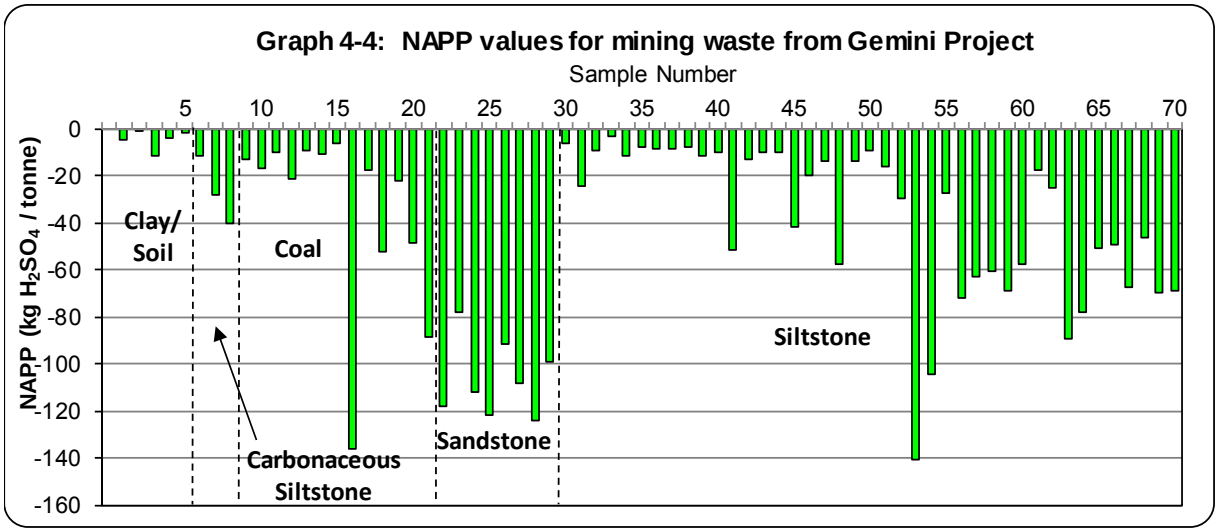
- **Sulfur**: The total sulfur content of the samples ranges from <0.01% to 0.60% (median 0.06 %S) (**Graph 4-3**). Compared to the median crustal abundance of sulfur (0.07%) (INAP, 2009) the median values of the mining waste materials is relatively low. Materials with a total sulfur content less than or equal to 0.1 % are essentially barren of sulfur, generally represent background concentrations, and have negligible capacity to generate acidity[1]. The sulfur content of carbonaceous siltstone and coal are both higher than natural background values and both lithologies show greater variation in sulfur content than the weathered material, sandstone and siltstone.



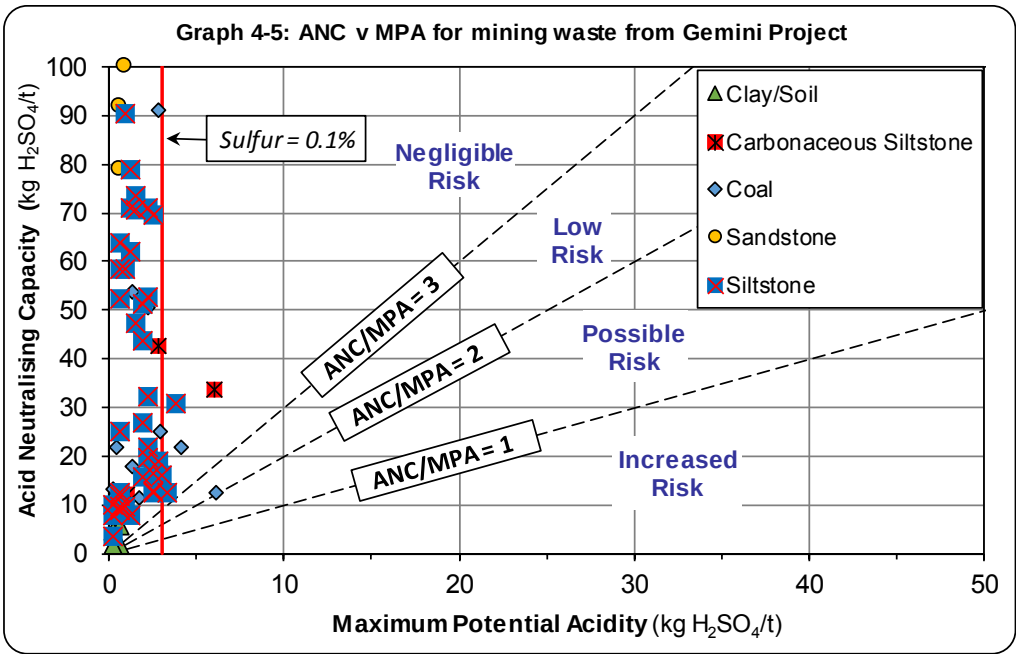
- **Sulfide Sulfur:** The sulfide sulfur content of 19 selected samples with total sulfur content greater than 0.1 %S was also tested (as measured in the Scr test). The results indicate that in the selected samples, an average of two-thirds of the sulfur content is present as non-sulfide sulfur, which is typically associated with non-acid generating forms of sulfur, such as organic sulfur, sulfate or secondary mineral sulfates such as gypsum. On average, one-third of the total sulfur content is present in the selected samples as sulfide sulfur (probably pyrite or marcasite) and has the potential to generate a small amount of acidity.
- **MPA**: Based on the total sulfur content (and sulfide sulfur content where available), the maximum potential acidity (MPA) that could be generated by the mining waste samples ranges from < 0.3 (below laboratory limit of reporting - LoR) to 6.0 kg H_2SO_4/t and has a low median value of 1.2 kg H_2SO_4/t.
- **ANC**: The ANC for the mining waste samples ranges from 1.6 to 142.0 kg H_2SO_4/t and has a moderate median value of 25.9 kg H_2SO_4/t. The fresh samples typically have higher ANC values compared to the weathered material.
- **ANC:MPA ratio**: The ANC:MPA ratio for the samples ranges from 2.1 to 178.0 and has a high median value of 23.6. Simplistically, this means that the samples have excess ANC over MPA.

[1] The median crustal abundance of sulfur (0.07 %S) has been rounded up to 0.1 % (INAP, 2009).

- **NAPP**: The calculated NAPP value for the mining waste samples is calculated by subtracting the ANC from the MPA and ranges from -140.8 to -1.0 kg H_2SO_4/t and has a median value of -24.6 kg H_2SO_4/t. **Graph 4-4** illustrates that all samples have a negative NAPP value, which is typically more negative for fresh materials compared to weathered materials.



Graph 4-5 shows a plot of ANC versus MPA for the 70 mining waste samples tested (by lithology). ANC/MPA ratio lines have been plotted on the graph to illustrate the factor of safety associated with the samples. Generally, those samples with an ANC:MPA ratio greater than 2 (or with a total or sulfide sulfur content ≤ 0.1 %) are considered to have a low to negligible risk of acid generation and a high factor of safety in terms of potential for AMD (INAP, 2009[2]; COA, 2016).



[2] INAP considers that mine materials with an ANC/MPA ratio greater than 2 are likely to be NAF unless significant preferential exposure of sulfides along fracture planes occurs in combination with insufficiently reactive ANC.

The results indicate that all of the mining waste samples tested plot in the low to negligible risk domains shown in the graph and represent materials with a very low risk of acid generation and a high factor of safety with respect to potential AMD.

Table 4-1 provides a summary of the geochemical classification criteria used by RGS to classify the acid forming nature of the 70 mining waste samples at the Project, and a breakdown of the number of samples in each classification category by lithology.

Table 4-1: Geochemical Classification Criteria for Mining Waste Materials

Geochemical Classification	Total Sulfur[1] (%)	ANC: MPA Ratio	NAPP (kg H_2SO_4/t)	Soil/Clay (n=5)	Carb. Siltstone (n=3)	Coal (n=13)	Sandstone (n=8)	Siltstone (n=41)
Non-Acid Forming (Barren)	≤ 0.1	-	-	5	2	9	8	39
Non-Acid Forming	> 0.1	> 2	≤ 0	0	1	4	0	2
Uncertain[2]	> 0.1	< 2	> -5 and ≤ +5	0	0	0	0	0
Potentially Acid Forming (Low Capacity)	> 0.1	< 2	≤ 5	0	0	0	0	0
Potentially Acid Forming	> 0.1	< 2	> 5	0	0	0	0	0

Notes:
1. Sulfide sulfur (using the Scr test) has been measured for selected waste rock samples and where available, sulfide sulfur has been used in place of total sulfur for sample classification and to calculate MPA.
2. Samples that fall outside the stated NAF/PAF classifications based on the criteria provided are classified as Uncertain.

The ABA test data presented in **Table B1 (Attachment B)** and discussed in this section have been used to classify the acid forming nature of the 70 mining waste samples from the Project. The results indicate that of the 70 samples tested, 90 % are classified as Non-Acid Forming (Barren) and 10 % are classified as Non-Acid Forming (NAF). No samples are classified as Uncertain or Potentially Acid Forming (PAF).

Overall, the ABA results confirm that the overwhelming majority of the mining waste materials have low sulfur content, excess ANC, a high factor of safety and a low risk of generating acidic drainage. Some of the carbonaceous siltstone and uneconomic coal samples have slightly elevated sulfide sulfur content compared to typical median crustal abundance, however these materials also have excess ANC and a low risk of generating acidic drainage.

4.2 Multi-Element Concentration in Solids

Multi-element scans were carried out on 10 selected samples to identify any elements (particularly metals/metalloids) present in the Project mining waste materials at concentrations that may be of environmental concern with respect to revegetation and surface water/groundwater quality. The total metals/metalloids concentration for individual elements in mine materials can be relevant for revegetation activities and/or where the potential exists for human contact (*eg*. if the material was to be used off-site).

The results from multi-element testing (total metals/metalloids) of the selected mining waste samples are presented in **Table B2 (Attachment B)**.

4.3 Geochemical Abundance Index

Total metal/metalloid concentrations in mining waste materials can be compared to the median crustal abundance for unmineralised soils (Bowen, 1979, INAP, 2009). The extent of enrichment is reported as the Geochemical Abundance Index (GAI), which relates the actual concentration in a sample with the median (or average) crustal abundance on a $\log_{10}$ scale. The GAI is expressed in integer increments from 0 to 6, where a GAI value of 0 indicates that the element is present at a concentration less than, or similar to, the median crustal abundance; and a GAI value of 6 indicates approximately a 100-fold enrichment above median crustal abundance **(Table 4-2)**.

Table 4-2: Geochemical Abundance Index (GAI) values and Enrichment Factors

GAI	Enrichment Factor	GAI	Enrichment Factor
-	Less than 3-fold enrichment	**4**	24 – 48 fold enrichment
1	3 – 6 fold enrichment	**5**	48 – 96 fold enrichment
2	6 – 12 fold enrichment	**6**	Greater than 96 fold enrichment
3	12 – 24 fold enrichment		

As a general rule, a GAI of 3 or greater signifies enrichment that may warrant further examination. This is particularly the case with some environmentally important 'trace' elements, such as As, Cr, Cd, Cu, Pb, Se and Zn, more so than with major rock-forming elements, such as Al, Ca, Fe, Mg and Na.

Elements identified as enriched may not necessarily be a concern for revegetation, drainage water quality or public health, but their significance should still be evaluated. The GAI provides an indication of metals/metalloids that may be enriched relative to the global median crustal abundance, however the following points should also be considered:

- The median crustal abundance varies between different literature sources, therefore affecting the calculated GAI values.
- If a sample is shown to be enriched relative to the median crustal abundance, there is no direct correlation that that particular sample will also leach metals/metalloids at elevated concentrations. The mobility of metals/metalloids is dependent on mineralogy, adsorption/desorption and the environment in which it occurs.
- Whilst some element concentrations can be elevated relative to the median crustal abundance, the nature of an ore deposit means the background levels are generally expected to be elevated.

Similarly, because an element is not enriched does not mean it will never be a concern, because under some conditions (eg. low pH) the solubility of common environmentally important elements such as Al, Cu, Cd, Fe and Zn increases significantly.

Table B2 (Attachment B) provides total metal/metalloid concentrations for the 10 selected mining waste samples described in **Section 4.2.** The relative enrichment of metals/metalloids in these samples compared to median crustal abundance (the Geochemical Abundance Index - GAI) is presented in **Table B3 (Attachment B)**.

The GAI results indicate that of the metals/metalloids measured, only one of the 10 selected samples was enriched compared to median crustal abundance with cobalt. While the concentration of cobalt is elevated relative to median crustal abundance, the nature of a coal deposit means some metals/metalloids are expected to be slightly elevated in mining waste materials.

The potential solubility of cobalt and other metals/metalloids was investigated further using water extract and KLC tests as presented in **Section 4.5** and **Section 4.6**, respectively.

4.4 Cation Exchange Capacity and Sodicity

The effective cation exchange capacity (eCEC) and exchangeable sodium percentage (ESP) results for 10 selected mining waste samples are presented in **Table B2 (Attachment B).** These samples were selected for testing as they will report to the spoil emplacement areas and could also be used in other site infrastructure and rehabilitation works.

The effective eCEC results show that the eCEC of the selected mining waste samples ranges from 4.2 to 18.0 meq/100g, and is typically low (mean = 10.0 meq/100g) (**Table 4-3**). For mining waste materials with low eCEC value, some fertiliser addition may be required to provide a reasonable growth medium for vegetation roots.

Table 4-3: Ratings for Effective Cation Exchange Capacity

eCEC Rating	CEC meq/100g
Very Low	<6
Low	6-12
Moderate	12-25
High	25-40
Very High	>40

The ESP results for the mining waste samples range from low (4.5%) to very high (31.5%) and are typically elevated (median = 19.3%), indicating that some of the sample materials are likely to be sodic. Generally, samples with ESP values less than 6 are considered non-sodic, whereas greater than 6 are considered moderately sodic, and greater than 14 are considered strongly sodic and may be susceptible to dispersion and erosion (Isbell, 2002; and Northcote and Skene, 1972).

Overall, the results of the eCEC and ESP tests on the selected mining waste samples indicate that most of the materials represented by these samples are likely to have elevated sodicity levels and may be susceptible to dispersion and erosion, although these characteristics may be improved to some extent by the addition of gypsum. In addition, fertiliser addition will need to be considered for some mining waste materials to provide a reasonable growth medium for revegetation and rehabilitation.

4.5 Water Quality Static Tests

There are no specific regulatory criteria for metal/metalloid concentrations in leachate from mining waste materials on mine sites in Queensland. As such, RGS has compared the multi-element results in water extracts from the 10 mining waste samples described in **Sections 4.2** and **4.3**, with Australian guidelines for livestock drinking water and aquatic freshwater ecosystems (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 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. Therefore, 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 mining waste materials.

The results from multi-element testing of water extracts (1:5 sample:water) from the 10 selected mining waste samples are presented in **Table B4 (Attachment B)**.

The pH of the water extracts ranges from 7.1 to 9.6 (median 9.2) and six samples have a pH value that is slightly greater than the upper limit of the pH range (pH 6 to 9) for 95 % species protection in freshwater aquatic ecosystems (ANZECC & ARMCANZ, 2000).

The water extracts have low to moderate EC values ranging from 270 to 1,220 µS/cm (median 710 µS/cm) indicating low to moderate salinity (and low to moderate concentrations of dissolved solids).

The current total alkalinity in the water extracts ranges from 244 to 3,620 mg $CaCO_3$/L) and has a median value of 720 mg $CaCO_3$/L. The alkalinity is mainly present as bicarbonate (HCO_3) in the samples. Most water extracts have a relatively low acidity value ranging from <1 to 101 mg $CaCO_3$/L, and excess alkalinity, leading to a positive net alkalinity value.

The total concentration of major ions in the water extracts is variable, with the dominant major ion typically being bicarbonate, accompanied by lower concentrations of sodium and chloride. Calcium magnesium, potassium and sulfate are also present in the water extracts in comparatively minor amounts. The concentration of dissolved sulfate in the water extracts ranges from 8 to 64 mg/L (median 24 mg/L) and therefore all the samples have a sulfate concentration more than an order of magnitude below the applied (ANZECC & ARMCANZ, 2000) water quality guideline criterion (1,000 mg/L) for livestock drinking water for this anion.

The concentration of trace metals/metalloids tested in the water extracts is typically low and predominantly below the laboratory LoR. Most metal/metalloid concentrations tested in the water extracts are below the applied water quality guideline criteria. The concentrations of arsenic (2 samples) and selenium (4 samples) are above the applied aquatic freshwater ecosystem water quality guideline concentrations for 95 % species protection (ANZECC & ARMCANZ, 2000). One of the water extracts samples has a selenium concentration (0.04 mg/L) higher than the applied livestock drinking watyer guideline value (0.02 mg/L). All other water extract samples have trace metal/metalloid concentrations at or below the applied livestock drinking water guidelines.

On the basis of these results, it is expected that the risk of potential impact on the quality of surface and groundwater water from water in contact with mining waste materials at the Project should be low.

The dynamic quality of mining waste contact water and any potential risk of to water resources at the site is investigated further using KLC tests in **Section 4.6.**

4.6 Water Quality Kinetic Tests

KLC testing has been completed on six composite samples of mining waste materials (using the methodology described in **Section 3.2.2** and **Attachment C**. The samples used in the KLC tests are listed in **Table B5** (**Attachment B**). The KLC tests were completed for a period of six months from July 2017 to January 2018 under a monthly watering and leaching cycle. The KLC tests were operated following mining industry guidelines for such tests (AMIRA, 2002; COA, 2016).

The leachate results from the KLC test program are presented alongside Australian water quality guideline values for livestock drinking water quality (ANZECC & ARCANZ, 2000). 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 KLC samples were crushed to pass a 10 mm sieve size and therefore have a high surface area for potential geochemical reaction. The ratio of sample to water in the KLC tests was approximately 2:1 (w/v) (ie. 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 helpful in some situations to provide relevant context, such comparisons cannot be directly extrapolated to the field situation at the Project.

The monthly KLC leach test results for the six composite mining waste samples are presented in **Attachment D**. Tables **KLC1** to **KLC6** provide the KLC test data for seven leach events (over six

months), selected components of which are also shown graphically. The KLC test results obtained to date indicate that:

- Leachate from the six KLC tests typically remains in the pH range 6 to 9 throughout the test period. The leachate pH from the sandstone sample (KLC3) was marginally above this pH range on one occasion.
- The acidity concentration in leachate from the six KLC tests is typically very low and ≤ 3 mg/L (as $CaCO_3$). In contrast, the alkalinity concentration in leachate for the six KLC tests is elevated and varies between 4 and 77 mg/L (as $CaCO_3$). These sample characteristics lead to positive net alkalinity values for all leachate samples.
- Apart from the carbonaceous siltstone and coal sample (KLC6), leachate from all KLC tests has an EC value less than 800 µs/cm. The EC value generally shows a steady or decreasing EC trend throughout the test period and at the end of six months the EC value is less than 203 µs/cm in leachate from all samples. The elevated EC value in the initial 'first flush' from KLC6 is probably at least partly due to the increased solubility of minerals through crushing the sample material before loading into the KLC test column.
- The major ion concentrations in leachate from the KLC tests are dominated by sodium and chloride (and bicarbonate) with lesser concentrations of sulfate in the siltstone samples KLC1 and KLC 2.
- The sulfate concentration in KLC leachate from all mining waste samples remains well below the applied ANZECC & ARMCANZ stock water quality guideline criterion (1,000 mg/L) over the test period.
- The KLC test samples retain at least ~95 % of their inherent total sulfur content after six months of exposure to idealised oxidising conditions, which reflects the slow rate of sulfide oxidation for these materials.
- The KLC test samples retain at least 99 % of their inherent ANC value after six months of exposure to idealised oxidising conditions.
- The sulfate generation rate results obtained for the six KLC tests on the mining waste samples 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 ($CaSO_4$), for example, 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 mining waste materials (AMIRA, 1995). The sulfate generation rate and associated sulfide oxidation rate for the six KLC tests are shown in **Table 4-4**.
- The sulfate generation rate from the KLC samples ranges from 0.34 to 4.47 mg/kg/week indicating that the rate of sulfide oxidation is low in these materials (equivalent to an oxidation rate ranging from 1.40×10^{-10} to 1.91×10^{-9} kg $O_2/m^3/s$). Mining waste materials with an oxidation rate in the low range (ie. less than 1×10^{-8} kg $O_2/m^3/s$) and a moderate ANC level 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 KLC samples tested fall into this category. Overall, the KLC results reflect the range of material characteristics predicted from the static geochemical test results presented in **Section 4.1**.

Table 4-4: Sulfate Generation and Sulfide Oxidation Rates for KLC Tests on Mining Waste

KLC Sample Number	Sample Description	Sulfate Generation Rate (mg/kg/week)	Oxidation Rate (kg $O_2/m^3/s$)
KLC1	Siltstone	0.65	2.69×10^{-10}
KLC2	Siltstone	0.34	1.40×10^{-10}
KLC3	Sandstone	2.00	8.20×10^{-10}
KLC4	Coal	2.45	1.00×10^{-9}
KLC5	Weathered Coal	1.41	5.77×10^{-10}
KLC6	Carbonaceous Siltstone & Coal	4.47	1.91×10^{-9}

- The concentration of trace metals/metalloids in leachate from the KLC samples is low and typically below the laboratory limit of reporting (LoR). This suggests that most trace metals/metalloids are sparingly soluble at the current pH of the KLC leachate. All measured leached metals/metalloids have concentrations below the applied water quality guideline values (ANZECC & ARMCANZ, 2000). The only exception is the concentration of selenium in initial leachate from KLC 6 (carbonaceous siltstone and coal), although the selenium concentration reduces to below the laboratory LoR for all subsequent leaching events.

Potential implications of these results with respect to the management of mining waste materials at the Project are discussed further in **Section 5.0.**

5.0 DISCUSSION

5.1 AMD Potential and Management

The results of the ABA tests presented in **Section 4** indicate that the AMD potential of the mining waste samples low. The overwhelming majority of the mining waste samples are classified as NAF, have excess ANC, and have very low sulfur content. Whilst the sulfur content of coal and carbonaceous siltstone can be elevated compared to typical background concentrations, it is mainly present in the non-sulfidic form, which does not contribute to acid generation. Overall, these samples represent materials with a very low risk of acid generation and a high factor of safety with respect to potential AMD.

Operational sampling and geochemical testing of mining waste materials should be used strategically throughout the mine life to verify these findings. The focus of the testing should be on potential coal reject (coal seam roof and floor samples from drill core) and actual coal rejects (coarse rejects and tailings from the coal quality laboratory or CHPP when the mine is operational).

Whilst no actual coal reject samples were available to be included in this geochemical assessment, representative sample of these materials are the subject of a separate geochemical assessment program (RGS, 2019). In the test program described herein, geochemical results for carbonaceous siltstone and coal materials suggest that inherent sulfur is mainly present in a NAF (non-sulfide) form. Coal materials will only remain stockpiled at the Run-of-Mine (ROM) area for a relatively short period of time, and management of these materials should for this reason, involve regular collection and monitoring of surface runoff and seepage from the ROM area.

Representative samples of coal reject materials likely to be generated from the Project have already been subjected to a program of both static and kinetic geochemical tests to verify the static and dynamic geochemical nature of these materials (RGS, 2019). It is expected that a relatively small amount of PAF coal reject materials will be encountered at the Project, and this material will be encapsulated within a much larger volume of NAF overburden materials with excess neutralising capacity at spoil dumps, with little risk of any adverse environmental outcome. This strategy is successfully employed at several coal mines in the Bowen Basin (eg. Middlemount Coal Mine).

5.2 Multi-Element Composition and Water Quality

5.2.1 Multi-element Composition and Enrichment

The multi-element concentrations of metal/metalloids in mining waste materials are presented in **Section 4.2**, along with a comparison with median crustal abundance in soils. The results indicate that most of the mining waste materials are not significantly enriched with metals/metalloids compared to median crustal abundance for non-mineralised areas. Whilst one of the siltstone samples was enriched with cobalt compared to median crustal abundance, the nature of a coal deposit means some metals/metalloids are expected to be slightly elevated in some mining waste materials.

5.2.2 Water Quality

Static and kinetic geochemical test results indicate that initial surface run-off and seepage from the NAF mining waste materials is likely to be pH neutral to alkaline and have a moderate salinity value. Weathered mining waste materials tends to have a higher salinity value than fresh materials. Surface runoff and seepage from bulk mining waste materials is likely to be in the range (pH 6 to 9) required for 95 % species protection in freshwater aquatic ecosystems (ANZECC & ARMCANZ, 2000).

The major ion concentrations in leachate from NAF mining waste materials are relatively low and dominated by bicarbonate, sodium, chloride and to a lesser extent sulfate. The sulfate concentration in leachate from all mining waste samples tested is well below the applied ANZECC & ARMCANZ livestock water quality guideline criterion (1,000 mg/L).

The initial concentration of most trace metals/metalloids tested for water in contact with most mining waste materials is typically low and predominantly below the laboratory LoR and applied water quality guideline criteria. The static water extract results suggest that whilst the concentrations of arsenic and selenium can be above applied aquatic freshwater ecosystem water quality guideline concentrations for 95 % species protection (ANZECC & ARMCANZ, 2000) in a few individual samples. However, the concentration of these metals/metalloids in surface runoff and seepage from bulk mining waste materials is likely to be much lower and within the applied guideline concentrations described above. Whilst one carbonaceous siltstone water extract sample had a selenium concentration marginally above the applied livestock drinking water guideline value, all other water extract samples have trace metal/metalloid concentrations at or below the applied livestock drinking water guideline values.

Direct comparison of dynamic KLC test leachate concentration values against the applied livestock water quality guideline criteria is not strictly valid due to a number of factors including scale-up effects, the high sample:water ratio (2:1), the high sample surface area used in the KLC tests, and the highly oxidising (cyclical wet and dry) assumed "worst case" conditions. However, it does highlight those elements, which may have the potential to be mobile under fully oxidising conditions.

The KLC leachate results from the NAF mining waste materials indicate that most metals/ metalloids are sparingly soluble under the current water extract and KLC leachate pH conditions, when compared against applied Australian water quality guideline values (ANZECC & ARMCANZ, 2000). The only minor exception is selenium in the initial leachate from one carbonaceous siltstone/coal sample. It should be noted that this metalloid is commonly indicated as elevated in KLC test programs for mining waste materials from coal mines in the Bowen Basin, but is not commonly detected in surface and groundwater monitoring programs in the field.

On the basis of the water extract and KLC test results described above, it is expected that the risk of potential impact on the quality of surface and groundwater water from water in contact with mining waste materials at the Project should be low.

5.3 Revegetation and Rehabilitation

From a soil chemistry viewpoint, bulk mining waste materials are likely to be pH neutral to alkaline. Most of these materials may also have some risk of being susceptible to dispersion and erosion, although these material characteristics could be improved to some extent by the addition of gypsum. In addition, fertiliser addition may also need to be considered for these materials to provide a reasonable growth medium for revegetation and rehabilitation.

Additional testing, including field trials, may be needed when the mine is operational and bulk mining waste materials become available, to determine the best management option for progressive rehabilitation of these materials during operations and at mine closure.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

RGS has completed a geochemical assessment of mining waste materials at the Gemini Coal Project. The scope of work completed by RGS is described in **Section 1.2**. The main findings of the geochemical assessment are as follows:

- All of the mining waste samples are classified as NAF, have excess ANC and typically have low sulfur. Whilst the sulfur content of coal and carbonaceous siltstone can be elevated compared to typical background concentrations, it is mainly present in the non-sulfidic form, which does not contribute to acid generation. Overall, these samples represent materials with a very low risk of acid generation and a high factor of safety with respect to potential for AMD.
- Initial and ongoing surface runoff and seepage from mining waste materials is expected to be moderately alkaline and have a moderate level of salinity.
- Kinetic leach column (KLC) test results indicate that mining waste materials are unlikely to generate acid conditions and are more likely to generate pH neutral to alkaline conditions.
- Metal/metalloid enrichment in mining waste materials, compared to median crustal abundance in non-mineralised soils, is limited to cobalt in a single carbonaceous siltstone sample. However, the nature of a coal deposit means some metals/metalloids are expected to be slightly elevated in some materials.
- Most metals/metalloids are sparingly soluble at the neutral to alkaline pH of leachate expected from bulk mining waste materials. Dissolved metal/metalloid concentrations in surface runoff and leachate from bulk mining waste materials are therefore expected to be low and unlikely to pose a significant risk to the quality of surface and groundwater resources at relevant storage facilities.
- Mining waste materials should be amenable to revegetation as part of rehabilitation activities, although, gypsum and fertiliser addition may need to be considered for sodic materials to limit dispersion and erosion and to provide a reasonable growth medium for revegetation and rehabilitation.
- As most mining materials appear to be susceptible to dispersion and erosion, additional testing including field trials, may be needed when the mine is operational and bulk materials are being generated. Such tests would help to determine the most appropriate management option for progressive rehabilitation of these materials during operations at mine closure.

6.2 Recommendations

As a result of the geochemical assessment work completed on mining waste materials at the Project, a number of recommendations are provided for these materials to minimise the risk of any significant environmental harm to the immediate and downstream environment.

- Placement of any carbonaceous mining waste material encountered during mining at the surface and outer batters of spoil emplacement areas should be avoided.
- Additional overburden/interburden testing and rehabilitation field trials should be completed during operations when bulk materials become available to confirm the most appropriate management option for progressive rehabilitation of these materials during operations and at mine closure.
- Surface water and seepage from the proposed mining and mining waste storage areas should be monitored to ensure that key water quality parameters remain within appropriate criteria. Water quality monitoring parameters should include pH, EC, total suspended solids (TSS) on a quarterly basis and the suite of water quality analyses described in **Table B4** (**Attachment B**) of this report opportunistically and at least on an annual basis.

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8.0 LIMITATIONS

RGS has prepared this report in accordance with the generally accepted practices and standards of the consulting profession for the use of Magnetic South, and only those third parties who have been authorised in writing by RGS to rely on the report. No other warranty is made as to the professional advice in this report. The report has been prepared in accordance with the scope of work described in **Section 1.2**.

The methodology adopted and information sources used by RGS are outlined in this report. RGS has made no independent verification of this information beyond the agreed scope of works and assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to RGS was false.

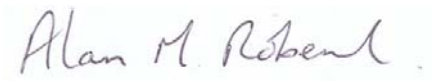
This report was prepared from July 2017 to September 2019 and is based on the information provided by Magnetic South and AARC at the time of preparation. RGS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not provide legal advice which, can only be given by qualified legal practitioners.

If you have any questions regarding the information presented in this report, please contact the undersigned on (+617) 3344 1222 or (+61) 431 620 623.

Yours sincerely,

RGS ENVIRONMENTAL PTY LTD



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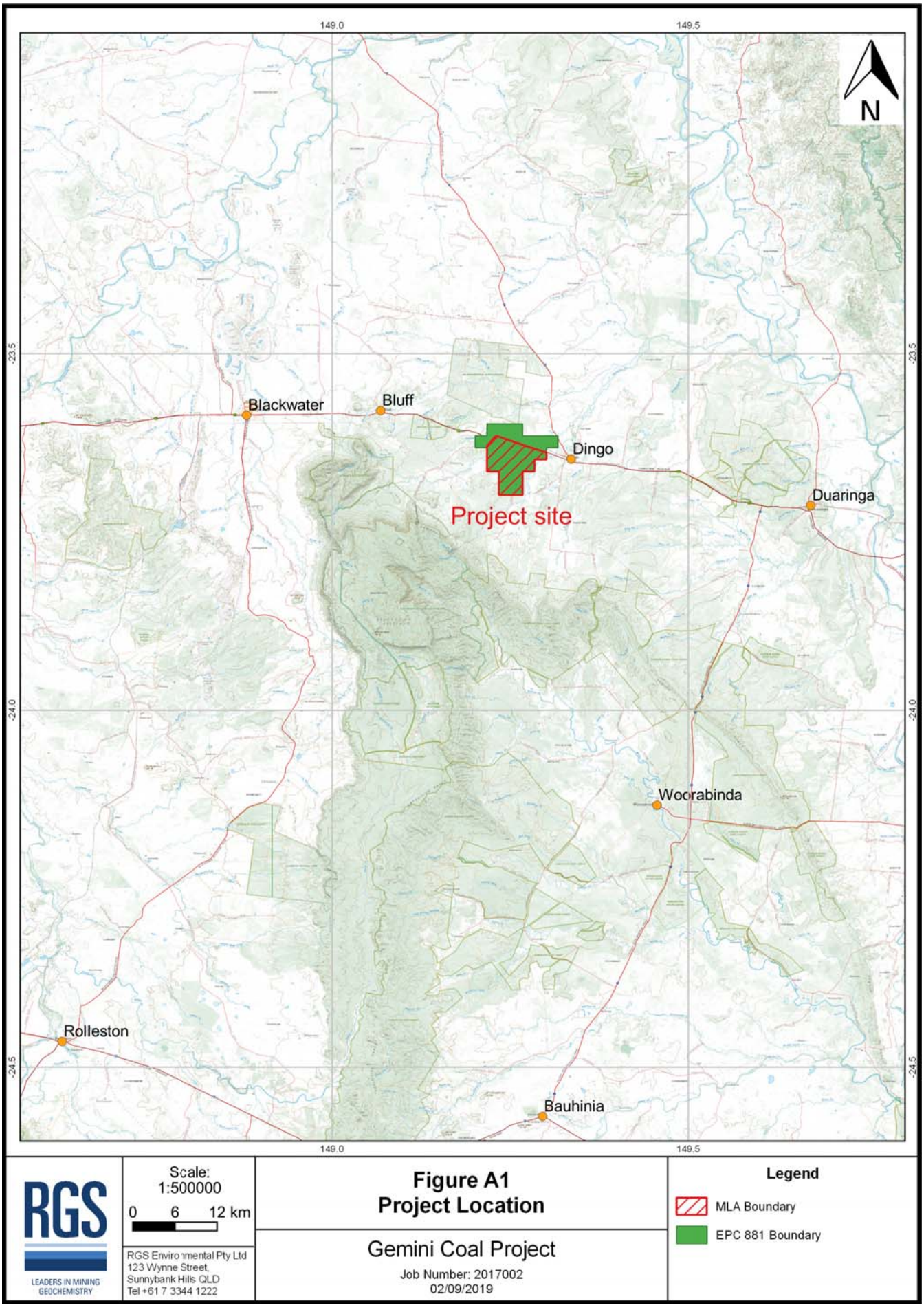
ATTACHMENT A

Figures



RGS
LEADERS IN MINING GEOCHEMISTRY

Scale: 1:500000
0 6 12 km

RGS Environmental Pty Ltd
123 Wynne Street,
Sunnybank Hills QLD
Tel +61 7 3344 1222

Figure A1
Project Location

Gemini Coal Project

Job Number: 2017002
02/09/2019

Legend

MLA Boundary

EPC 881 Boundary

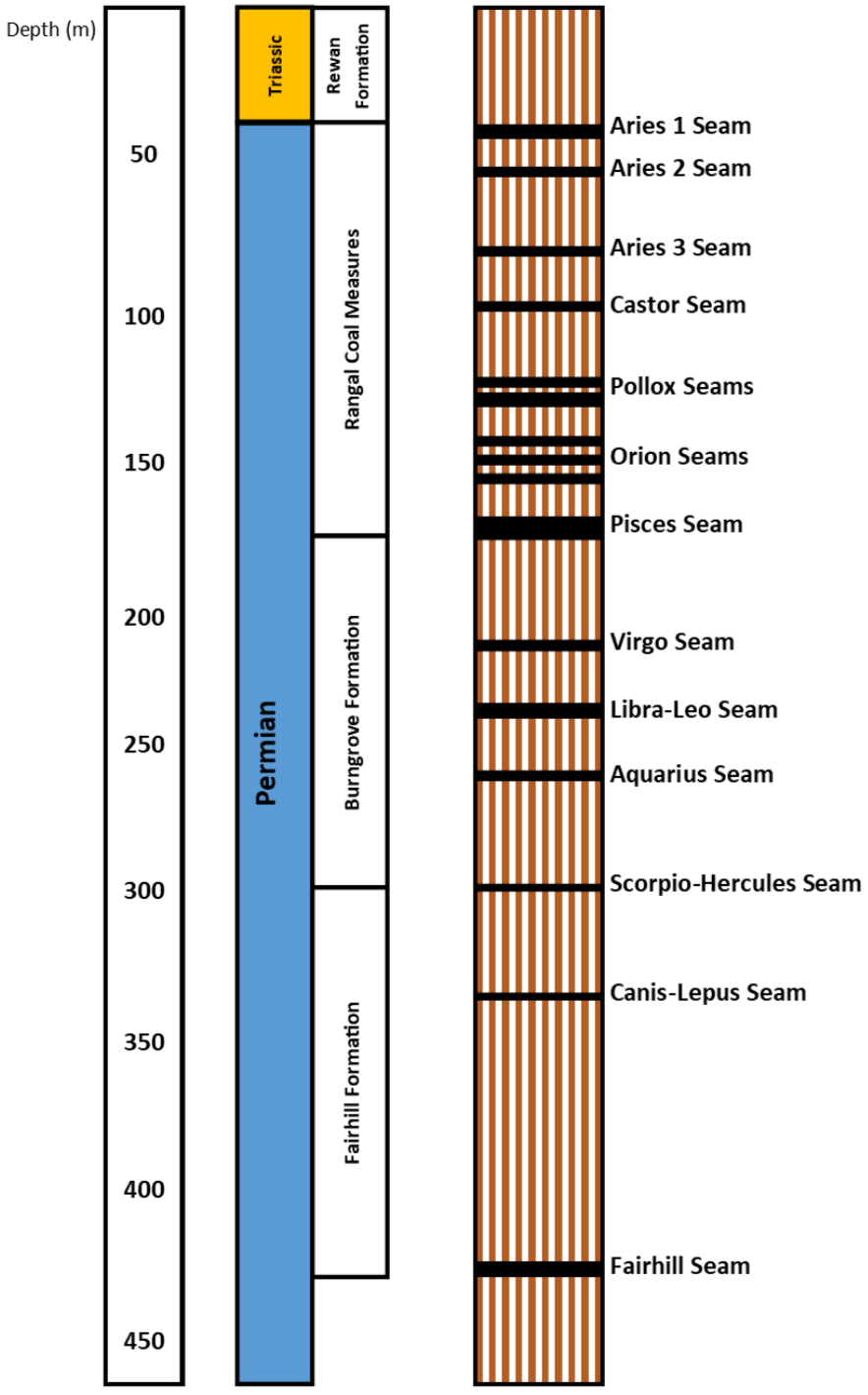


Figure A2

Representative Stratigraphic Column

RGS Environmental Pty Ltd
123 Wynne Street,
Sunnybank Hills QLD
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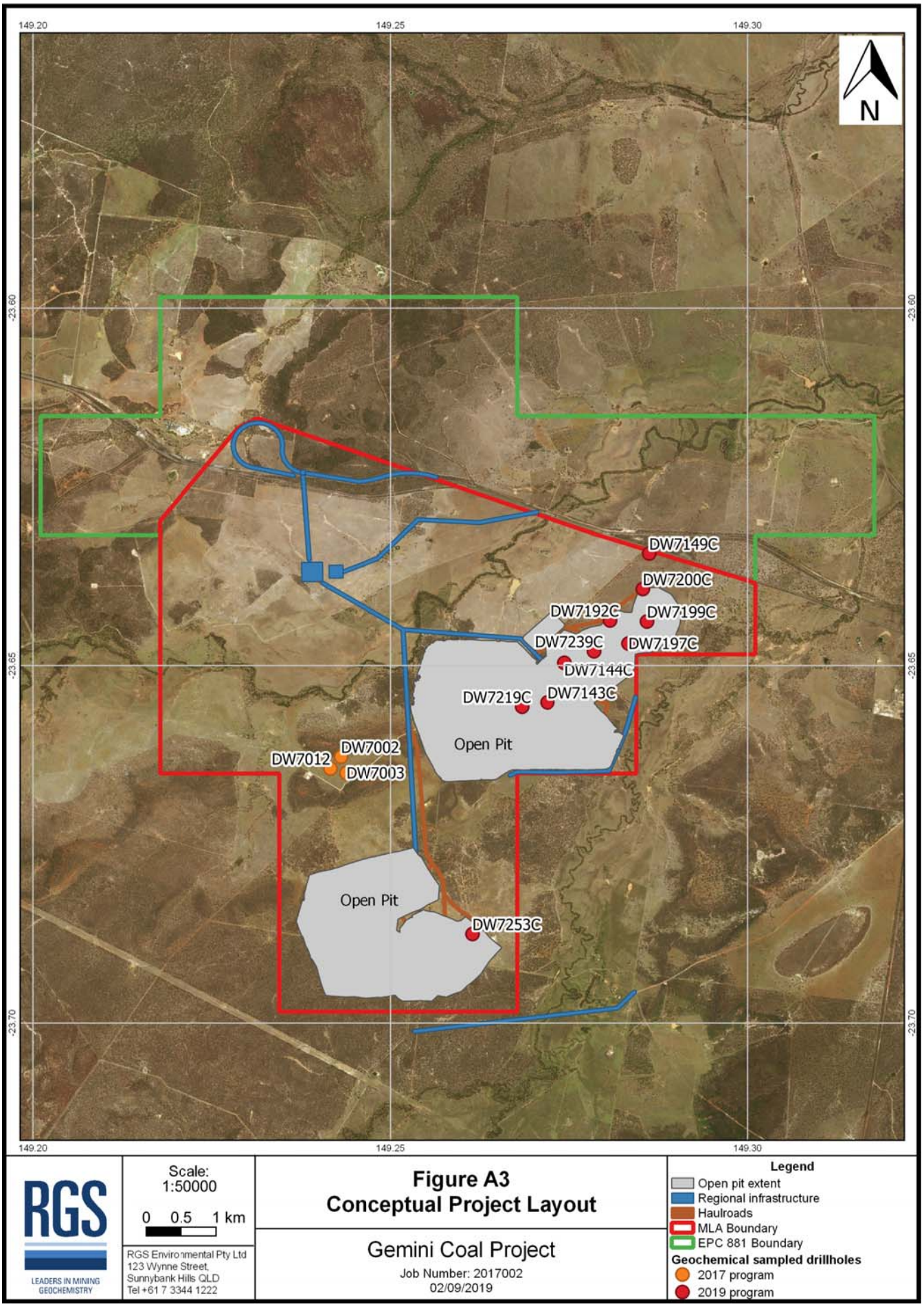
Gemini Coal Project

Job Number: 2017002
02/09/2019



RGS
LEADERS IN MINING GEOCHEMISTRY

Scale: 1:50000

0 0.5 1 km

RGS Environmental Pty Ltd
123 Wynne Street,
Sunnybank Hills QLD
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Figure A3
Conceptual Project Layout

Gemini Coal Project

Job Number: 2017002
02/09/2019

Legend

- Open pit extent
- Regional infrastructure
- Haulroads
- MLA Boundary
- EPC 881 Boundary

Geochemical sampled drillholes

- 2017 program
- 2019 program

ATTACHMENT B

Tables of Results

Table B1: Acid Base Account results for mining waste from the Gemini Project

RGS Sample No.	Drill Hole ID	Client Sample ID	Sample Lithology	From (m)	To (m)	Depth Interval (m)	pH[1]	EC[1]	Total S	Scr	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	Sample Classification[3]
1	DW7002	7002G01	Soil 100%	0.00	2.00	2.00	6.5	646	0.02		0.6	5.5	-4.9	9.0	Non Acid Forming (Barren)
23	DW7003	7003G01	Soil 100%	0.00	2.00	2.00	5.2	1,040	0.02		0.6	1.6	-1.0	2.6	Non Acid Forming (Barren)
45	DW7012	7012G01	Soil 100%	0.00	2.50	2.50	8.5	1,070	0.02		0.6	12.1	-11.5	19.8	Non Acid Forming (Barren)
24	DW7003	7003G02	Clay 100%	2.00	4.00	2.00	5.5	1,080	0.005		0.2	4.4	-4.2	28.7	Non Acid Forming (Barren)
2	DW7002	7002G02	Clay 100%	5.00	6.00	1.00	5.0	1,110	0.005		0.2	1.6	-1.4	10.4	Non Acid Forming (Barren)
53	DW7012	7012G09	COAL 17%, Carb Siltstone 83%	27.00	30.00	3.00	9.0	454	0.18	0.033	1.0	12.2	-11.2	12.1	Non Acid Forming (Barren)
38	DW7003	7003G16	Carb Siltstone 100%	46.40	49.00	2.60	8.6	807	0.53	0.194	5.9	33.7	-27.8	5.7	Non Acid Forming
70	DW7012	7012G26	Carb Siltstone 100%	146.28	148.00	1.72	9.5	722	0.09		2.8	42.6	-39.8	15.5	Non Acid Forming (Barren)
48	DW7012	7012G04	COAL 100%	14.29	15.32	1.03	7.2	306	0.44	0.006	0.2	13.2	-13.0	71.8	Non Acid Forming (Barren)
51	DW7012	7012G07	COAL 100%	24.60	25.60	1.00	9.3	460	0.23	0.041	1.3	17.8	-16.5	14.2	Non Acid Forming
31	DW7003	7003G09	COAL 100% (Weathered)	31.60	33.00	1.40	7.3	807	0.34	0.056	1.7	11.5	-9.8	6.7	Non Acid Forming (Barren)
32	DW7003	7003G10	COAL 100% (Weathered)	33.00	35.20	2.20	7.2	906	0.24	0.014	0.4	21.7	-21.3	50.6	Non Acid Forming (Barren)
55	DW7012	7012G11	COAL 100%	33.08	33.75	0.67	9.3	640	0.53	0.090	2.8	12.0	-9.2	4.4	Non Acid Forming (Barren)
35	DW7003	7003G13	COAL 100%	40.00	41.10	1.10	8.0	937	0.40	0.102	3.1	13.6	-10.5	4.4	Non Acid Forming
58	DW7012	7012G14	COAL 100%	53.57	53.89	0.32	9.2	697	0.60	0.197	6.0	12.6	-6.6	2.1	Non Acid Forming
64	DW7012	7012G20	COAL 93%, Siltstone 7%	96.40	98.61	2.21	9.6	554	0.13	0.037	1.1	137.0	-135.9	120.9	Non Acid Forming (Barren)
12	DW7002	7002G12	COAL 100%	97.20	98.95	1.75	9.0	345	0.45	0.134	4.1	21.7	-17.6	5.3	Non Acid Forming
43	DW7003	7003G21	COAL 100%	114.10	115.90	1.80	9.4	573	0.17	0.041	1.3	53.6	-52.3	42.7	Non Acid Forming (Barren)
18	DW7002	7002G18	COAL 100%	137.13	140.82	3.69	9.2	429	0.49	0.094	2.9	25.1	-22.2	8.7	Non Acid Forming (Barren)
69	DW7012	7012G25	COAL 46%, Carb Claystone 15%, Carb Siltstone 39%	140.52	146.28	5.76	9.0	1,440	0.27	0.070	2.1	50.6	-48.5	23.6	Non Acid Forming (Barren)
21	DW7002	7002G21	COAL 100%	156.45	157.26	0.81	9.6	333	0.09		2.8	91.2	-88.4	33.1	Non Acid Forming (Barren)
50	DW7012	7012G06	Sandstone 100%	23.00	24.60	1.60	9.6	495	0.03		0.9	119.0	-118.1	129.5	Non Acid Forming (Barren)
8	DW7002	7002G08	Sandstone 100%	68.00	71.00	3.00	9.5	270	0.02		0.6	78.9	-78.3	128.8	Non Acid Forming (Barren)
62	DW7012	7012G18	Sandstone 100%	85.00	89.00	4.00	9.4	585	0.04		1.2	113.0	-111.8	92.2	Non Acid Forming (Barren)
10	DW7002	7002G10	Sandstone 100%	92.00	94.00	2.00	9.6	304	0.03		0.9	123.0	-122.1	133.9	Non Acid Forming (Barren)
41	DW7003	7003G19	Sandstone 100%	95.00	96.00	1.00	9.3	665	0.02		0.6	91.8	-91.2	149.9	Non Acid Forming (Barren)
66	DW7012	7012G22	Sandstone 100%	106.00	109.00	3.00	9.5	640	0.02		0.6	109.0	-108.4	178.0	Non Acid Forming (Barren)
16	DW7002	7002G16	Sandstone 100%	116.00	120.00	4.00	9.3	442	0.03		0.9	125.0	-124.1	136.1	Non Acid Forming (Barren)
17	DW7002	7002G17	COAL 11%, Sandstone 89%	135.00	137.13	2.13	9.4	398	0.03		0.9	100.0	-99.1	108.8	Non Acid Forming (Barren)
25	DW7003	7003G03	Siltstone 100%	4.00	5.00	1.00	6.8	893	0.04		1.2	7.8	-6.6	6.4	Non Acid Forming (Barren)
46	DW7012	7012G02	Siltstone 100%	5.00	8.00	3.00	9.0	700	0.02		0.6	25.0	-24.4	40.8	Non Acid Forming (Barren)
26	DW7003	7003G04	Siltstone 100%	6.00	7.00	1.00	7.5	710	0.02		0.6	9.7	-9.1	15.8	Non Acid Forming (Barren)
3	DW7002	7002G03	Siltstone 100%	7.00	8.00	1.00	7.1	1,220	0.005		0.2	3.5	-3.3	22.9	Non Acid Forming (Barren)
27	DW7003	7003G05	Siltstone 100%	8.00	11.00	3.00	7.6	1,170	0.02		0.6	12.4	-11.8	20.2	Non Acid Forming (Barren)
47	DW7012	7012G03	Siltstone 100%	13.00	14.29	1.29	7.7	640	0.02		0.6	8.7	-8.1	14.2	Non Acid Forming (Barren)
28	DW7003	7003G06	Siltstone 100%	14.00	20.00	6.00	7.5	1,180	0.02		0.6	9.0	-8.4	14.7	Non Acid Forming (Barren)
49	DW7012	7012G05	Siltstone 100%	15.32	15.56	0.24	7.6	598	0.03		0.9	9.6	-8.7	10.4	Non Acid Forming (Barren)
4	DW7002	7002G04	Siltstone 100%	17.00	18.00	1.00	7.6	684	0.005		0.2	7.7	-7.5	50.3	Non Acid Forming (Barren)
29	DW7003	7003G07	Siltstone 100%	20.00	23.00	3.00	7.7	911	0.02		0.6	11.8	-11.2	19.3	Non Acid Forming (Barren)
5	DW7002	7002G05	Siltstone 100%	22.00	24.00	2.00	7.6	450	0.005		0.2	9.8	-9.6	64.0	Non Acid Forming (Barren)
6	DW7002	7002G06	Siltstone 100%	25.00	28.00	3.00	9.5	409	0.02		0.6	52.2	-51.6	85.2	Non Acid Forming (Barren)

Table B1: Acid Base Account results for mining waste from the Gemini Project

RGS Sample No.	Drill Hole ID	Client Sample ID	Sample Lithology	From (m)	To (m)	Depth Interval (m)	pH[1]	EC[1]	Total S	Scr	MPA[2]	ANC[2]	NAPP[2]	ANC: MPA Ratio	Sample Classification[3]
52	DW7012	7012G08	Siltstone 100%	25.60	27.00	1.40	9.0	620	0.14	0.096	2.9	16.0	-13.1	5.4	Non Acid Forming (Barren)
30	DW7003	7003G08	Siltstone 100%	30.00	31.60	1.60	8.3	1,140	0.08		2.5	12.7	-10.3	5.2	Non Acid Forming (Barren)
54	DW7012	7012G10	Siltstone 100%	30.00	33.08	3.08	9.2	529	0.08		2.5	12.4	-10.0	5.1	Non Acid Forming (Barren)
56	DW7012	7012G12	COAL 6%, Siltstone 94%	33.75	38.00	4.25	9.2	802	0.06		1.8	43.5	-41.7	23.7	Non Acid Forming (Barren)
33	DW7003	7003G11	Siltstone 100%	35.20	36.50	1.30	7.6	1,020	0.07		2.1	21.8	-19.7	10.2	Non Acid Forming (Barren)
34	DW7003	7003G12	Siltstone 100%	37.85	40.00	2.15	8.3	1,230	0.08		2.5	16.3	-13.9	6.7	Non Acid Forming (Barren)
7	DW7002	7002G07	Siltstone 100%	40.00	42.00	2.00	9.6	305	0.03		0.9	58.5	-57.6	63.7	Non Acid Forming (Barren)
36	DW7003	7003G14	Siltstone 100%	41.10	43.30	2.20	8.2	1,120	0.13	0.060	1.8	15.5	-13.7	8.4	Non Acid Forming (Barren)
37	DW7003	7003G15	Siltstone 100%	45.40	46.40	1.00	8.2	1,070	0.16	0.106	3.2	12.3	-9.1	3.8	Non Acid Forming
39	DW7003	7003G17	Siltstone 100%	49.00	50.00	1.00	9.0	890	0.09		2.8	18.9	-16.1	6.9	Non Acid Forming (Barren)
40	DW7003	7003G18	Siltstone 100%	51.00	53.00	2.00	8.8	964	0.13	0.072	2.2	32.2	-30.0	14.6	Non Acid Forming (Barren)
57	DW7012	7012G13	Siltstone 100%	52.55	53.57	1.02	9.3	616	0.04		1.2	142.0	-140.8	115.9	Non Acid Forming (Barren)
59	DW7012	7012G15	Siltstone 100%	53.89	56.00	2.11	9.3	758	0.05		1.5	106.0	-104.5	69.2	Non Acid Forming (Barren)
60	DW7012	7012G16	Siltstone 100%	67.00	72.00	5.00	9.4	666	0.17	0.125	3.8	30.9	-27.1	8.1	Non Acid Forming
61	DW7012	7012G17	Siltstone 100%	76.16	78.00	1.84	9.5	646	0.05		1.5	73.4	-71.9	47.9	Non Acid Forming (Barren)
9	DW7002	7002G09	Siltstone 100%	78.00	82.00	4.00	9.4	296	0.02		0.6	63.6	-63.0	103.8	Non Acid Forming (Barren)
11	DW7002	7002G11	Siltstone 100%	94.00	97.20	3.20	9.5	335	0.04		1.2	61.8	-60.6	50.4	Non Acid Forming (Barren)
63	DW7012	7012G19	Siltstone 100%	94.00	96.40	2.40	9.5	634	0.05		1.5	70.7	-69.2	46.2	Non Acid Forming (Barren)
65	DW7012	7012G21	Siltstone 100%	98.61	100.00	1.39	9.7	697	0.02		0.6	58.5	-57.9	95.5	Non Acid Forming (Barren)
13	DW7002	7002G13	Siltstone 100%	98.95	101.00	2.05	8.8	890	0.07		2.1	19.6	-17.5	9.1	Non Acid Forming (Barren)
14	DW7002	7002G14	Siltstone 100%	102.00	104.00	2.00	9.0	595	0.06		1.8	26.7	-24.9	14.5	Non Acid Forming (Barren)
15	DW7002	7002G15	Siltstone 100%	110.00	112.00	2.00	9.3	468	0.03		0.9	90.2	-89.3	98.2	Non Acid Forming (Barren)
42	DW7003	7003G20	Siltstone 100%	112.40	114.10	1.70	9.2	801	0.04		1.2	78.9	-77.7	64.4	Non Acid Forming (Barren)
44	DW7003	7003G22	Siltstone 100%	115.90	120.00	4.10	9.2	779	0.07		2.1	52.8	-50.7	24.6	Non Acid Forming (Barren)
67	DW7012	7012G23	Siltstone 100%	121.00	123.00	2.00	9.2	802	0.06		1.8	51.3	-49.5	27.9	Non Acid Forming (Barren)
68	DW7012	7012G24	Siltstone 100%	138.00	140.52	2.52	9.5	714	0.08		2.5	69.5	-67.1	28.4	Non Acid Forming (Barren)
19	DW7002	7002G19	Siltstone 100%	140.82	154.00	13.18	9.4	386	0.05		1.5	47.4	-45.9	31.0	Non Acid Forming (Barren)
20	DW7002	7002G20	Siltstone 100%	154.00	156.45	2.45	9.4	432	0.04		1.2	71.1	-69.9	58.0	Non Acid Forming (Barren)
22	DW7002	7002G22	Siltstone 100%	157.26	158.00	0.74	9.4	579	0.07		2.1	71.1	-69.0	33.2	Non Acid Forming (Barren)

Notes

1. Current pH, EC, Alkalinity and Acidity 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 criteria detail provided in report text.

* Where total sulfur or ANC results are less than the laboratory Limit of Reporting (LoR) a value of half of the LoR is used .

Table B2: Multi-element test results for mining waste from the Gemini Project

	RGS Sample Number →	2	3	8	20	28	38	24
	ALS Laboratory ID →	EB1713010001	EB1713010002	EB1713010007	EB1713010010	EB1713010016	EB1713010024	EB1713010012
	Client Sample ID →	7002G02	7002G03	7002G08	7002G20	7003G06	7003G16	7003G02
Parameters	Limit of Reporting	Clay	Siltstone	Sandstone	Siltstone	Siltstone	Carb. Siltstone	Clay
Major Cations		All units mg/kg						
Calcium (Ca)	50	----	610	26,600	----	3,480	8,890	----
Magnesium (Mg)	50	----	2,200	11,200	----	4,720	7,510	----
Potassium (K)	50	----	1,040	1,140	----	2,070	1,340	----
Sodium (Na)	50	----	2,130	530	----	3,020	1,320	----
Chloride	50	----	2,000	300	----	1,970	1,190	----
Major, Minor and Trace Elements		All units mg/kg						
Aluminium (Al)	50	----	5,570	12,000	----	11100	12100	----
Antimony (Sb)	5	----	<5	<5	----	<5	<5	----
Arsenic (As)	5	----	10	5	----	43	48	----
Barium (Ba)	10	----	240	120	----	130	760	----
Cadmium (Cd)	1	----	<1	<1	----	<1	<1	----
Chromium (Cr) - hexavalent	2	----	14	29	----	12	10	----
Cobalt (Co)	2	----	114	13	----	9	14	----
Copper (Cu)	5	----	63	20	----	58	25	----
Iron (Fe)	50	----	14,000	36,200	----	19,800	69,700	----
Lead (Pb)	5	----	16	11	----	16	10	----
Manganese (Mn)	5	----	748	1,030	----	79	1580	----
Nickel (Ni)	2	----	75	24	----	33	25	----
Selenium (Se)	5	----	<5	<5	----	<5	<5	----
Vanadium (V)	0.1	----	31.0	49.0	----	40	55	----
Zinc (Zn)	5	----	76	60	----	69	50	----
Exchangable Cations		All units meq/100g (except Exchangable Sodium & Aluminium Percentage (%))						
Exch. Calcium	0.1	1.8	2.3	3.0	3.4	2.6	1.3	2.0
Exch. Magnesium	0.1	10.8	11.9	2	2.2	6.8	1.9	8.5
Exch. Potassium	0.1	0.4	0.4	0.05	0.05	0.05	0.05	0.3
Exch. Sodium	0.1	2.9	3.3	0.2	0.8	4.4	1.0	4.2
Cation Exchange Capacity	0.1	16.1	18.0	5.3	6.4	13.9	4.2	15.1
Calcium:Magnesium Ratio	-	0.2	0.2	1.5	1.5	0.4	0.7	0.2
Magnesium:Potassium Ratio	-	27.0	29.8	40.0	44.0	136.0	38.0	28.3
Exchangable Sodium Percentage	0.1%	18.2	18.4	4.5	12.8	31.5	24.0	28.0

Notes: < indicates less than the laboratory limit of reporting (LoR).

Table B2: Multi-element test results for mining waste from the Gemini Project

	RGS Sample Number →	18	31	50	62	70	58
	ALS Laboratory ID →	EB1713010009	EB1713010019	EB1713010028	EB1713010035	EB1713010039	EB1713010033
	Client Sample ID →	7002G18	7003G09	7012G06	7012G18	7012G26	7012G14
Parameters	Limit of Reporting	Coal	Coal	Sandstone	Sandstone	Carb. Siltstone	Coal
Major Cations		All units mg/kg					
Calcium (Ca)	50	9,050	4,030	29,900	31,500	14,900	9,210
Magnesium (Mg)	50	5,130	3,220	12,000	13,500	5,660	3,730
Potassium (K)	50	1,280	1,450	1,450	1,130	1,620	1,390
Sodium (Na)	50	680	2,240	1,470	1,060	1,270	1,380
Chloride	50	470	1,380	480	600	1,030	980
Major, Minor and Trace Elements		All units mg/kg					
Aluminium (Al)	50	6680	6,280	7,210	11300	8660	6,660
Antimony (Sb)	5	<5	<5	<5	<5	<5	<5
Arsenic (As)	5	9	10	18	8	5	27
Barium (Ba)	10	500	620	20	40	20	950
Cadmium (Cd)	1	<1	<1	<1	<1	<1	<1
Chromium (Cr) - hexavalent	2	8	6	19	17	6	7
Cobalt (Co)	2	5	8	11	23	5	7
Copper (Cu)	5	27	34	25	28	42	30
Iron (Fe)	50	30,400	16,900	38,900	47,600	17,800	25,700
Lead (Pb)	5	10	7	11	7	20	10
Manganese (Mn)	5	448	59	1,000	991	278	604
Nickel (Ni)	2	20	15	20	32	10	11
Selenium (Se)	5	<5	<5	<5	<5	<5	<5
Vanadium (V)	0.1	18	29.0	28.0	59	20	26.0
Zinc (Zn)	5	49	55	74	74	58	43
Exchangable Cations		All units meq/100g (except Exchangable Sodium & Aluminium Percentage (%))					
Exch. Calcium	0.1	----	----	2.0	3.1	3.7	----
Exch. Magnesium	0.1	----	----	3.4	2.4	1.7	----
Exch. Potassium	0.1	----	----	0.05	0.05	0.05	----
Exch. Sodium	0.1	----	----	2.1	1	1.4	----
Cation Exchange Capacity	0.1	----	----	7.7	6.5	6.8	----
Calcium:Magnesium Ratio	-	----	----	0.6	1.3	2.2	----
Magnesium:Potassium Ratio	-	----	----	68.0	48.0	34.0	----
Exchangable Sodium Percentage	0.1%	----	----	27.3	15.4	20.2	----

Notes: < indicates less than the laboratory limit of reporting (LoR).

Table B3: Geochemical Abundance Index (GAI) results for mining waste from the Gemini Project

	RGS Sample Number →		3	8	28	38	18	31	50	62	70	58
	ALS Laboratory ID →		EB1713010002	EB1713010007	EB1713010016	EB1713010024	EB1713010009	EB1713010019	EB1713010028	EB1713010035	EB1713010039	EB1713010033
	Client Sample ID →		7002G03	7002G08	7003G06	7003G16	7002G17	7003G08	7012G06	7012G18	7012G26	7012G14
Parameters	Limit of Reporting	Average Crustal Abundance[1]	Siltstone	Sandstone	Siltstone	Carb. Siltstone	Coal	Coal	Sandstone	Sandstone	Carb. Siltstone	Coal
Major Elements	all units in mg/kg		Geochemical Abundance Index									
Calcium (Ca)	50	15,000	0	0	0	0	0	0	0	0	0	0
Magnesium (Mg)	50	5,000	0	1	0	0	0	0	1	1	0	0
Potassium (K)	50	14,000	0	0	0	0	0	0	0	0	0	0
Sodium (Na)	50	5,000	0	0	0	0	0	0	0	0	0	0
Chloride	50	500	1	0	1	1	0	1	0	0	0	0
Major, Minor and Trace Elements	all units in mg/kg		Geochemical Abundance Index									
Aluminium (Al)	50	71,000	0	0	0	0	0	0	0	0	0	0
Antimony (Sb)	5	5	0	0	0	0	0	0	0	0	0	0
Arsenic (As)	5	6	0	0	2	2	0	0	1	0	0	2
Barium (Ba)	10	500	0	0	0	0	0	0	0	0	0	0
Cadmium (Cd)	1	0.35	0	0	0	0	0	0	0	0	0	0
Chromium (Cr) - hexavalent	2	70	0	0	0	0	0	0	0	0	0	0
Cobalt (Co)	2	8	3	0	0	0	0	0	0	1	0	0
Copper (Cu)	5	30	0	0	0	0	0	0	0	0	0	0
Iron (Fe)	50	40,000	0	0	0	0	0	0	0	0	0	0
Lead (Pb)	5	35	0	0	0	0	0	0	0	0	0	0
Manganese (Mn)	5	1,000	0	0	0	0	0	0	0	0	0	0
Nickel (Ni)	2	50	0	0	0	0	0	0	0	0	0	0
Selenium (Se)	5	0.4	2	2	2	2	2	2	2	2	2	2
Zinc (Zn)	5	90	0	0	0	0	0	0	0	0	0	0

Notes: GAI's greater than or equal to 3 are highlighted.

1. Average Crustal Abundance values sourced from the "GARD Guide", Chapter 5 (INAP, 2009).

1. When no GARD Guide value is available for particular element, then values are taken from Bowen H.J.M.(1979) Environmental Chemistry of the Elements, pages 60-61.

Table B4: Multi-Element Test results for water extracts from mining waste from the Gemini Project

		RGS Sample Number →	3	8	28	38	18	31	50	62	70	58
		ALS Laboratory ID →	EB1713010002	EB1713010007	EB1713010016	EB1713010024	EB1713010009	EB1713010019	EB1713010028	EB1713010035	EB1713010039	EB1713010033
		Client Sample ID →	7002G03	7002G08	7003G06	7003G16	7002G18	7003G09	7012G06	7012G18	7012G26	7012G14
		Water Quality Guidelines:										
Parameters	Limit of Reporting	Aquatic Ecosystems (freshwater)[1]	Livestock Drinking Water[2]	Siltstone	Sandstone	Siltstone	Carb. Siltstone	Coal	Coal	Sandstone	Sandstone	Carb. Siltstone	Coal
pH	0.01 pH unit	6 to 9	-	7.1	9.5	7.5	8.6	9.2	7.3	9.6	9.4	9.5	9.2
Electrical Conductivity	1 µS/cm	<1,000#	3,580^	1,220	270	1,180	807	429	807	495	585	722	697
Carbonate Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	<1	54	<1	<1	18	<1	72	54	36	18
Bicarbonate Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	244	3,300	612	378	540	828	3,540	2,740	2,020	396
Total Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	244	3,360	612	378	558	828	3,620	2,800	2,060	414
Acidity ($mgCaCO_3/L$)	1 mg/L	-	-	41	1	39	3	1	101	1	1	1	1
Net Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	203	3,360	573	375	558	727	3,620	2,800	2,060	414
Major Ions	All units mg/L			All units mg/L									
Calcium (Ca)	2	-	1,000	<2	6	<2	4	8	<2	<2	2	4	<2
Magnesium (Mg)	2	-	-	6	4	1	4	4	2	<2	<2	2	<2
Potassium (K)	2	-	-	4	10	4	10	8	8	8	6	6	6
Sodium (Na)	2	-	-	248	46	252	170	70	188	124	108	144	124
Chloride (Cl)	2	-	-	400	60	394	238	94	276	96	120	206	196
Fluoride (F)	0.2	-	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sulfate (SO_4)	2	-	1,000	<2	8	8	64	30	44	16	24	14	26
Trace Metals/Metalloids	All units mg/L			All units mg/L									
Aluminium (Al)	1.0	0.055	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Antimony (Sb)	0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic (As) - triavalent	0.1	0.024 **	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.08	<0.1	0.02	0.04
Barium (Ba)	1.0	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium (Cd)	0.1	0.0002	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (Cr) - total	0.1	0.001 (hex)*	1 (total)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper (Cu)	0.1	0.0014	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Iron (Fe)	1.0	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead (Pb)	0.1	0.0034	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese (Mn)	0.1	1.90	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Molybdenum (Mo)	0.1	-	0.15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.02	0.08	0.04	0.04
Nickel (Ni)	0.1	0.011	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium (Se)	0.1	0.011	0.02	0.02	<0.1	<0.1	0.04	<0.1	0.02	<0.1	0.02	<0.1	<0.1
Vanadium (V)	0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Zinc (Zn)	0.1	0.008	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

* Cr (VI) = hexavalent. ** 0.013 mg/Lfor pentavalent Arsenic (V).

for still water bodies only, moving rivers at low flow rates should not exceed 2,200µS/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 2,400mg/L for livestock drinking water.

Notes: < indicates concentration less than the detection limit. Shaded cells 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.

ATTACHMENT C

Geochemical Assessment of Mining Waste Materials

ATTACHMENT C

GEOCHEMICAL ASSESSMENT OF MINING 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 acid that could be generated by the sample by either directly determining 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 a waste 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)

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. RGS generally avoids use the NAG test at coal mining projects as the high organic content of some materials can cause erroneous results.

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 mining 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.

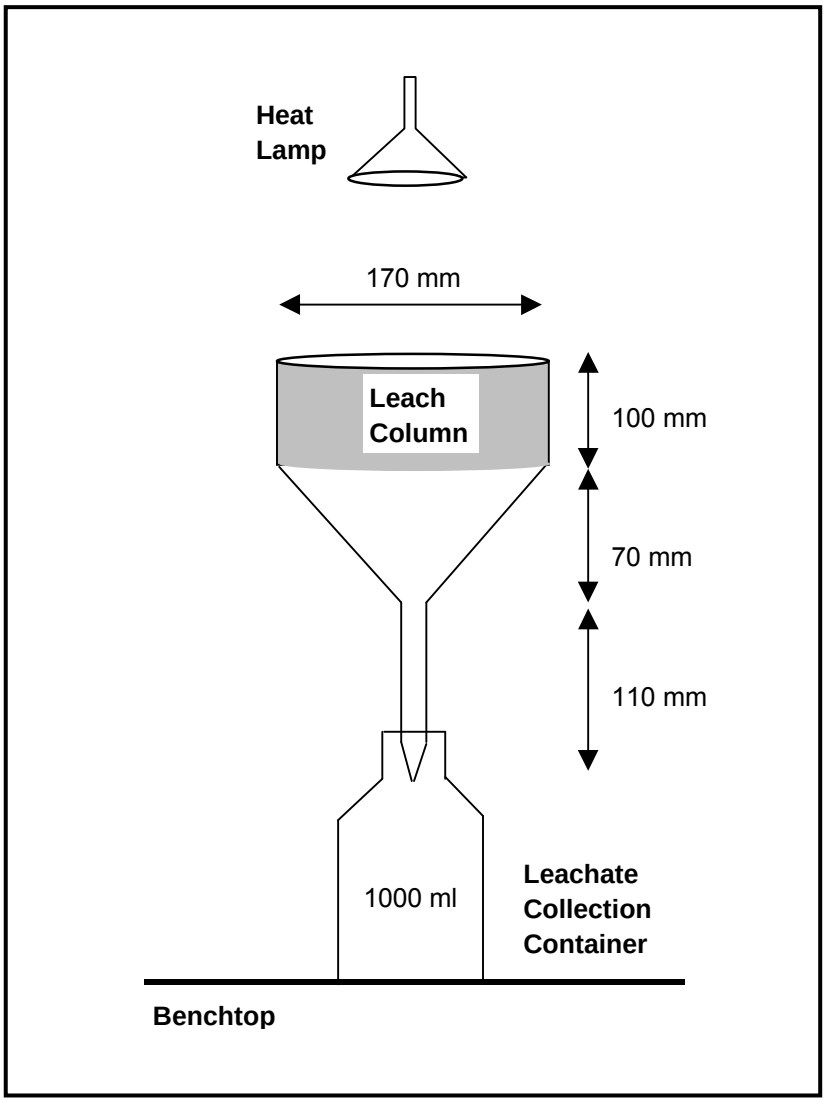
In KLC tests, water is added to a sample and the mixture allowed to leach products and by-products of acid producing and consuming reactions. Samples of leachate are then collected and analysed. Intermittent water application is applied to simulate rainfall and heat lamps are used to simulate sunshine. 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 C1 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 and depending on the physical nature of the material and particle size can be used on an as-received basis (*i.e.* no crushing as with process residues) or crushed to nominal 5-10 mm particle size (as with waste rock). 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 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 C1

Kinetic Leach Column Setup



ATTACHMENT D

KLC Test Results and Trends

KLC 1 (Siltstone 100%)

Weight (kg)	1.50	**Total S (%)**	0.01	**ANC**	26.3
pH (1:5)	8.30	**Scr (%)**	0.01	**NAPP**	-25.9
EC (µS/cm)	613	**MPA**	0.4	**ANC:MPA**	66.1

Date			**09-May-17**	**09-Aug-17**	**05-Sep-17**	**03-Oct-17**	**07-Nov-17**	**15-Dec-17**	**16-Jan-18**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1713594	EB1716503	EB1718214	EB1720293	EB1723258	EB1725752	EB1801935
Volume On (L)			1.5	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.723	0.725	0.754	0.840	0.659	0.850	0.828
Cum. Volume (L)			0.72	1.45	2.20	3.04	3.70	4.55	5.38
Pore Volumes			0.5	1.1	1.6	2.3	2.7	3.4	4.0
pH (RGS Measurement)			7.45	7.50	7.40	7.50	7.43	8.56	7.61
pH (ALS Measurement)			7.55	7.48	6.98	7.47	7.64	7.52	7.74
pH (deionised water used in test)			5.27	5.78	5.60	5.78	5.11	4.90	5.64
EC (RGS Measurement) (µS/cm)			700	403	228	272	182	136	98
EC (ALS Measurement) (µS/cm)			769	508	195	281	190	131	95
Acidity (mg/L)*			2	2	<1	<1	<1	1	<1
Alkalinity (mg/L)*			36	23	8	11	12	17	11
Net Alkalinity (mg/L)*			34	21	8	11	12	16	11
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	5	3	1	0.5	0.5	0.5	0.5
Potassium (K)	1	-	3	1	<1	<1	<1	<1	<1
Magnesium (Mg)	1	-	8	5	2	0.5	0.5	0.5	0.5
Sodium (Na)	1	-	126	65	32	50	33	22	18
Chloride (Cl)	1	-	214	119	43	75	44	27	22
Fluoride (F)	0.1	2	0.4	0.2	0.1	0.2	0.1	<0.1	<0.1
Sulfate (SO_4)	1	1,000	6	8	7	7	3	4	3
Trace metals/ metalloids	**LoR**	**WQ Guidelines#**	All units mg/L						
Aluminium (Al)	0.01	5	0.12	0.02	0.24	0.9	0.27	0.51	1.07
Arsenic (As)	0.001	0.5	0.004	<0.001	<0.001	<0.001	0.001	<0.001	0.002
Boron (B)	0.05	5	0.06	0.16	<0.05	<0.05	<0.05	<0.05	0.06
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	0.001	<0.001	<0.001	0.001	0.001	<0.001	0.002
Iron (Fe)	0.05	1	0.07	<0.05	0.08	0.13	0.09	0.17	0.21
Manganese (Mn)	0.001	2	0.010	0.002	0.006	0.007	0.014	0.005	0.003
Molybdenum (Mo)	0.001	0.15	0.003	0.001	0.001	0.001	<0.001	<0.001	<0.001
Nickel (Ni)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	0.007
Calculations**									
SO_4 Release Rate			3	4	4	4	1	2	2
Cumulative SO_4 Release			3	7	4	7	1	4	5
Ca Release Rate			2.4	1.5	0.5	0.3	0.2	0.3	0.3
Cumulative Ca Release			2.4	3.9	0.5	0.8	0.2	0.5	0.8
Mg Release Rate			3.9	2.4	1.0	0.3	0.2	0.3	0.3
Cumulative Mg Release			3.9	6.3	1.0	1.3	0.2	0.5	0.8
Residual ANC (%)			99.9	99.9	99.8	99.8	99.8	99.8	99.8
Residual Sulfur (%)			99.3	98.3	97.4	96.4	96.0	95.4	95.0
SO_4/(Ca+Mg) molar ratio			0.1	0.3	0.7	2.2	0.9	1.3	0.9

< 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 & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

KLC 2 (Siltstone 100%)

Weight (kg)	1.50	**Total S (%)**	0.03	**ANC**	10.6
pH (1:5)	7.60	**Scr (%)**	0.03	**NAPP**	-9.6
EC (µS/cm)	1,001	**MPA**	1.0	**ANC:MPA**	10.5

Date			**09-May-17**	**09-Aug-17**	**05-Sep-17**	**03-Oct-17**	**07-Nov-17**	**15-Dec-18**	**16-Jan-18**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1713594	EB1716503	EB1718214	EB1720293	EB1723258	EB1725752	EB1801935
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.662	0.815	0.963	0.850	0.875	0.870	0.874
Cum. Volume (L)			0.66	1.48	2.44	3.29	4.17	5.04	5.91
Pore Volumes			0.5	1.1	1.8	2.4	3.1	3.7	4.4
pH (RGS Measurement)			8.58	7.79	8.15	7.14	7.32	8.21	6.65
pH (ALS Measurement)			7.74	6.56	6.59	7.06	6.97	7.12	7.06
pH (deionised water used in test)			5.27	5.78	5.60	5.78	5.11	4.90	5.64
EC (RGS Measurement) (µS/cm)			169	140	173	200	130	108	134
EC (ALS Measurement) (µS/cm)			162	181	175	207	116	106	139
Acidity (mg/L)*			<1	2	<1	<1	<1	<1	<1
Alkalinity (mg/L)*			11	9	6	4	5	9	4
Net Alkalinity (mg/L)*			11	7	6	4	5	9	4
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Potassium (K)	1	-	1	<1	<1	<1	<1	<1	<1
Magnesium (Mg)	1	-	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Sodium (Na)	1	-	30	28	34	37	20	20	26
Chloride (Cl)	1	-	33	35	42	58	27	25	36
Fluoride (F)	0.1	2	0.2	0.3	0.1	0.2	0.2	0.1	0.2
Sulfate (SO_4)	1	1,000	2	3	2	3	2	3	3
Trace metals/ metalloids	**LoR**	**WQ Guidelines#**	All units mg/L						
Aluminium (Al)	0.01	5	3.72	2.42	0.23	0.51	0.36	0.42	0.77
Arsenic (As)	0.001	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	0.05	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	0.003	0.002	<0.001	0.002	0.001	<0.001	0.001
Iron (Fe)	0.05	1	0.61	0.38	<0.05	0.08	0.10	0.07	0.13
Manganese (Mn)	0.001	2	0.044	0.018	0.001	0.009	0.021	0.009	0.010
Molybdenum (Mo)	0.001	0.15	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel (Ni)	0.001	1	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	0.012
Calculations**									
SO_4 Release Rate			1	2	1	2	1	2	2
Cumulative SO_4 Release			1	3	4	5	7	8	10
Ca Release Rate			0.2	0.3	0.3	0.3	0.3	0.3	0.3
Cumulative Ca Release			0.2	0.5	0.8	1.1	1.4	1.7	2.0
Mg Release Rate			0.2	0.3	0.3	0.3	0.3	0.3	0.3
Cumulative Mg Release			0.2	0.5	0.8	1.1	1.4	1.7	2.0
Residual ANC (%)			100.0	100.0	100.0	99.9	99.9	99.9	99.9
Residual Sulfur (%)			99.9	99.7	99.6	99.4	99.3	99.2	99.0
SO_4/(Ca+Mg) molar ratio			0.6	0.9	0.6	0.9	0.6	0.9	0.9

< 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 & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

KLC 3 (Sandstone 100%)

Weight (kg)	1.50	**Total S (%)**	0.03	**ANC**	113.7
pH (1:5)	9.50	**Scr (%)**	0.03	**NAPP**	-112.8
EC (µS/cm)	573	**MPA**	0.9	**ANC:MPA**	123.8

Date			**09-May-17**	**09-Aug-17**	**05-Sep-17**	**03-Oct-17**	**07-Nov-17**	**15-Dec-18**	**16-Jan-18**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1713594	EB1716503	EB1718214	EB1720293	EB1723258	EB1725752	EB1801935
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.738	0.775	0.803	0.655	0.851	0.755	0.833
Cum. Volume (L)			0.74	1.51	2.32	2.97	3.82	4.58	5.41
Pore Volumes			0.5	1.1	1.7	2.2	2.8	3.4	4.0
pH (RGS Measurement)			8.18	7.35	8.22	7.29	7.26	9.15	7.68
pH (ALS Measurement)			7.47	7.13	7.07	7.29	7.43	8.69	8.42
pH (deionised water used in test)			5.27	5.78	5.60	5.78	5.11	4.90	5.64
EC (RGS Measurement) (µS/cm)			360	499	395	268	232	268	202
EC (ALS Measurement) (µS/cm)			317	582	424	282	254	267	229
Acidity (mg/L)*			2	2	<1	2	2	<1	<1
Alkalinity (mg/L)*			14	30	12	12	14	31	30
Net Alkalinity (mg/L)*			12	28	12	10	12	31	30
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	2	7	6	3	4	4	4
Potassium (K)	1	-	1	2	2	2	2	2	2
Magnesium (Mg)	1	-	1	7	5	3	3	3	2
Sodium (Na)	1	-	33	75	64	42	37	42	37
Chloride (Cl)	1	-	75	147	105	67	55	56	40
Fluoride (F)	0.1	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate (SO_4)	1	1,000	13	16	20	15	13	18	21
Trace metals/ metalloids	**LoR**	**WQ Guidelines#**	All units mg/L						
Aluminium (Al)	0.01	5	0.14	0.02	0.04	0.13	0.1	0.21	0.22
Arsenic (As)	0.001	0.5	0.005	0.002	0.003	0.002	0.003	0.003	0.003
Boron (B)	0.05	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.002
Iron (Fe)	0.05	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn)	0.001	2	0.002	0.012	0.009	0.010	0.006	0.005	0.003
Molybdenum (Mo)	0.001	0.15	0.006	0.042	0.029	0.024	0.015	0.015	0.014
Nickel (Ni)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
Calculations**									
SO_4 Release Rate			6	8	11	7	7	9	12
Cumulative SO_4 Release			6	15	25	32	39	48	60
Ca Release Rate			1.0	3.6	3.2	1.3	2.3	2.0	2.2
Cumulative Ca Release			1.0	4.6	7.8	9.1	11.4	13.4	15.6
Mg Release Rate			0.5	3.6	2.7	1.3	1.7	1.5	1.1
Cumulative Mg Release			0.5	4.1	6.8	8.1	9.8	11.3	12.4
Residual ANC (%)			100.0	99.8	99.7	99.7	99.6	99.5	99.5
Residual Sulfur (%)			99.9	99.8	99.7	99.6	99.5	99.4	99.3
SO_4/(Ca+Mg) molar ratio			1.5	0.4	0.6	0.8	0.6	0.8	1.2

< 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.

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KLC 4 (Coal 100%)

Weight (kg)	1.50	**Total S (%)**	0.38	**ANC**	41.8
pH (1:5)	9.30	**Scr (%)**	0.140	**NAPP**	-37.5
EC (µS/cm)	458	**MPA**	4.3	**ANC:MPA**	9.7

Date			**09-May-17**	**09-Aug-17**	**05-Sep-17**	**03-Oct-17**	**07-Nov-17**	**15-Dec-18**	**16-Jan-18**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1713594	EB1716503	EB1718214	EB1720293	EB1723258	EB1725752	EB1801935
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.677	0.790	0.803	0.813	0.791	0.832	0.781
Cum. Volume (L)			0.68	1.47	2.27	3.08	3.87	4.71	5.49
Pore Volumes			0.5	1.1	1.7	2.3	2.9	3.5	4.1
pH (RGS Measurement)			8.67	7.32	8.27	7.33	7.26	8.48	7.47
pH (ALS Measurement)			7.14	7.04	7.14	7.22	7.45	7.77	7.68
pH (deionised water used in test)			5.27	5.78	5.60	5.78	5.11	4.90	5.64
EC (RGS Measurement) (µS/cm)			147	193	333	131	289	253	200
EC (ALS Measurement) (µS/cm)			185	231	352	135	303	230	220
Acidity (mg/L)*			1	1	<1	<1	1	1	<1
Alkalinity (mg/L)*			11	21	14	10	16	24	45
Net Alkalinity (mg/L)*			10	20	14	10	15	23	45
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	2	4	6	2	7	4	4
Potassium (K)	1	-	<1	1	2	1	2	2	2
Magnesium (Mg)	1	-	0.5	3	5	2	4	4	3
Sodium (Na)	1	-	22	29	52	19	42	33	33
Chloride (Cl)	1	-	27	48	84	26	52	39	30
Fluoride (F)	0.1	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate (SO_4)	1	1,000	6	7	16	10	36	30	34
Trace metals/ metalloids	**LoR**	**WQ Guidelines#**	All units mg/L						
Aluminium (Al)	0.01	5	0.05	0.05	0.03	0.11	0.04	0.08	0.11
Arsenic (As)	0.001	0.5	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	0.05	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	0.05	1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Manganese (Mn)	0.001	2	<0.001	0.005	0.001	0.002	0.006	0.006	0.006
Molybdenum (Mo)	0.001	0.15	0.003	0.007	0.014	0.006	0.011	0.007	0.008
Nickel (Ni)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**									
SO_4 Release Rate			2.7	3.7	8.6	5.4	19	17	18
Cumulative SO_4 Release			2.7	6.4	15.0	20.4	39	56	74
Ca Release Rate			0.9	2.1	3.2	1.1	3.7	2.2	2.1
Cumulative Ca Release			0.9	3.0	6.2	7.3	11.0	13.2	15.3
Mg Release Rate			0.2	1.6	2.7	1.1	2.1	2.2	1.6
Cumulative Mg Release			0.2	1.8	4.5	5.6	7.7	9.9	11.5
Residual ANC (%)			100.0	99.9	99.9	99.8	99.7	99.7	99.6
Residual Sulfur (%)			100.0	99.9	99.9	99.8	99.6	99.5	99.3
SO_4/(Ca+Mg) molar ratio			0.9	0.3	0.5	0.8	1.1	1.2	1.6

< 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.

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KLC 5 (Weathered Coal)

Weight (kg)	1.50	**Total S (%)**	0.29	**ANC**	16.6
pH (1:5)	7.30	**Scr (%)**	0.035	**NAPP**	-15.5
EC (µS/cm)	857	**MPA**	1.1	**ANC:MPA**	15.5

Date			**09-May-17**	**09-Aug-17**	**05-Sep-17**	**03-Oct-17**	**07-Nov-17**	**15-Dec-18**	**16-Jan-18**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1713594	EB1716503	EB1718214	EB1720293	EB1723258	EB1725752	EB1801935
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.641	0.795	0.846	0.752	0.845	0.851	0.870
Cum. Volume (L)			0.64	1.44	2.28	3.03	3.88	4.73	5.60
Pore Volumes			0.5	1.1	1.7	2.2	2.9	3.5	4.1
pH (RGS Measurement)			7.89	6.50	6.78	6.49	7.36	7.91	7.14
pH (ALS Measurement)			7.09	6.73	6.32	6.65	7.04	7.06	6.82
pH (deionised water used in test)			5.27	5.78	5.60	5.78	5.11	4.90	5.64
EC (RGS Measurement) (µS/cm)			171	385	403	795	305	245	169
EC (ALS Measurement) (µS/cm)			180	433	425	859	320	237	176
Acidity (mg/L)*			2	1	1	2	3	2	1
Alkalinity (mg/L)*			7	12	5	5	12	9	5
Net Alkalinity (mg/L)*			5	11	4	3	9	7	4
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	0.5	3	47	5	0.5	0.5	0.5
Potassium (K)	1	-	1	1	2	3	1	1	1
Magnesium (Mg)	1	-	0.5	5	6	9	1	1	0.5
Sodium (Na)	1	-	31	60	65	140	49	41	31
Chloride (Cl)	1	-	27	117	114	275	82	62	44
Fluoride (F)	0.1	2	0.2	<0.1	<0.1	0.1	0.2	<0.1	<0.1
Sulfate (SO_4)	1	1,000	4	9	17	21	12	9	7
Trace metals/ metalloids	**LoR**	**WQ Guidelines#**	All units mg/L						
Aluminium (Al)	0.01	5	2.3	0.06	0.04	0.01	0.26	0.46	0.88
Arsenic (As)	0.001	0.5	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	0.05	5	<0.05	<0.05	0.06	0.09	<0.05	<0.05	0.06
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	0.05	1	0.82	<0.05	<0.05	<0.05	0.17	0.19	0.32
Manganese (Mn)	0.001	2	0.002	0.004	0.005	0.006	0.001	0.002	<0.001
Molybdenum (Mo)	0.001	0.15	0.002	0.001	<0.001	0.001	0.001	<0.001	<0.001
Nickel (Ni)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	0.179
Calculations**									
SO_4 Release Rate			2	5	10	11	7	5	4
Cumulative SO_4 Release			2	6	16	27	33	38	43
Ca Release Rate			0.2	1.6	26.5	2.5	0.3	0.3	0.3
Cumulative Ca Release			0.2	1.8	28.3	30.8	31.1	31.4	31.7
Mg Release Rate			0.2	2.7	3.4	4.5	0.6	0.6	0.3
Cumulative Mg Release			0.2	2.9	6.2	10.8	11.3	11.9	12.2
Residual ANC (%)			100.0	99.9	99.4	99.3	99.3	99.2	99.2
Residual Sulfur (%)			100.0	99.9	99.8	99.7	99.6	99.6	99.5
SO_4/(Ca+Mg) molar ratio			1.3	0.3	0.1	0.4	2.3	1.7	2.2

< 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.

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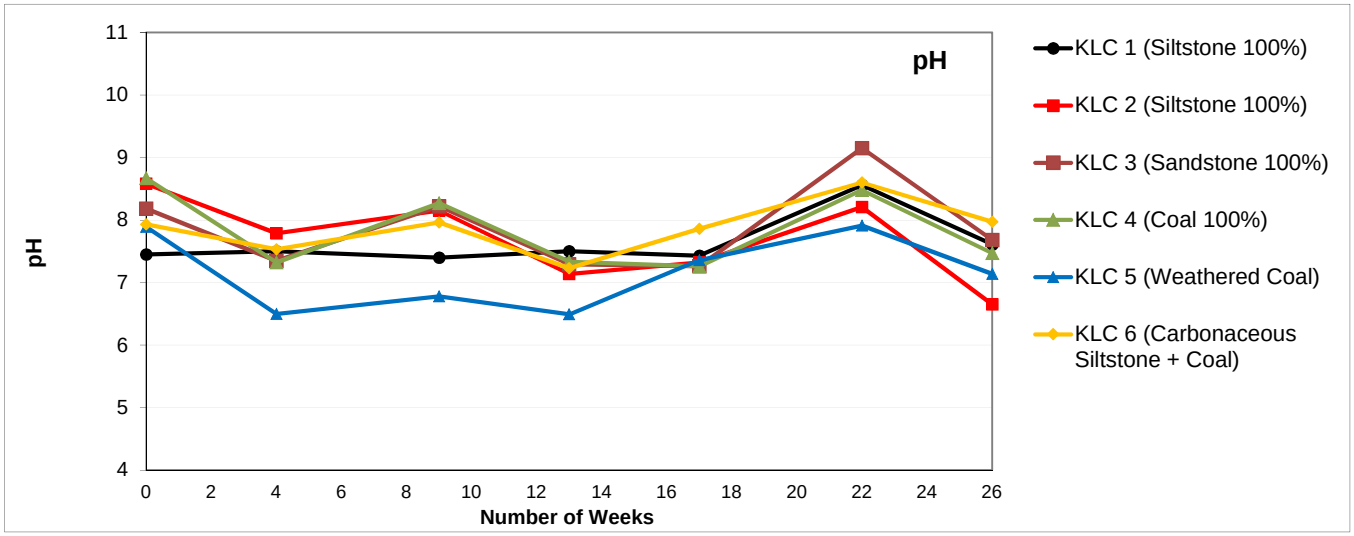
KLC 6 (Carbonaceous Siltstone + Coal)

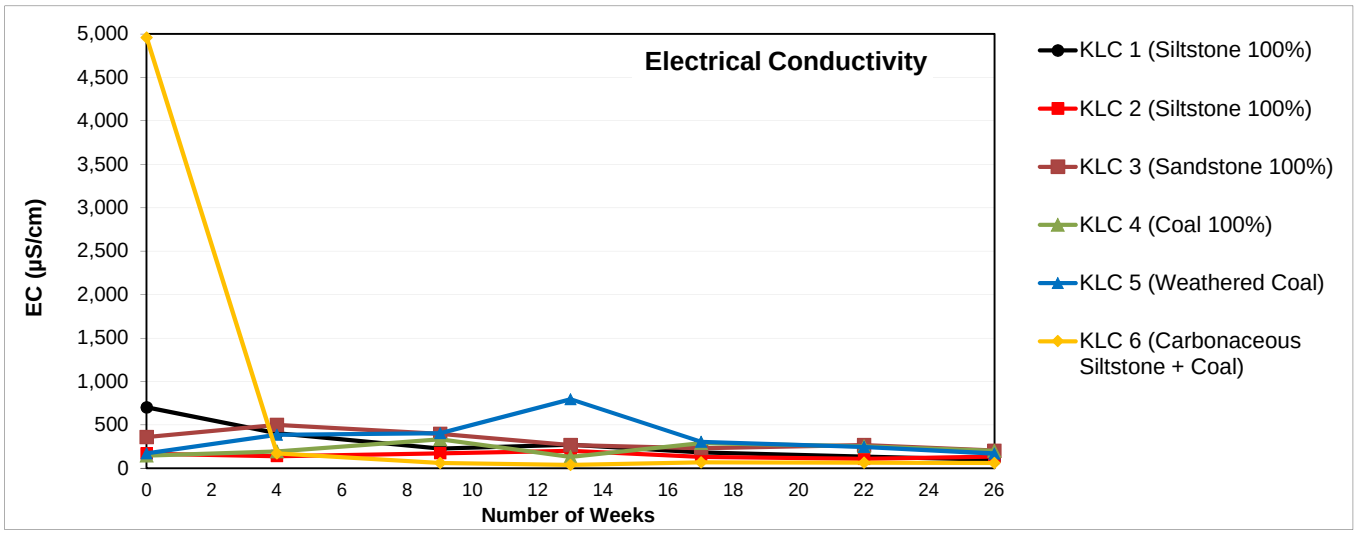
Weight (kg)	1.50	**Total S (%)**	0.36	**ANC**	23
pH (1:5)	8.80	**Scr (%)**	0.114	**NAPP**	-19.5
EC (µS/cm)	630	**MPA**	3.5	**ANC:MPA**	6.6

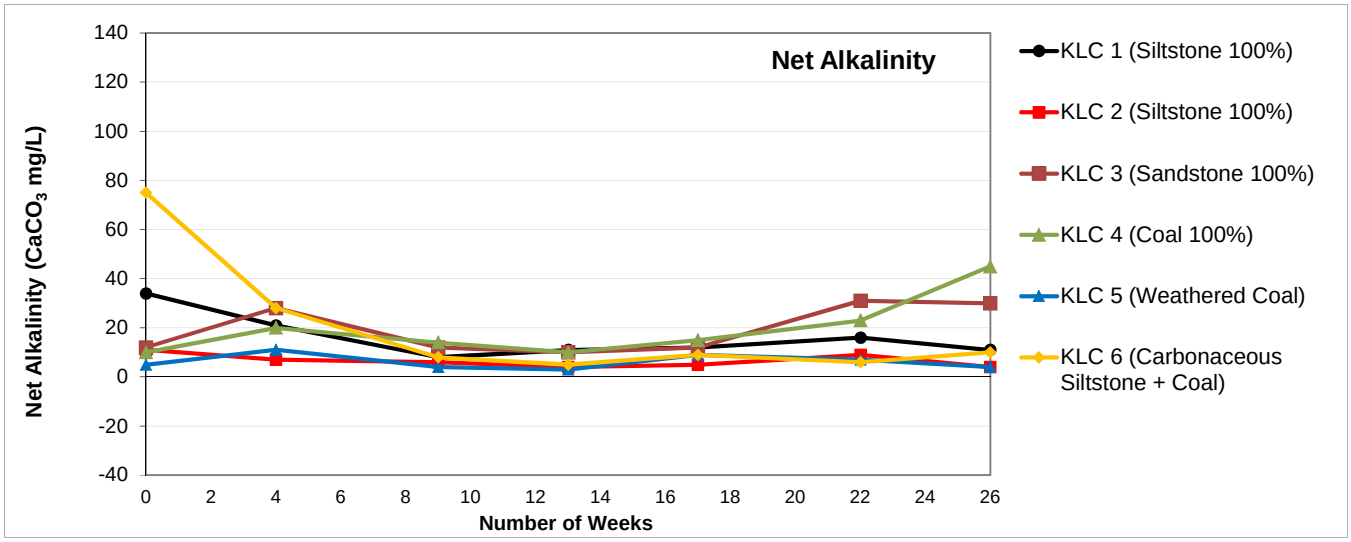
Date			**09-May-17**	**09-Aug-17**	**05-Sep-17**	**03-Oct-17**	**07-Nov-17**	**15-Dec-18**	**16-Jan-18**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1713594	EB1716503	EB1718214	EB1720293	EB1723258	EB1725752	EB1801935
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.591	0.754	0.837	0.811	0.887	0.893	0.876
Cum. Volume (L)			0.59	1.35	2.18	2.99	3.88	4.77	5.65
Pore Volumes			0.4	1.0	1.6	2.2	2.9	3.5	4.2
pH (RGS Measurement)			7.93	7.53	7.96	7.23	7.86	8.60	7.97
pH (ALS Measurement)			7.76	7.39	7.07	7.07	7.39	7.52	7.51
pH (deionised water used in test)			5.27	5.78	5.60	5.78	5.11	4.90	5.64
EC (RGS Measurement) (µS/cm)			4,960	171	60	39	69	63	61
EC (ALS Measurement) (µS/cm)			4,420	218	63	32	67	56	67
Acidity (mg/L)*			2	1	<1	<1	1	2	2
Alkalinity (mg/L)*			77	29	8	5	10	8	12
Net Alkalinity (mg/L)*			75	28	8	5	9	6	10
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	21	0.5	0.5	0.5	0.5	0.5	0.5
Potassium (K)	1	-	13	1	<1	<1	<1	<1	1
Magnesium (Mg)	1	-	21	0.5	0.5	0.5	0.5	0.5	0.5
Sodium (Na)	1	-	496	31	11	5	10	10	13
Chloride (Cl)	1	-	1,140	33	10	4	8	9	7
Fluoride (F)	0.1	2	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate (SO_4)	1	1,000	242	16	8	4	10	9	10
Trace metals/ metalloids	**LoR**	**WQ Guidelines#**	All units mg/L						
Aluminium (Al)	0.01	5	<0.01	0.58	0.54	0.25	0.21	0.41	1.29
Arsenic (As)	0.001	0.5	0.214	0.008	0.006	0.004	0.007	0.005	0.008
Boron (B)	0.05	5	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	0.05	1	<0.05	0.07	0.07	<0.05	0.05	0.07	0.16
Manganese (Mn)	0.001	2	0.023	0.002	0.001	0.002	0.002	0.003	0.002
Molybdenum (Mo)	0.001	0.15	0.067	0.009	0.005	0.002	0.003	0.002	0.002
Nickel (Ni)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**									
SO_4 Release Rate			95.3	8.0	4.5	2.2	6	5	6
Cumulative SO_4 Release			95.3	103.4	107.9	110.0	116	121	127
Ca Release Rate			8.3	0.3	0.3	0.3	0.3	0.3	0.3
Cumulative Ca Release			8.3	8.5	8.8	9.1	9.4	9.7	10.0
Mg Release Rate			8.3	0.3	0.3	0.3	0.3	0.3	0.3
Cumulative Mg Release			8.3	8.5	8.8	9.1	9.4	9.7	10.0
Residual ANC (%)			99.8	99.8	99.8	99.7	99.7	99.7	99.7
Residual Sulfur (%)			99.1	99.0	99.0	99.0	98.9	98.9	98.8
SO_4/(Ca+Mg) molar ratio			1.8	5.0	2.5	1.3	3.2	2.8	3.2

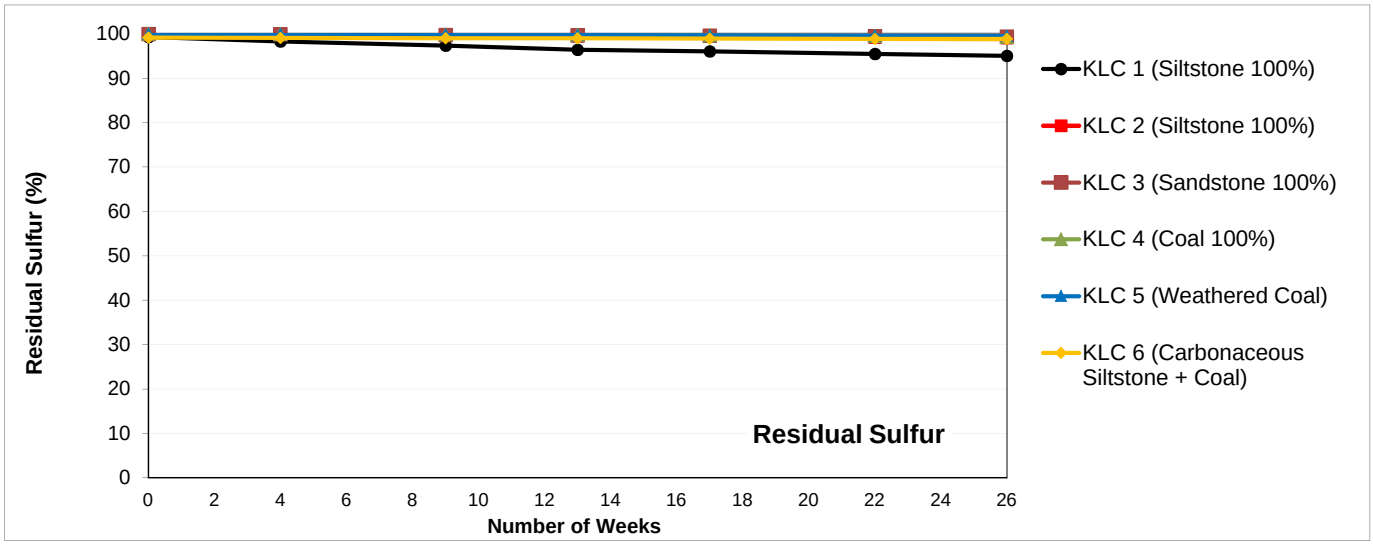
< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.
** SO_4, Ca and Mg release rates calculated in mg/kg/flush.
Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity.
MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

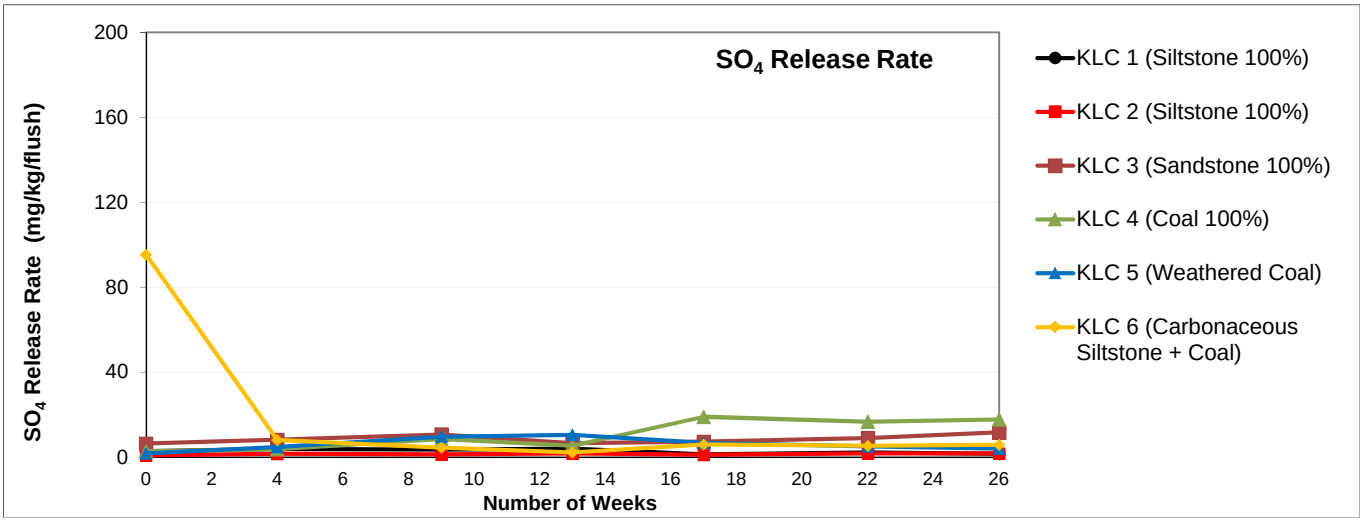
ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

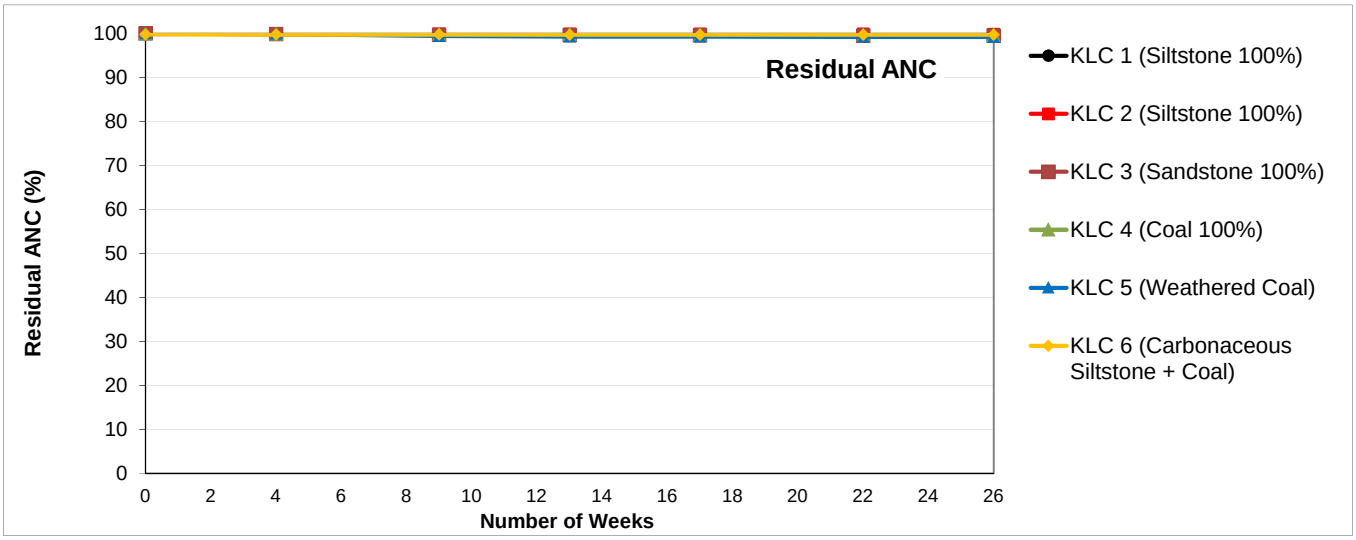

pH
pH
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

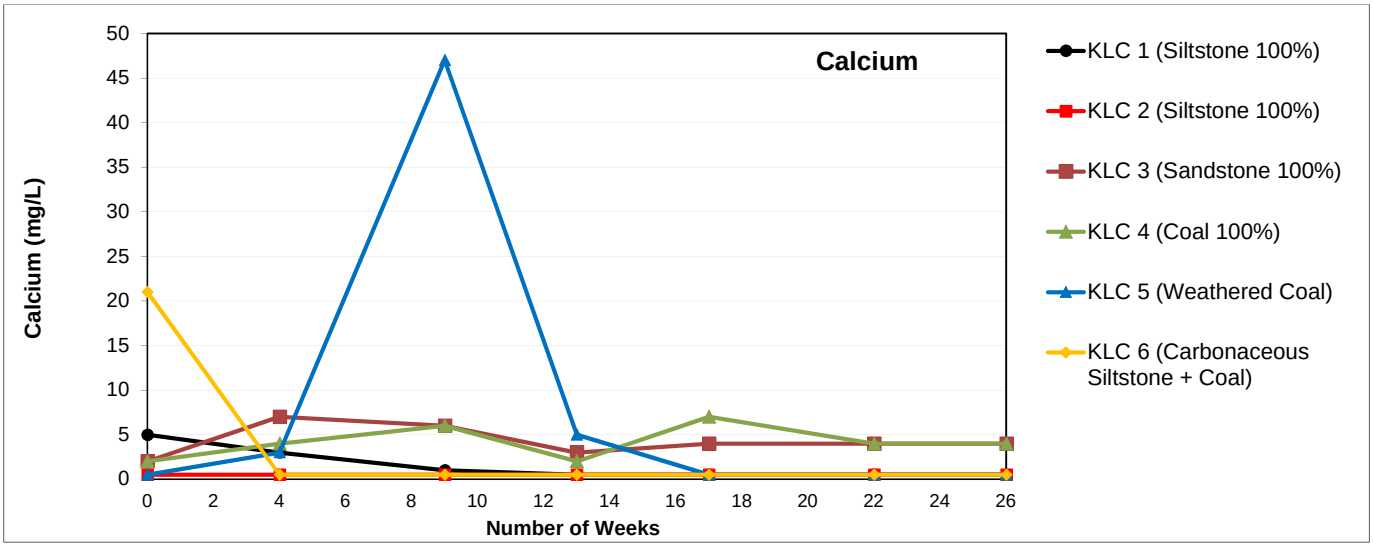

Electrical Conductivity
EC (µS/cm)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

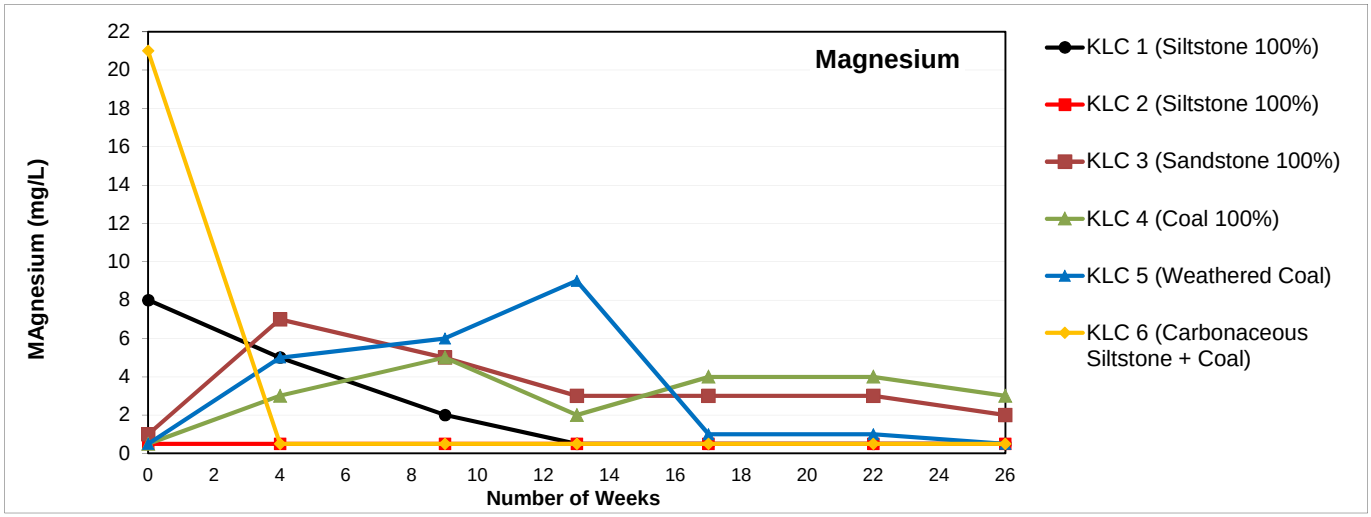

Net Alkalinity
Net Alkalinity (CaCO3 mg/L)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

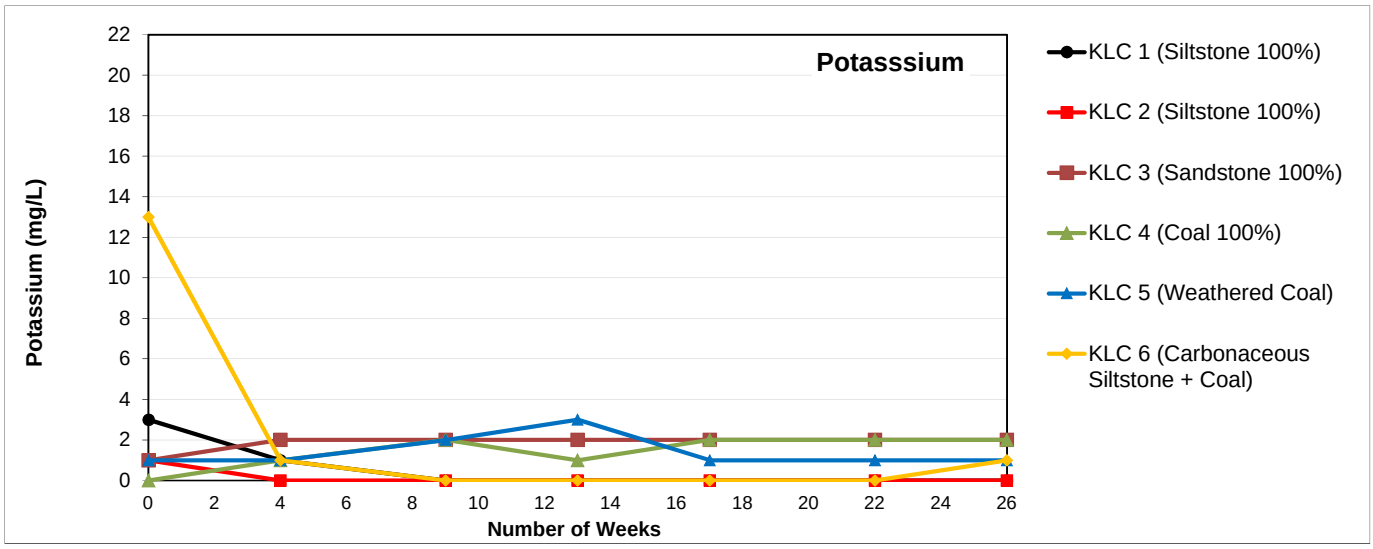

Residual Sulfur (%)
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
Residual Sulfur
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

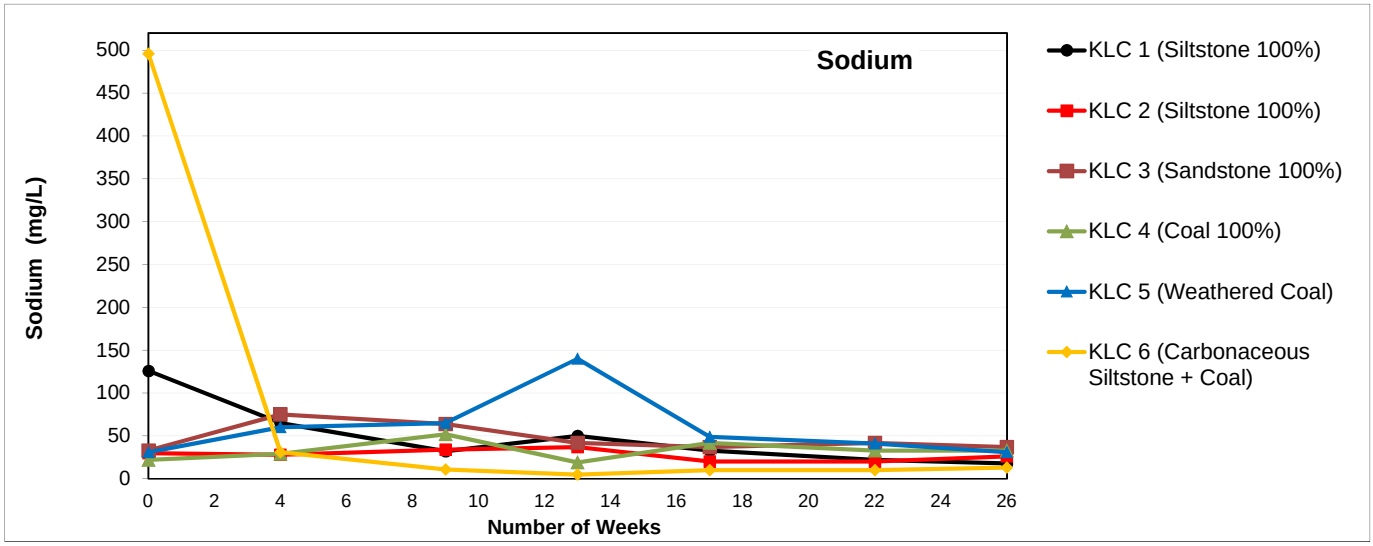

SO4 Release Rate (mg/kg/flush)
200
160
120
80
40
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
SO4 Release Rate
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

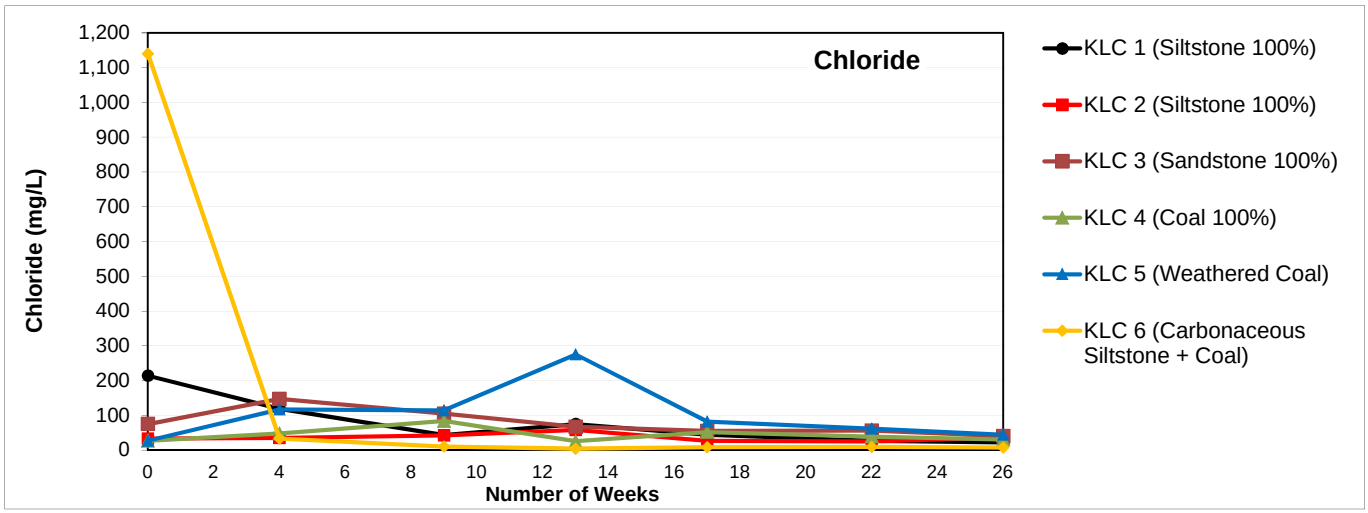

Residual ANC (%)
100
90
80
70
60
50
40
30
20
10
0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
Residual ANC
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

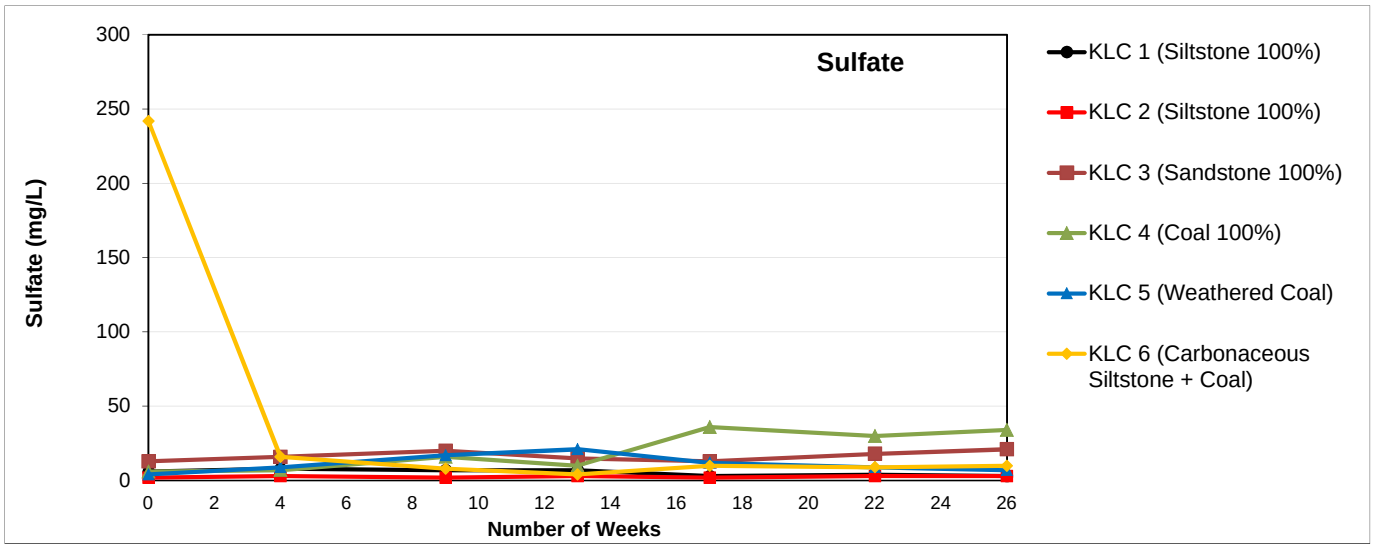

Calcium
Calcium (mg/L)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

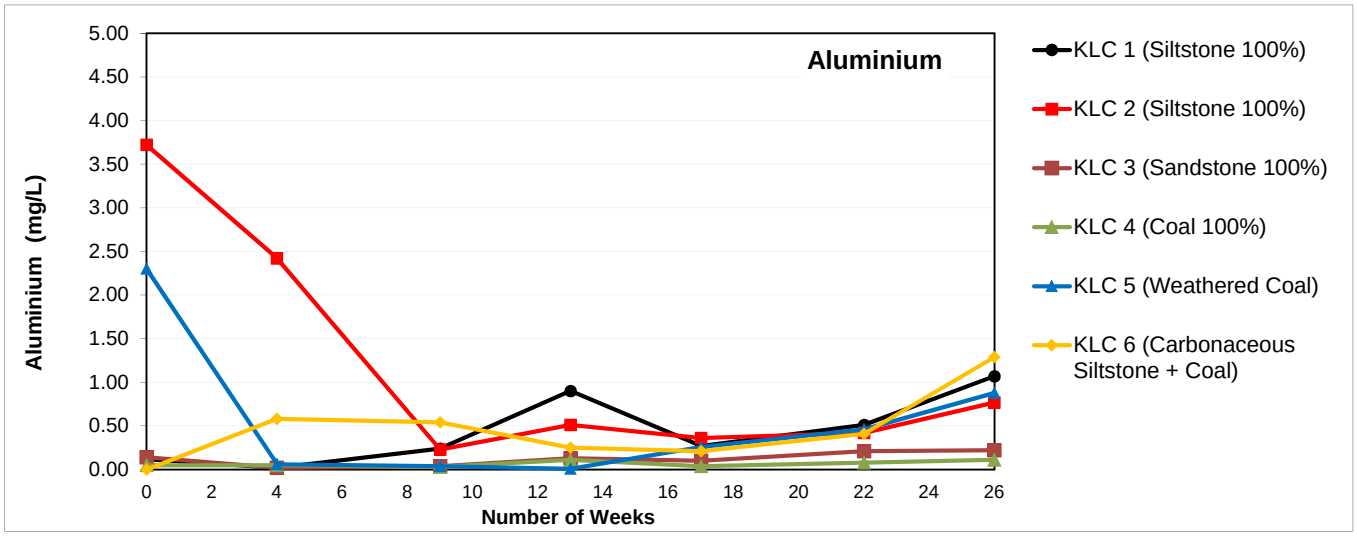

Magnesium
MAgnesium (mg/L)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

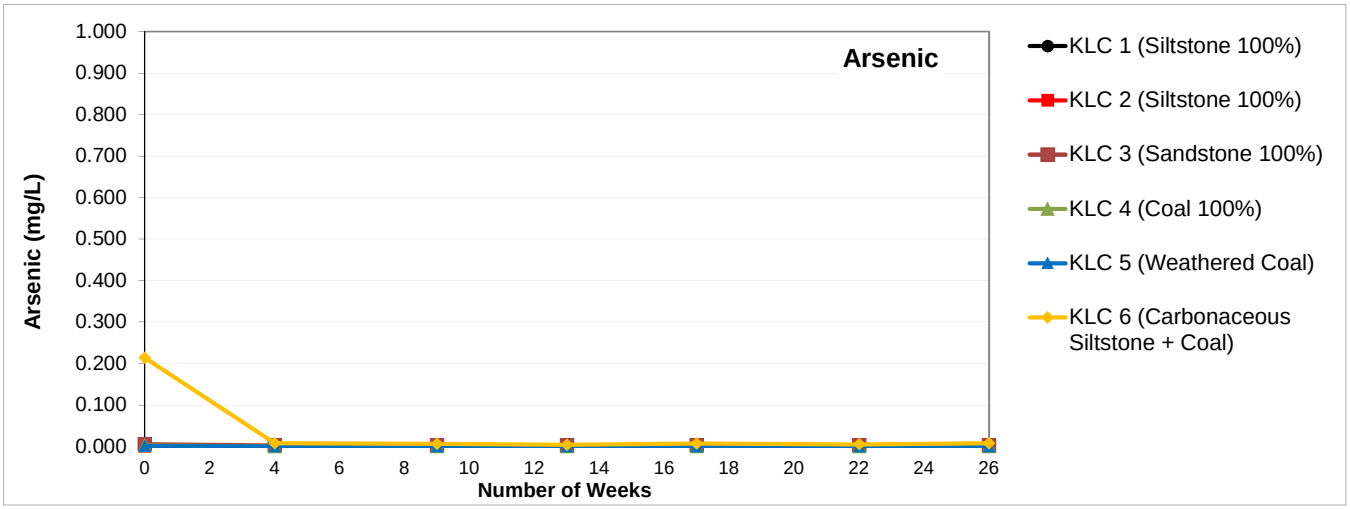

Potasssium
Potassium (mg/L)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

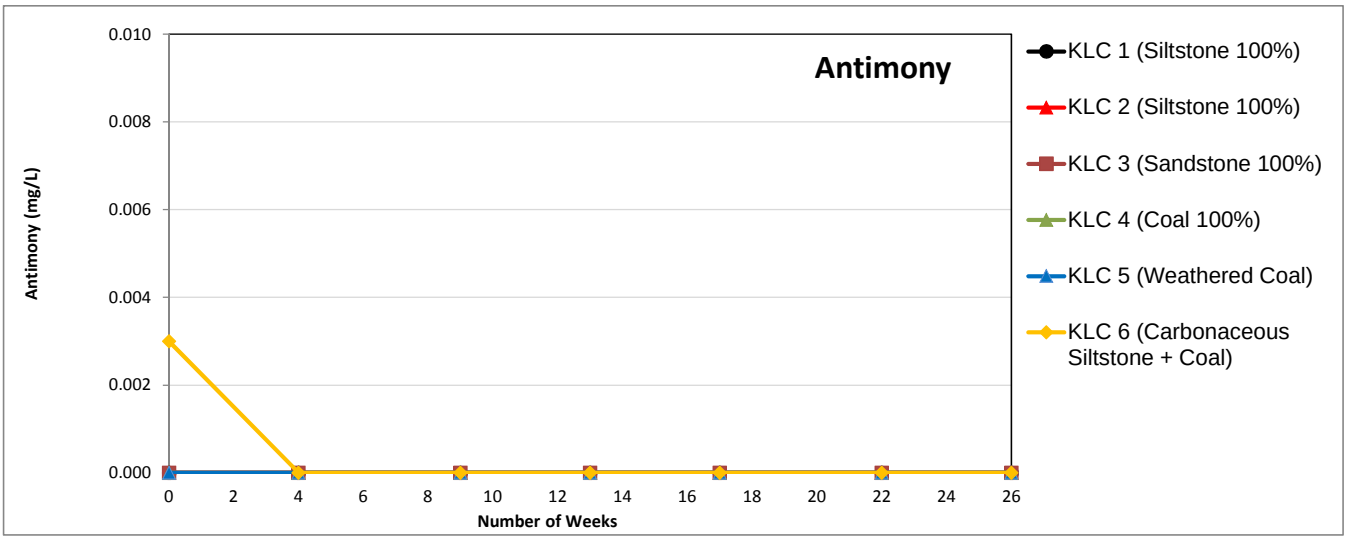

Sodium
Sodium (mg/L)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

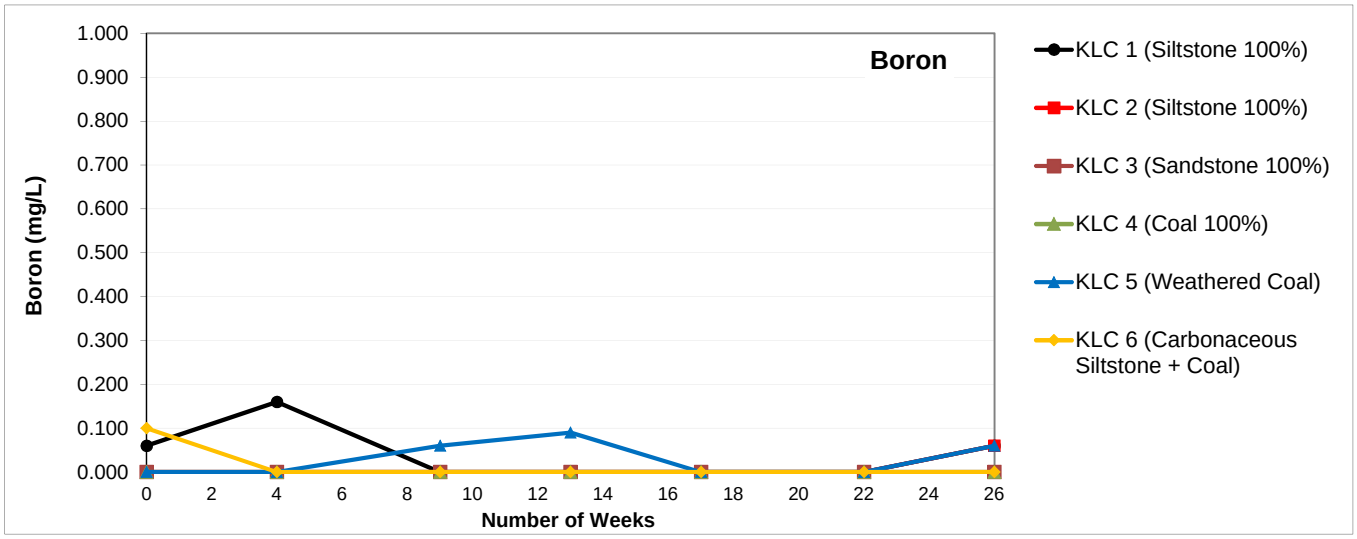

Chloride
Chloride (mg/L)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

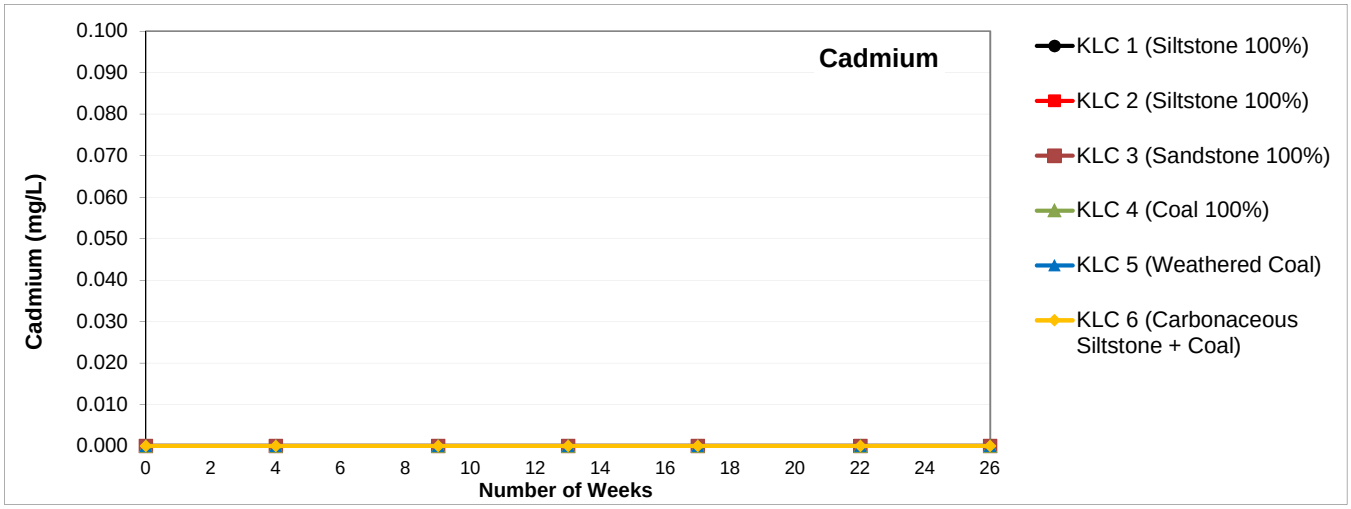

Sulfate
Sulfate (mg/L)
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

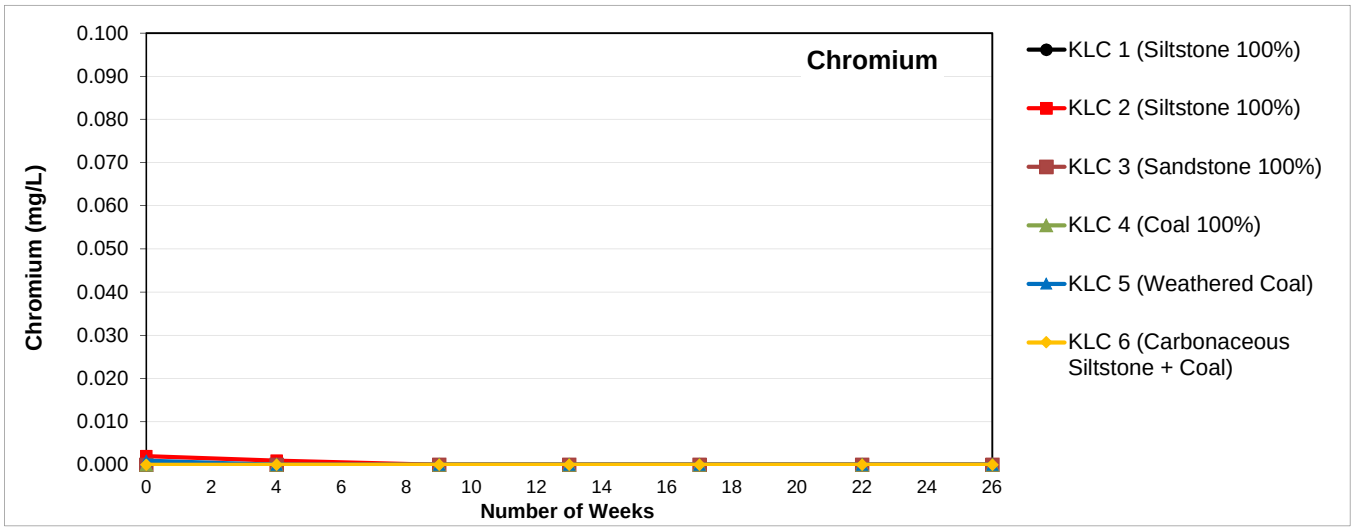

Aluminium
Aluminium (mg/L)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

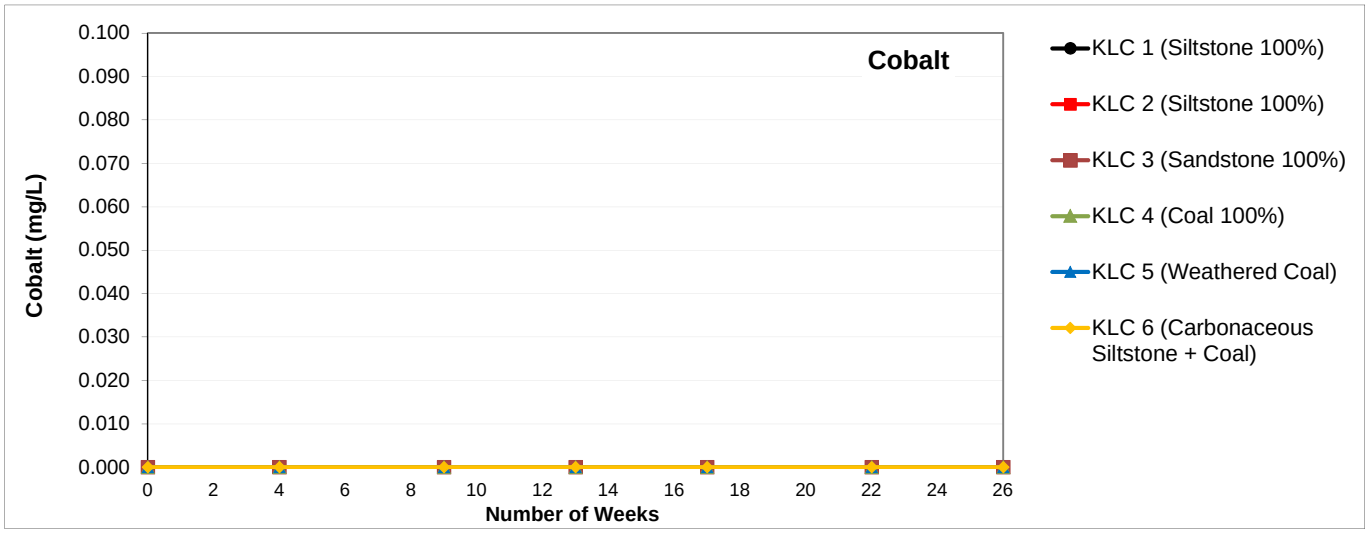

Arsenic
Arsenic (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Antimony
Antimony (mg/L)
0.010
0.008
0.006
0.004
0.002
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Boron
Boron (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Cadmium
Cadmium (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Chromium
Chromium (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Cobalt
Cobalt (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
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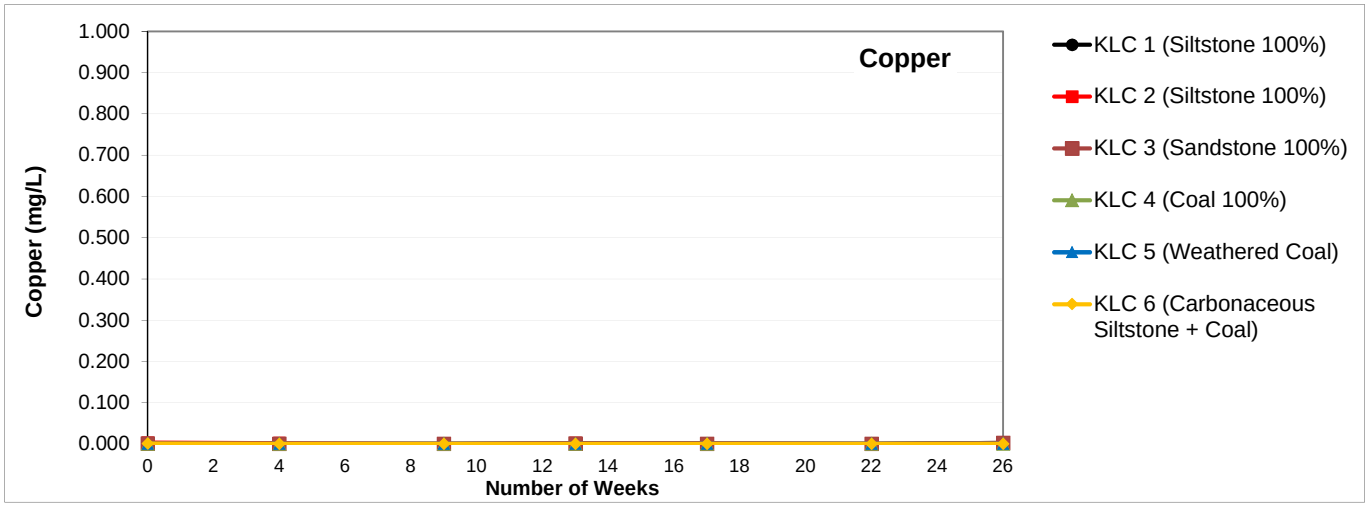
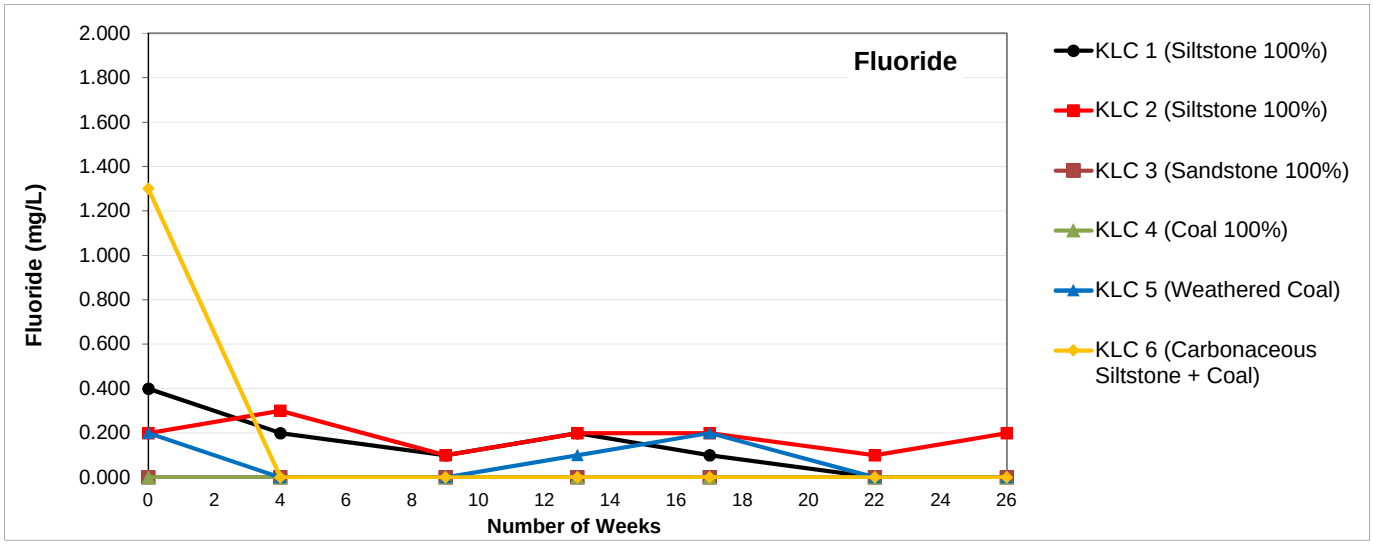
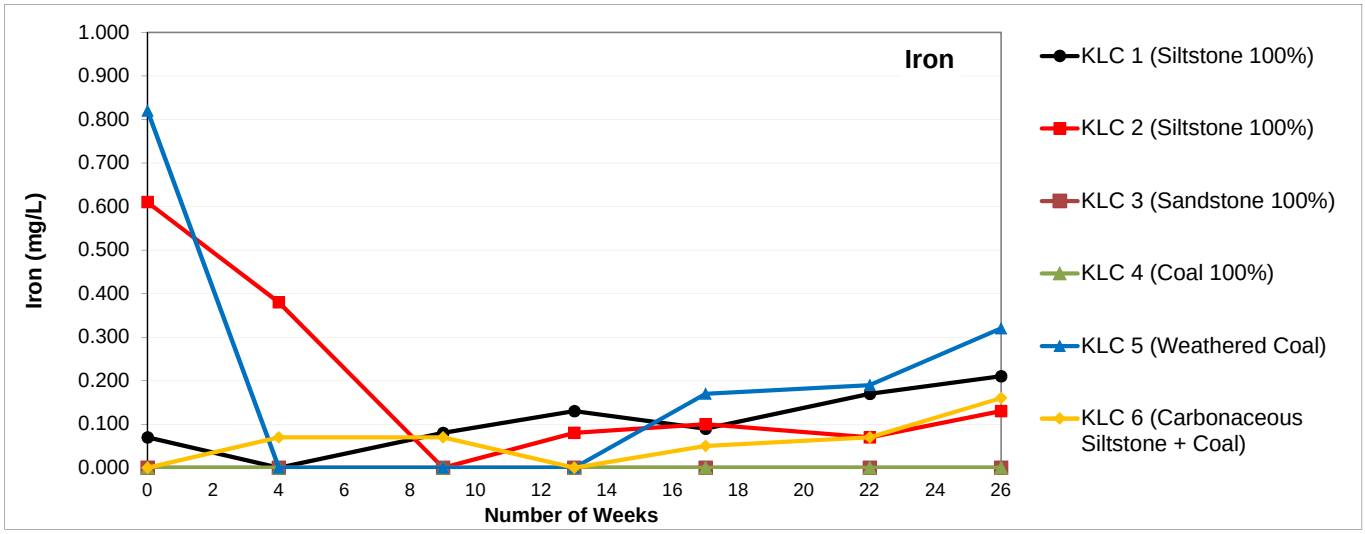
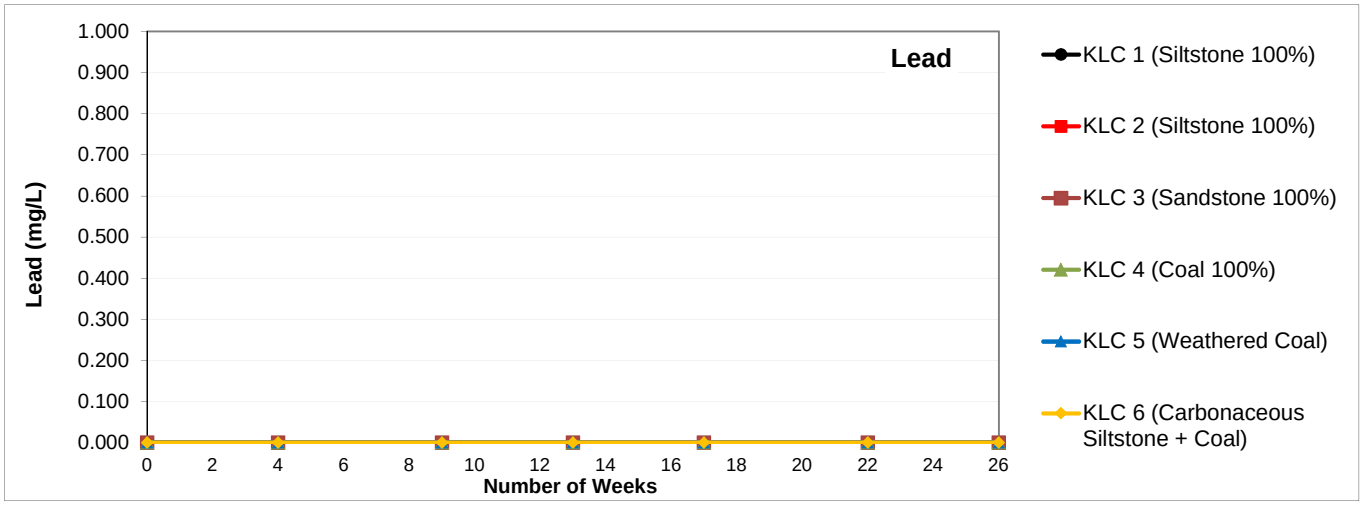
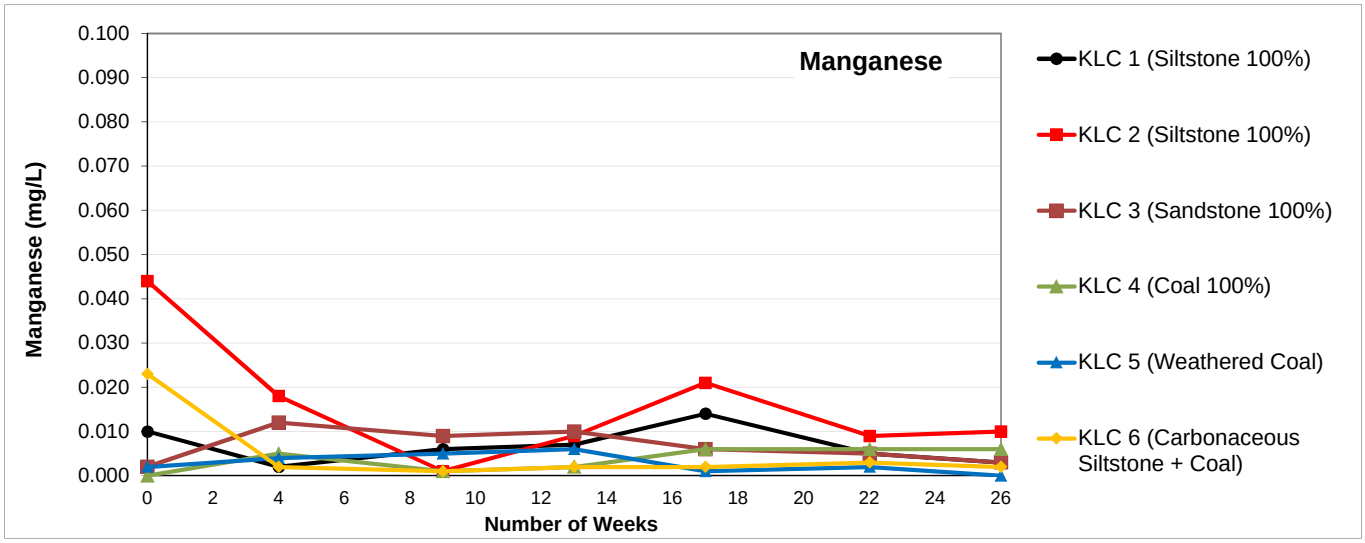
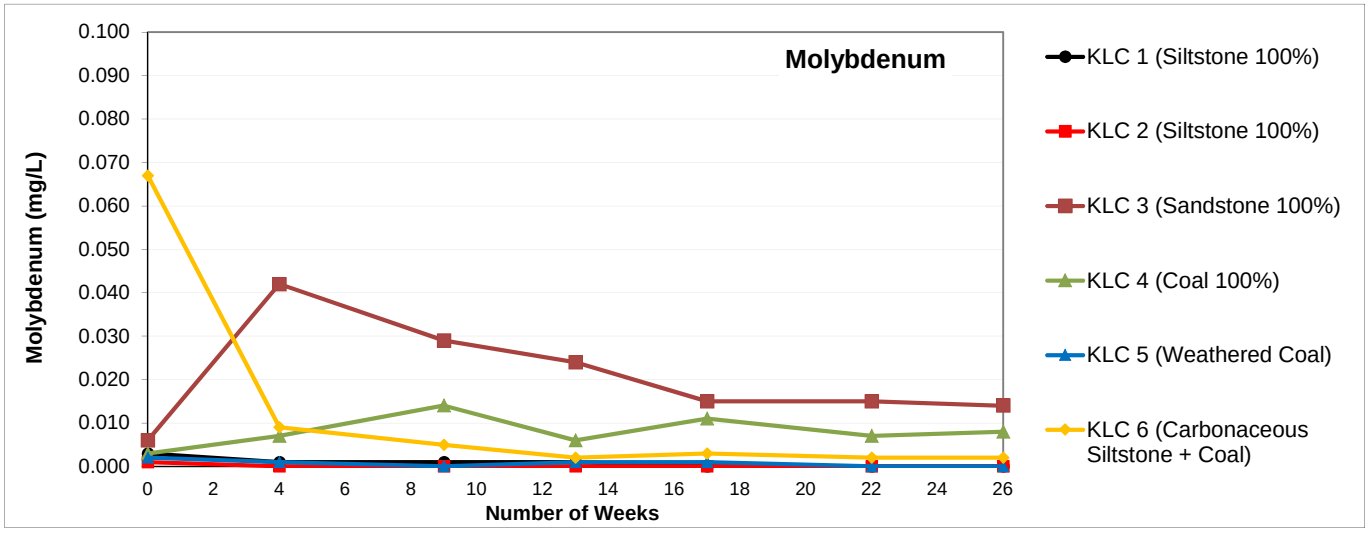

Copper
Copper (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

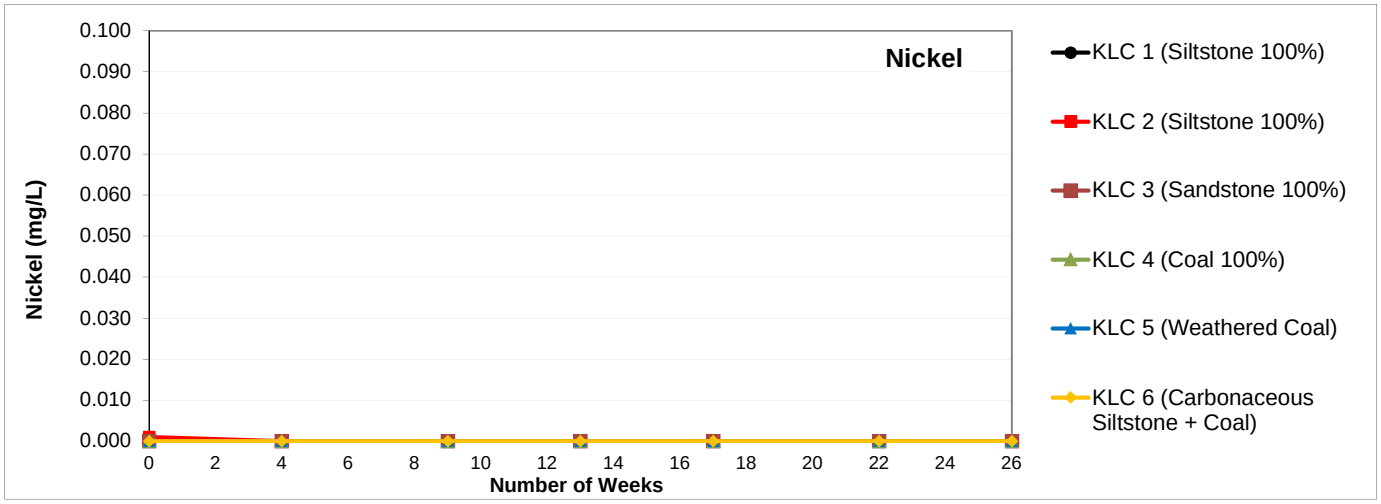

Fluoride
Fluoride (mg/L)
2.000
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

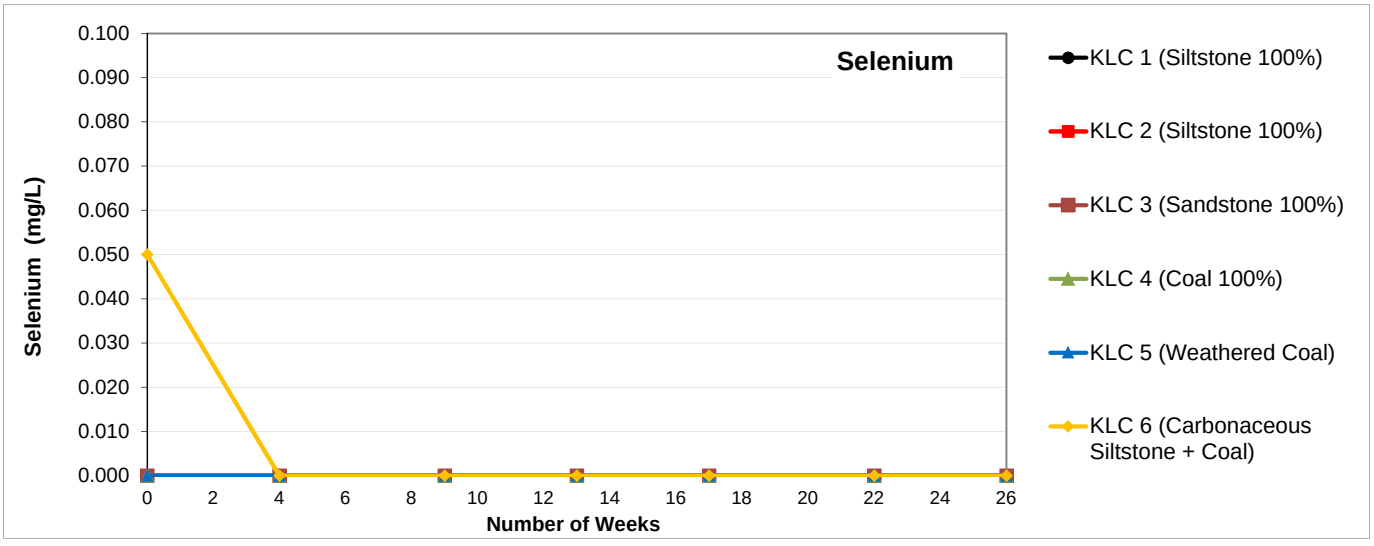

Iron
Iron (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

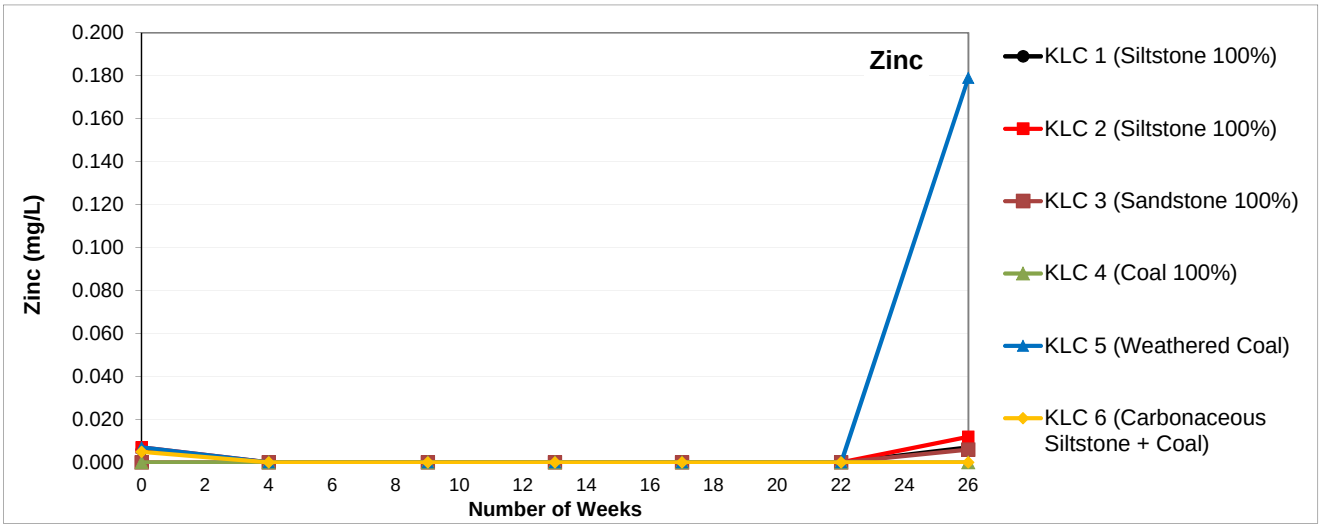

Lead
Lead (mg/L)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Manganese
Manganese (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Molybdenum
Molybdenum (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Nickel
Nickel (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Selenium
Selenium (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)


Zinc
Zinc (mg/L)
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
0
2
4
6
8
10
12
14
16
18
20
22
24
26
Number of Weeks
KLC 1 (Siltstone 100%)
KLC 2 (Siltstone 100%)
KLC 3 (Sandstone 100%)
KLC 4 (Coal 100%)
KLC 5 (Weathered Coal)
KLC 6 (Carbonaceous Siltstone + Coal)

ATTACHMENT E

ALS Laboratory Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1711745**	Page	: 1 of 17
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: Dingo West Coal Project	Date Samples Received	: 07-Jun-2017 15:30
Order number	: ----	Date Analysis Commenced	: 10-Jun-2017
C-O-C number	: ----	Issue Date	: 23-Jun-2017 07:35
Sampler	: ----		
Site	: ----		
Quote number	: BNBQ/218/16		
No. of samples received	: 71		
No. of samples analysed	: 71		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Satishkumar Trivedi	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils, Stafford, QLD

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 no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7002G01	7002G02	7002G03	7002G04	7002G05
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-001	EB1711745-002	EB1711745-003	EB1711745-004	EB1711745-005
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**6.5**	**5.0**	**7.1**	**7.6**	**7.6**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-4.9**	**-1.6**	**-3.5**	**-7.7**	**-9.8**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**646**	**1110**	**1220**	**684**	**450**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**5.5**	**1.6**	**3.5**	**7.7**	**9.8**
ANC as CaCO3	----	0.1	% CaCO3	**0.6**	**0.2**	**0.4**	**0.8**	**1.0**
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	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7002G06	7002G07	7002G08	7002G09	7002G10
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-006	EB1711745-007	EB1711745-008	EB1711745-009	EB1711745-010
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.5	9.6	9.5	9.4	9.6
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-51.6	-57.6	-78.3	-63.0	-122
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	409	305	270	296	304
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	52.2	58.5	78.9	63.6	123
ANC as CaCO3	----	0.1	% CaCO3	5.3	6.0	8.0	6.5	12.6
Fizz Rating	----	0	Fizz Unit	2	2	2	2	3
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.03	0.02	0.02	0.03

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7002G11	7002G12	7002G13	7002G14	7002G15
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-011	EB1711745-012	EB1711745-013	EB1711745-014	EB1711745-015
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.5**	**9.0**	**8.8**	**9.0**	**9.3**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-60.6**	**-7.9**	**-17.4**	**-24.9**	**-89.3**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**335**	**345**	**890**	**595**	**468**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**61.8**	**21.7**	**19.6**	**26.7**	**90.2**
ANC as CaCO3	----	0.1	% CaCO3	**6.3**	**2.2**	**2.0**	**2.7**	**9.2**
Fizz Rating	----	0	Fizz Unit	**2**	**1**	**1**	**1**	**2**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.04**	**0.45**	**0.07**	**0.06**	**0.03**

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7002G16	7002G17	7002G18	7002G19	7002G20
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-016	EB1711745-017	EB1711745-018	EB1711745-019	EB1711745-020
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.3	9.4	9.2	9.4	9.4
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-124	-99.1	-10.1	-45.9	-69.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	442	398	429	386	432
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	125	100	25.1	47.4	71.1
ANC as CaCO3	----	0.1	% CaCO3	12.7	10.2	2.6	4.8	7.2
Fizz Rating	----	0	Fizz Unit	3	2	1	2	2
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.03	0.49	0.05	0.04

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7002G21	7002G22	7003G01	7003G02	7003G03
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-021	EB1711745-022	EB1711745-023	EB1711745-024	EB1711745-025
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.6**	**9.4**	**5.2**	**5.5**	**6.8**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-88.4**	**-69.0**	**-1.0**	**-4.4**	**-6.6**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**333**	**579**	**1040**	**1080**	**893**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**91.2**	**71.1**	**1.6**	**4.4**	**7.8**
ANC as CaCO3	----	0.1	% CaCO3	**9.3**	**7.2**	**0.2**	**0.4**	**0.8**
Fizz Rating	----	0	Fizz Unit	**2**	**2**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.09**	**0.07**	**0.02**	<0.01	**0.04**

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7003G04	7003G05	7003G06	7003G07	7003G08
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-026	EB1711745-027	EB1711745-028	EB1711745-029	EB1711745-030
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.5**	**7.6**	**7.5**	**7.7**	**8.3**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-9.1**	**-11.8**	**-8.4**	**-11.2**	**-10.2**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**710**	**1170**	**1180**	**911**	**1140**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**9.7**	**12.4**	**9.0**	**11.8**	**12.7**
ANC as CaCO3	----	0.1	% CaCO3	**1.0**	**1.3**	**0.9**	**1.2**	**1.3**
Fizz Rating	----	0	Fizz Unit	**0**	**1**	**0**	**1**	**1**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.02**	**0.02**	**0.02**	**0.08**

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7003G09	7003G10	7003G11	7003G12	7003G13
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-031	EB1711745-032	EB1711745-033	EB1711745-034	EB1711745-035
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.3**	**7.2**	**7.6**	**8.3**	**8.0**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-1.1**	**-14.4**	**-19.6**	**-13.8**	**-1.4**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**807**	**906**	**1020**	**1230**	**937**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**11.5**	**21.7**	**21.8**	**16.3**	**13.6**
ANC as CaCO3	----	0.1	% CaCO3	**1.2**	**2.2**	**2.2**	**1.7**	**1.4**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**1**	**1**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.34**	**0.24**	**0.07**	**0.08**	**0.40**

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7003G14	7003G15	7003G16	7003G17	7003G18
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-036	EB1711745-037	EB1711745-038	EB1711745-039	EB1711745-040
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.2**	**8.2**	**8.6**	**9.0**	**8.8**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-11.5**	**-7.4**	**-17.5**	**-16.1**	**-28.2**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1120**	**1070**	**807**	**890**	**964**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**15.5**	**12.3**	**33.7**	**18.9**	**32.2**
ANC as CaCO3	----	0.1	% CaCO3	**1.6**	**1.2**	**3.4**	**1.9**	**3.3**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**2**	**1**	**2**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.13**	**0.16**	**0.53**	**0.09**	**0.13**

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7003G19	7003G20	7003G21	7003G22	7012G01
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-041	EB1711745-042	EB1711745-043	EB1711745-044	EB1711745-045
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.3	9.2	9.4	9.2	8.5
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-91.2	-77.7	-48.4	-50.6	-11.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	665	801	573	779	1070
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	91.8	78.9	53.6	52.8	12.1
ANC as CaCO3	----	0.1	% CaCO3	9.4	8.0	5.5	5.4	1.2
Fizz Rating	----	0	Fizz Unit	2	2	2	2	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.04	0.17	0.07	0.02

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7012G02	7012G03	7012G04	7012G05	7012G06
			Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-046	EB1711745-047	EB1711745-048	EB1711745-049	EB1711745-050
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.0**	**7.7**	**7.2**	**7.6**	**9.6**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-24.4**	**-8.1**	<0.5	**-8.7**	**-118**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**700**	**640**	**306**	**598**	**495**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**25.0**	**8.7**	**13.2**	**9.6**	**119**
ANC as CaCO3	----	0.1	% CaCO3	**2.6**	**0.9**	**1.4**	**1.0**	**12.2**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**0**	**3**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.02**	**0.44**	**0.03**	**0.03**

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7012G07	7012G08	7012G09	7012G10	7012G11
			Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-051	EB1711745-052	EB1711745-053	EB1711745-054	EB1711745-055
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.3	9.0	9.0	9.2	9.3
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-10.8	-11.7	-6.7	-10.0	4.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	460	620	454	529	640
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	17.8	16.0	12.2	12.4	12.0
ANC as CaCO3	----	0.1	% CaCO3	1.8	1.6	1.2	1.3	1.2
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.23	0.14	0.18	0.08	0.53

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7012G12	7012G13	7012G14	7012G15	7012G16
			Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-056	EB1711745-057	EB1711745-058	EB1711745-059	EB1711745-060
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.2**	**9.3**	**9.2**	**9.3**	**9.4**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-41.7**	**-141**	**5.8**	**-104**	**-25.7**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**802**	**616**	**697**	**758**	**666**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**43.5**	**142**	**12.6**	**106**	**30.9**
ANC as CaCO3	----	0.1	% CaCO3	**4.4**	**14.5**	**1.3**	**10.8**	**3.2**
Fizz Rating	----	0	Fizz Unit	**2**	**3**	**1**	**2**	**2**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.06**	**0.04**	**0.60**	**0.05**	**0.17**

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7012G17	7012G18	7012G19	7012G20	7012G21
			Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-061	EB1711745-062	EB1711745-063	EB1711745-064	EB1711745-065
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.5	9.4	9.5	9.6	9.7
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-71.9	-112	-69.2	-133	-57.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	646	585	634	554	697
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	73.4	113	70.7	137	58.5
ANC as CaCO3	----	0.1	% CaCO3	7.5	11.6	7.2	13.9	6.0
Fizz Rating	----	0	Fizz Unit	2	2	2	3	2
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.05	0.04	0.05	0.13	0.02

Analytical Results

Sub-Matrix: ROCK (Matrix: SOIL)			Client sample ID	7012G22	7012G23	7012G24	7012G25	7012G26
			Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1711745-066	EB1711745-067	EB1711745-068	EB1711745-069	EB1711745-070
				Result	Result	Result	Result	Result
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.5**	**9.2**	**9.5**	**9.0**	**9.5**
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-108**	**-49.5**	**-67.0**	**-42.3**	**-39.8**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**640**	**802**	**714**	**1440**	**722**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**109**	**51.3**	**69.5**	**50.6**	**42.6**
ANC as CaCO3	----	0.1	% CaCO3	**11.1**	**5.2**	**7.1**	**5.2**	**4.3**
Fizz Rating	----	0	Fizz Unit	**3**	**2**	**2**	**2**	**2**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.06**	**0.08**	**0.27**	**0.09**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	DI water used in 1:5 leach	----	----	----	----
				Client sampling date / time	07-Jun-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1711745-071	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**6.61**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		<1	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1713010**	Page	: 1 of 16
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo west	Date Samples Received	: 26-Jun-2017 09:32
Order number	: ----	Date Analysis Commenced	: 29-Jun-2017
C-O-C number	: ----	Issue Date	: 04-Jul-2017 14:39
Sampler	: ----		
Site	: ----		
Quote number	: BNBQ/218/16		
No. of samples received	: 39		
No. of samples analysed	: 28		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Andrew Epps	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Ben Felgendrejeris		Brisbane Acid Sulphate Soils, Stafford, QLD

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 no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- **The samples in this work order have been re-batched from EB1711745.**
- ED037 (Alkalinity): NATA accreditation does not cover the performance of this service.
- ED038 (Acidity): NATA accreditation does not cover the performance of this service.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	7002G02	7002G03	7002G08	7002G12	7002G18
			Client sampling date / time	26-Jun-2017 00:00	26-Jun-2017 00:00	26-Jun-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1713010-001	EB1713010-002	EB1713010-007	EB1713010-008	EB1713010-009
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	----	----	----	0.134	0.094
ED005: Exchange Acidity								
Exchange Acidity	----	0.1	meq/100g	0.2	----	----	----	----
Exchangeable Aluminium	----	0.1	meq/100g	0.1	----	----	----	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	3.0	----	----
Exchangeable Magnesium	----	0.2	meq/100g	----	----	2.0	----	----
Exchangeable Potassium	----	0.2	meq/100g	----	----	<0.2	----	----
Exchangeable Sodium	----	0.2	meq/100g	----	----	0.2	----	----
Cation Exchange Capacity	----	0.2	meq/100g	----	----	5.3	----	----
Exchangeable Sodium Percent	----	0.2	%	----	----	4.5	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	1.8	2.3	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	10.8	11.9	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	0.4	0.4	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	2.9	3.3	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	16.1	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	18.0	----	----	----
Exchangeable Sodium Percent	----	0.1	%	18.2	18.4	----	----	----
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	----	1220	16800	----	2790
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	1220	16500	----	2700
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	<5	270	----	90
ED038A: Acidity								
ø Acidity	----	1	mg/kg	----	204	<5	----	<5
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	<10	40	----	150
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	2000	300	----	470
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	<10	30	----	40
Magnesium	7439-95-4	10	mg/kg	----	30	20	----	20
Sodium	7440-23-5	10	mg/kg	----	1240	230	----	350
Potassium	7440-09-7	10	mg/kg	----	20	50	----	40

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7002G02	7002G03	7002G08	7002G12	7002G18
				Client sampling date / time	26-Jun-2017 00:00	26-Jun-2017 00:00	26-Jun-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713010-001	EB1713010-002	EB1713010-007	EB1713010-008	EB1713010-009
					Result	Result	Result	Result	Result
ED093T: Total Major Cations									
Calcium	7440-70-2	50	mg/kg		----	610	26600	----	9050
Magnesium	7439-95-4	50	mg/kg		----	2200	11200	----	5130
Sodium	7440-23-5	50	mg/kg		----	2130	530	----	680
Potassium	7440-09-7	50	mg/kg		----	1040	1140	----	1280
EG005S : Soluble Metals by ICPAES									
Aluminium	7429-90-5	1	mg/kg		----	<1	<1	----	<1
Antimony	7440-36-0	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Arsenic	7440-38-2	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Barium	7440-39-3	1	mg/kg		----	<1	<1	----	<1
Cadmium	7440-43-9	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Chromium	7440-47-3	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Copper	7440-50-8	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Iron	7439-89-6	1	mg/kg		----	<1	<1	----	<1
Lead	7439-92-1	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Manganese	7439-96-5	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Molybdenum	7439-98-7	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Nickel	7440-02-0	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Selenium	7782-49-2	0.1	mg/kg		----	0.1	<0.1	----	<0.1
Vanadium	7440-62-2	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
Zinc	7440-66-6	0.1	mg/kg		----	<0.1	<0.1	----	<0.1
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	5570	12000	----	6680
Antimony	7440-36-0	5	mg/kg		----	<5	<5	----	<5
Arsenic	7440-38-2	5	mg/kg		----	10	5	----	9
Barium	7440-39-3	10	mg/kg		----	240	120	----	500
Cadmium	7440-43-9	1	mg/kg		----	<1	<1	----	<1
Chromium	7440-47-3	2	mg/kg		----	14	29	----	8
Cobalt	7440-48-4	2	mg/kg		----	114	13	----	5
Copper	7440-50-8	5	mg/kg		----	63	20	----	27
Iron	7439-89-6	50	mg/kg		----	14000	36200	----	30400
Lead	7439-92-1	5	mg/kg		----	16	11	----	10
Manganese	7439-96-5	5	mg/kg		----	748	1030	----	448
Molybdenum	7439-98-7	2	mg/kg		----	<2	<2	----	<2
Nickel	7440-02-0	2	mg/kg		----	75	24	----	20

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7002G02	7002G03	7002G08	7002G12	7002G18
				Client sampling date / time	26-Jun-2017 00:00	26-Jun-2017 00:00	26-Jun-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713010-001	EB1713010-002	EB1713010-007	EB1713010-008	EB1713010-009
					Result	Result	Result	Result	Result
EG005T: Total Metals by ICP-AES - Continued									
Selenium	7782-49-2	5	mg/kg		----	<5	<5	----	<5
Vanadium	7440-62-2	5	mg/kg		----	**31**	**49**	----	**18**
Zinc	7440-66-6	5	mg/kg		----	**76**	**60**	----	**49**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	7002G20	7003G02	7003G06	7003G09	7003G10
			Client sampling date / time	26-Jun-2017 00:00	26-Jun-2017 00:00	26-Jun-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1713010-010	EB1713010-012	EB1713010-016	EB1713010-019	EB1713010-020
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	----	----	----	0.056	0.014
ED005: Exchange Acidity								
Exchange Acidity	----	0.1	meq/100g	----	<0.1	----	----	----
Exchangeable Aluminium	----	0.1	meq/100g	----	<0.1	----	----	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	3.4	----	2.6	----	----
Exchangeable Magnesium	----	0.2	meq/100g	2.2	----	6.8	----	----
Exchangeable Potassium	----	0.2	meq/100g	<0.2	----	<0.2	----	----
Exchangeable Sodium	----	0.2	meq/100g	0.8	----	4.4	----	----
Cation Exchange Capacity	----	0.2	meq/100g	6.4	----	13.9	----	----
Exchangeable Sodium Percent	----	0.2	%	12.8	----	31.5	----	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	2.0	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	8.5	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	0.3	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	4.2	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	15.1	----	----	----
Exchangeable Sodium Percent	----	0.1	%	----	28.0	----	----	----
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	----	----	3060	4140	----
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	3060	4140	----
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	<5	<5	----
ED038A: Acidity								
ø Acidity	----	1	mg/kg	----	----	196	506	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	40	220	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	----	1970	1380	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	<10	<10	----
Magnesium	7439-95-4	10	mg/kg	----	----	<10	10	----
Sodium	7440-23-5	10	mg/kg	----	----	1260	940	----
Potassium	7440-09-7	10	mg/kg	----	----	20	40	----
ED093T: Total Major Cations								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7002G20	7003G02	7003G06	7003G09	7003G10
				Client sampling date / time	26-Jun-2017 00:00	26-Jun-2017 00:00	26-Jun-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713010-010	EB1713010-012	EB1713010-016	EB1713010-019	EB1713010-020
					Result	Result	Result	Result	Result
ED093T: Total Major Cations - Continued									
Calcium	7440-70-2	50	mg/kg		----	----	3480	4030	----
Magnesium	7439-95-4	50	mg/kg		----	----	4720	3220	----
Sodium	7440-23-5	50	mg/kg		----	----	3020	2240	----
Potassium	7440-09-7	50	mg/kg		----	----	2070	1450	----
EG005S : Soluble Metals by ICPAES									
Aluminium	7429-90-5	1	mg/kg		----	----	<1	<1	----
Antimony	7440-36-0	0.1	mg/kg		----	----	<0.1	<0.1	----
Arsenic	7440-38-2	0.1	mg/kg		----	----	<0.1	<0.1	----
Barium	7440-39-3	1	mg/kg		----	----	<1	<1	----
Cadmium	7440-43-9	0.1	mg/kg		----	----	<0.1	<0.1	----
Chromium	7440-47-3	0.1	mg/kg		----	----	<0.1	<0.1	----
Copper	7440-50-8	0.1	mg/kg		----	----	<0.1	<0.1	----
Iron	7439-89-6	1	mg/kg		----	----	<1	<1	----
Lead	7439-92-1	0.1	mg/kg		----	----	<0.1	<0.1	----
Manganese	7439-96-5	0.1	mg/kg		----	----	<0.1	<0.1	----
Molybdenum	7439-98-7	0.1	mg/kg		----	----	<0.1	<0.1	----
Nickel	7440-02-0	0.1	mg/kg		----	----	<0.1	<0.1	----
Selenium	7782-49-2	0.1	mg/kg		----	----	<0.1	0.1	----
Vanadium	7440-62-2	0.1	mg/kg		----	----	<0.1	<0.1	----
Zinc	7440-66-6	0.1	mg/kg		----	----	<0.1	<0.1	----
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	----	11100	6280	----
Antimony	7440-36-0	5	mg/kg		----	----	<5	<5	----
Arsenic	7440-38-2	5	mg/kg		----	----	43	10	----
Barium	7440-39-3	10	mg/kg		----	----	130	620	----
Cadmium	7440-43-9	1	mg/kg		----	----	<1	<1	----
Chromium	7440-47-3	2	mg/kg		----	----	12	6	----
Cobalt	7440-48-4	2	mg/kg		----	----	9	8	----
Copper	7440-50-8	5	mg/kg		----	----	58	34	----
Iron	7439-89-6	50	mg/kg		----	----	19800	16900	----
Lead	7439-92-1	5	mg/kg		----	----	16	7	----
Manganese	7439-96-5	5	mg/kg		----	----	79	59	----
Molybdenum	7439-98-7	2	mg/kg		----	----	<2	<2	----
Nickel	7440-02-0	2	mg/kg		----	----	33	15	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7002G20	7003G02	7003G06	7003G09	7003G10
				Client sampling date / time	26-Jun-2017 00:00	26-Jun-2017 00:00	26-Jun-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713010-010	EB1713010-012	EB1713010-016	EB1713010-019	EB1713010-020
					Result	Result	Result	Result	Result
EG005T: Total Metals by ICP-AES - Continued									
Selenium	7782-49-2	5	mg/kg		----	----	<5	<5	----
Vanadium	7440-62-2	5	mg/kg		----	----	**40**	**29**	----
Zinc	7440-66-6	5	mg/kg		----	----	**69**	**55**	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	7003G13	7003G14	7003G15	7003G16	7003G18
			Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit	EB1713010-021	EB1713010-022	EB1713010-023	EB1713010-024	EB1713010-025
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.102	0.060	0.106	0.194	0.072
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	----	1.3	----
Exchangeable Magnesium	----	0.2	meq/100g	----	----	----	1.9	----
Exchangeable Potassium	----	0.2	meq/100g	----	----	----	<0.2	----
Exchangeable Sodium	----	0.2	meq/100g	----	----	----	1.0	----
Cation Exchange Capacity	----	0.2	meq/100g	----	----	----	4.2	----
Exchangeable Sodium Percent	----	0.2	%	----	----	----	24.0	----
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	----	----	----	1890	----
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	----	1890	----
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	----	<5	----
ED038A: Acidity								
ø Acidity	----	1	mg/kg	----	----	----	16	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	----	320	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	----	----	1190	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	----	20	----
Magnesium	7439-95-4	10	mg/kg	----	----	----	20	----
Sodium	7440-23-5	10	mg/kg	----	----	----	850	----
Potassium	7440-09-7	10	mg/kg	----	----	----	50	----
ED093T: Total Major Cations								
Calcium	7440-70-2	50	mg/kg	----	----	----	8890	----
Magnesium	7439-95-4	50	mg/kg	----	----	----	7510	----
Sodium	7440-23-5	50	mg/kg	----	----	----	1320	----
Potassium	7440-09-7	50	mg/kg	----	----	----	1340	----
EG005S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	----	----	----	<1	----
Antimony	7440-36-0	0.1	mg/kg	----	----	----	<0.1	----
Arsenic	7440-38-2	0.1	mg/kg	----	----	----	<0.1	----
Barium	7440-39-3	1	mg/kg	----	----	----	<1	----
Cadmium	7440-43-9	0.1	mg/kg	----	----	----	<0.1	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7003G13	7003G14	7003G15	7003G16	7003G18
				Client sampling date / time	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00	26-May-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713010-021	EB1713010-022	EB1713010-023	EB1713010-024	EB1713010-025
					Result	Result	Result	Result	Result
EG005S : Soluble Metals by ICPAES - Continued									
Chromium	7440-47-3	0.1	mg/kg		----	----	----	<0.1	----
Copper	7440-50-8	0.1	mg/kg		----	----	----	<0.1	----
Iron	7439-89-6	1	mg/kg		----	----	----	<1	----
Lead	7439-92-1	0.1	mg/kg		----	----	----	<0.1	----
Manganese	7439-96-5	0.1	mg/kg		----	----	----	<0.1	----
Molybdenum	7439-98-7	0.1	mg/kg		----	----	----	<0.1	----
Nickel	7440-02-0	0.1	mg/kg		----	----	----	<0.1	----
Selenium	7782-49-2	0.1	mg/kg		----	----	----	**0.2**	----
Vanadium	7440-62-2	0.1	mg/kg		----	----	----	<0.1	----
Zinc	7440-66-6	0.1	mg/kg		----	----	----	<0.1	----
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	----	----	**12100**	----
Antimony	7440-36-0	5	mg/kg		----	----	----	<5	----
Arsenic	7440-38-2	5	mg/kg		----	----	----	**48**	----
Barium	7440-39-3	10	mg/kg		----	----	----	**760**	----
Cadmium	7440-43-9	1	mg/kg		----	----	----	<1	----
Chromium	7440-47-3	2	mg/kg		----	----	----	**10**	----
Cobalt	7440-48-4	2	mg/kg		----	----	----	**14**	----
Copper	7440-50-8	5	mg/kg		----	----	----	**25**	----
Iron	7439-89-6	50	mg/kg		----	----	----	**69700**	----
Lead	7439-92-1	5	mg/kg		----	----	----	**10**	----
Manganese	7439-96-5	5	mg/kg		----	----	----	**1580**	----
Molybdenum	7439-98-7	2	mg/kg		----	----	----	<2	----
Nickel	7440-02-0	2	mg/kg		----	----	----	**25**	----
Selenium	7782-49-2	5	mg/kg		----	----	----	<5	----
Vanadium	7440-62-2	5	mg/kg		----	----	----	**55**	----
Zinc	7440-66-6	5	mg/kg		----	----	----	**50**	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	7003G21	7012G04	7012G06	7012G07	7012G08
			Client sampling date / time	26-May-2017 00:00	01-Jun-2017 00:00	26-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1713010-026	EB1713010-027	EB1713010-028	EB1713010-029	EB1713010-030
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.041	0.006	----	0.041	0.096
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	2.0	----	----
Exchangeable Magnesium	----	0.2	meq/100g	----	----	3.4	----	----
Exchangeable Potassium	----	0.2	meq/100g	----	----	<0.2	----	----
Exchangeable Sodium	----	0.2	meq/100g	----	----	2.1	----	----
Cation Exchange Capacity	----	0.2	meq/100g	----	----	7.7	----	----
Exchangeable Sodium Percent	----	0.2	%	----	----	27.3	----	----
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	----	----	18100	----	----
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	17700	----	----
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	360	----	----
ED038A: Acidity								
ø Acidity	----	1	mg/kg	----	----	<5	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	80	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	----	480	----	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	<10	----	----
Magnesium	7439-95-4	10	mg/kg	----	----	<10	----	----
Sodium	7440-23-5	10	mg/kg	----	----	620	----	----
Potassium	7440-09-7	10	mg/kg	----	----	40	----	----
ED093T: Total Major Cations								
Calcium	7440-70-2	50	mg/kg	----	----	29900	----	----
Magnesium	7439-95-4	50	mg/kg	----	----	12000	----	----
Sodium	7440-23-5	50	mg/kg	----	----	1470	----	----
Potassium	7440-09-7	50	mg/kg	----	----	1450	----	----
EG005S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	----	----	<1	----	----
Antimony	7440-36-0	0.1	mg/kg	----	----	<0.1	----	----
Arsenic	7440-38-2	0.1	mg/kg	----	----	0.4	----	----
Barium	7440-39-3	1	mg/kg	----	----	<1	----	----
Cadmium	7440-43-9	0.1	mg/kg	----	----	<0.1	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7003G21	7012G04	7012G06	7012G07	7012G08
				Client sampling date / time	26-May-2017 00:00	01-Jun-2017 00:00	26-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713010-026	EB1713010-027	EB1713010-028	EB1713010-029	EB1713010-030
					Result	Result	Result	Result	Result
EG005S : Soluble Metals by ICPAES - Continued									
Chromium	7440-47-3	0.1	mg/kg		----	----	<0.1	----	----
Copper	7440-50-8	0.1	mg/kg		----	----	<0.1	----	----
Iron	7439-89-6	1	mg/kg		----	----	<1	----	----
Lead	7439-92-1	0.1	mg/kg		----	----	<0.1	----	----
Manganese	7439-96-5	0.1	mg/kg		----	----	<0.1	----	----
Molybdenum	7439-98-7	0.1	mg/kg		----	----	**0.1**	----	----
Nickel	7440-02-0	0.1	mg/kg		----	----	<0.1	----	----
Selenium	7782-49-2	0.1	mg/kg		----	----	<0.1	----	----
Vanadium	7440-62-2	0.1	mg/kg		----	----	<0.1	----	----
Zinc	7440-66-6	0.1	mg/kg		----	----	<0.1	----	----
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	----	**7210**	----	----
Antimony	7440-36-0	5	mg/kg		----	----	<5	----	----
Arsenic	7440-38-2	5	mg/kg		----	----	**18**	----	----
Barium	7440-39-3	10	mg/kg		----	----	**20**	----	----
Cadmium	7440-43-9	1	mg/kg		----	----	<1	----	----
Chromium	7440-47-3	2	mg/kg		----	----	**19**	----	----
Cobalt	7440-48-4	2	mg/kg		----	----	**11**	----	----
Copper	7440-50-8	5	mg/kg		----	----	**25**	----	----
Iron	7439-89-6	50	mg/kg		----	----	**38900**	----	----
Lead	7439-92-1	5	mg/kg		----	----	**11**	----	----
Manganese	7439-96-5	5	mg/kg		----	----	**1000**	----	----
Molybdenum	7439-98-7	2	mg/kg		----	----	<2	----	----
Nickel	7440-02-0	2	mg/kg		----	----	**20**	----	----
Selenium	7782-49-2	5	mg/kg		----	----	<5	----	----
Vanadium	7440-62-2	5	mg/kg		----	----	**28**	----	----
Zinc	7440-66-6	5	mg/kg		----	----	**74**	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	7012G09	7012G11	7012G14	7012G16	7012G18
			Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	26-Jun-2017 00:00
Compound	CAS Number	LOR	Unit	EB1713010-031	EB1713010-032	EB1713010-033	EB1713010-034	EB1713010-035
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.033	0.090	0.197	0.125	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	----	----	----	3.1
Exchangeable Magnesium	----	0.2	meq/100g	----	----	----	----	2.4
Exchangeable Potassium	----	0.2	meq/100g	----	----	----	----	<0.2
Exchangeable Sodium	----	0.2	meq/100g	----	----	----	----	1.0
Cation Exchange Capacity	----	0.2	meq/100g	----	----	----	----	6.5
Exchangeable Sodium Percent	----	0.2	%	----	----	----	----	15.4
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	----	----	2070	----	14000
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	1980	----	13700
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	90	----	270
ED038A: Acidity								
ø Acidity	----	1	mg/kg	----	----	<5	----	<5
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	130	----	120
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	----	980	----	600
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	<10	----	10
Magnesium	7439-95-4	10	mg/kg	----	----	<10	----	<10
Sodium	7440-23-5	10	mg/kg	----	----	620	----	540
Potassium	7440-09-7	10	mg/kg	----	----	30	----	30
ED093T: Total Major Cations								
Calcium	7440-70-2	50	mg/kg	----	----	9210	----	31500
Magnesium	7439-95-4	50	mg/kg	----	----	3730	----	13500
Sodium	7440-23-5	50	mg/kg	----	----	1380	----	1060
Potassium	7440-09-7	50	mg/kg	----	----	1390	----	1130
EG005S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	----	----	<1	----	<1
Antimony	7440-36-0	0.1	mg/kg	----	----	<0.1	----	<0.1
Arsenic	7440-38-2	0.1	mg/kg	----	----	0.2	----	<0.1
Barium	7440-39-3	1	mg/kg	----	----	<1	----	<1
Cadmium	7440-43-9	0.1	mg/kg	----	----	<0.1	----	<0.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7012G09	7012G11	7012G14	7012G16	7012G18
				Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	01-Jun-2017 00:00	26-Jun-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713010-031	EB1713010-032	EB1713010-033	EB1713010-034	EB1713010-035
					Result	Result	Result	Result	Result
EG005S : Soluble Metals by ICPAES - Continued									
Chromium	7440-47-3	0.1	mg/kg		----	----	<0.1	----	<0.1
Copper	7440-50-8	0.1	mg/kg		----	----	<0.1	----	<0.1
Iron	7439-89-6	1	mg/kg		----	----	<1	----	<1
Lead	7439-92-1	0.1	mg/kg		----	----	<0.1	----	<0.1
Manganese	7439-96-5	0.1	mg/kg		----	----	<0.1	----	<0.1
Molybdenum	7439-98-7	0.1	mg/kg		----	----	**0.2**	----	**0.4**
Nickel	7440-02-0	0.1	mg/kg		----	----	<0.1	----	<0.1
Selenium	7782-49-2	0.1	mg/kg		----	----	<0.1	----	**0.1**
Vanadium	7440-62-2	0.1	mg/kg		----	----	<0.1	----	<0.1
Zinc	7440-66-6	0.1	mg/kg		----	----	<0.1	----	<0.1
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	----	**6660**	----	**11300**
Antimony	7440-36-0	5	mg/kg		----	----	<5	----	<5
Arsenic	7440-38-2	5	mg/kg		----	----	**27**	----	**8**
Barium	7440-39-3	10	mg/kg		----	----	**950**	----	**40**
Cadmium	7440-43-9	1	mg/kg		----	----	<1	----	<1
Chromium	7440-47-3	2	mg/kg		----	----	**7**	----	**17**
Cobalt	7440-48-4	2	mg/kg		----	----	**7**	----	**23**
Copper	7440-50-8	5	mg/kg		----	----	**30**	----	**28**
Iron	7439-89-6	50	mg/kg		----	----	**25700**	----	**47600**
Lead	7439-92-1	5	mg/kg		----	----	**10**	----	**7**
Manganese	7439-96-5	5	mg/kg		----	----	**604**	----	**991**
Molybdenum	7439-98-7	2	mg/kg		----	----	<2	----	<2
Nickel	7440-02-0	2	mg/kg		----	----	**11**	----	**32**
Selenium	7782-49-2	5	mg/kg		----	----	<5	----	<5
Vanadium	7440-62-2	5	mg/kg		----	----	**26**	----	**59**
Zinc	7440-66-6	5	mg/kg		----	----	**43**	----	**74**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7012G20	7012G25	7012G26	----	----
				Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	26-Jun-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1713010-036	EB1713010-038	EB1713010-039	--------	--------
					Result	Result	Result	----	----
EA026 : Chromium Reducible Sulfur									
Chromium Reducible Sulphur	----	0.005	%		0.037	0.070	----	----	----
ED006: Exchangeable Cations on Alkaline Soils									
Exchangeable Calcium	----	0.2	meq/100g		----	----	3.7	----	----
Exchangeable Magnesium	----	0.2	meq/100g		----	----	1.7	----	----
Exchangeable Potassium	----	0.2	meq/100g		----	----	<0.2	----	----
Exchangeable Sodium	----	0.2	meq/100g		----	----	1.4	----	----
Cation Exchange Capacity	----	0.2	meq/100g		----	----	6.8	----	----
Exchangeable Sodium Percent	----	0.2	%		----	----	20.2	----	----
ED037: Alkalinity									
ø Total Alkalinity as CaCO3	----	1	mg/kg		----	----	10300	----	----
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg		----	----	10100	----	----
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg		----	----	180	----	----
ED038A: Acidity									
ø Acidity	----	1	mg/kg		----	----	<5	----	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		----	----	70	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	----	1030	----	----
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		----	----	20	----	----
Magnesium	7439-95-4	10	mg/kg		----	----	10	----	----
Sodium	7440-23-5	10	mg/kg		----	----	720	----	----
Potassium	7440-09-7	10	mg/kg		----	----	30	----	----
ED093T: Total Major Cations									
Calcium	7440-70-2	50	mg/kg		----	----	14900	----	----
Magnesium	7439-95-4	50	mg/kg		----	----	5660	----	----
Sodium	7440-23-5	50	mg/kg		----	----	1270	----	----
Potassium	7440-09-7	50	mg/kg		----	----	1620	----	----
EG005S : Soluble Metals by ICPAES									
Aluminium	7429-90-5	1	mg/kg		----	----	<1	----	----
Antimony	7440-36-0	0.1	mg/kg		----	----	<0.1	----	----
Arsenic	7440-38-2	0.1	mg/kg		----	----	0.1	----	----
Barium	7440-39-3	1	mg/kg		----	----	<1	----	----
Cadmium	7440-43-9	0.1	mg/kg		----	----	<0.1	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	7012G20	7012G25	7012G26	----	----
				Client sampling date / time	01-Jun-2017 00:00	01-Jun-2017 00:00	26-Jun-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1713010-036	EB1713010-038	EB1713010-039	--------	--------
					Result	Result	Result	----	----
EG005S : Soluble Metals by ICPAES - Continued									
Chromium	7440-47-3	0.1	mg/kg		----	----	<0.1	----	----
Copper	7440-50-8	0.1	mg/kg		----	----	<0.1	----	----
Iron	7439-89-6	1	mg/kg		----	----	<1	----	----
Lead	7439-92-1	0.1	mg/kg		----	----	<0.1	----	----
Manganese	7439-96-5	0.1	mg/kg		----	----	<0.1	----	----
Molybdenum	7439-98-7	0.1	mg/kg		----	----	**0.2**	----	----
Nickel	7440-02-0	0.1	mg/kg		----	----	<0.1	----	----
Selenium	7782-49-2	0.1	mg/kg		----	----	<0.1	----	----
Vanadium	7440-62-2	0.1	mg/kg		----	----	<0.1	----	----
Zinc	7440-66-6	0.1	mg/kg		----	----	<0.1	----	----
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	----	**8660**	----	----
Antimony	7440-36-0	5	mg/kg		----	----	<5	----	----
Arsenic	7440-38-2	5	mg/kg		----	----	**5**	----	----
Barium	7440-39-3	10	mg/kg		----	----	**20**	----	----
Cadmium	7440-43-9	1	mg/kg		----	----	<1	----	----
Chromium	7440-47-3	2	mg/kg		----	----	**6**	----	----
Cobalt	7440-48-4	2	mg/kg		----	----	**5**	----	----
Copper	7440-50-8	5	mg/kg		----	----	**42**	----	----
Iron	7439-89-6	50	mg/kg		----	----	**17800**	----	----
Lead	7439-92-1	5	mg/kg		----	----	**20**	----	----
Manganese	7439-96-5	5	mg/kg		----	----	**278**	----	----
Molybdenum	7439-98-7	2	mg/kg		----	----	**2**	----	----
Nickel	7440-02-0	2	mg/kg		----	----	**10**	----	----
Selenium	7782-49-2	5	mg/kg		----	----	<5	----	----
Vanadium	7440-62-2	5	mg/kg		----	----	**20**	----	----
Zinc	7440-66-6	5	mg/kg		----	----	**58**	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1713594**	Page	: 1 of 6
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo west	Date Samples Received	: 04-Jul-2017 13:35
Order number	: ----	Date Analysis Commenced	: 05-Jul-2017
C-O-C number	: ----	Issue Date	: 10-Jul-2017 16:43
Sampler	: VERONICA CANALES		
Site	: ----		
Quote number	: BNBQ/218/16		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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 no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	30-Jun-2017 00:00	30-Jun-2017 00:00	30-Jun-2017 00:00	30-Jun-2017 00:00	30-Jun-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713594-001	EB1713594-002	EB1713594-003	EB1713594-004	EB1713594-005
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.55	7.74	7.47	7.14	7.09
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		769	162	317	185	180
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		36	11	14	11	7
Total Alkalinity as CaCO3	----	1	mg/L		36	11	14	11	7
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		2	<1	2	1	2
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		6	2	13	6	4
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		214	33	75	27	27
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		5	<1	2	2	<1
Magnesium	7439-95-4	1	mg/L		8	<1	1	<1	<1
Sodium	7440-23-5	1	mg/L		126	30	33	22	31
Potassium	7440-09-7	1	mg/L		3	1	1	<1	1
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.12	3.72	0.14	0.05	2.30
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		0.004	<0.001	0.005	0.002	0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	0.002	<0.001	<0.001	0.001
Copper	7440-50-8	0.001	mg/L		0.001	0.003	0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	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
Zinc	7440-66-6	0.005	mg/L		0.006	0.007	<0.005	<0.005	0.007
Manganese	7439-96-5	0.001	mg/L		0.010	0.044	0.002	<0.001	0.002
Molybdenum	7439-98-7	0.001	mg/L		0.003	0.001	0.006	0.003	0.002
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	30-Jun-2017 00:00	30-Jun-2017 00:00	30-Jun-2017 00:00	30-Jun-2017 00:00	30-Jun-2017 00:00
Compound	CAS Number	LOR	Unit		EB1713594-001	EB1713594-002	EB1713594-003	EB1713594-004	EB1713594-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.06**	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**0.07**	**0.61**	<0.05	<0.05	**0.82**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.4**	**0.2**	<0.1	<0.1	**0.2**

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)			Client sample ID	KLC 6	----	----	----	----
			Client sampling date / time	30-Jun-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1713594-006	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.76**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**4420**	----	----	----	----
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	**77**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**77**	----	----	----	----
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	**242**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**1140**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**21**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**21**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**496**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**13**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	**0.003**	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.214**	----	----	----	----
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	**0.023**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.067**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.05**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)				Client sample ID	**KLC 6**	----	----	----	----
				Client sampling date / time	30-Jun-2017 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1713594-006**	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.10**	----	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**1.3**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1716503**	Page	: 1 of 6
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo West	Date Samples Received	: 11-Aug-2017 17:00
Order number	: ----	Date Analysis Commenced	: 14-Aug-2017
C-O-C number	: ----	Issue Date	: 22-Aug-2017 13:25
Sampler	: MARY MACELROY		
Site	: ----		
Quote number	: BNBQ/218/16		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

General Comments

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- EG020-F (Dissolved Metals): Sample EB1716488-002 shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction re-analysis.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC1	KLC2	KLC3	KLC4	KLC5
			Client sampling date / time	11-Aug-2017 00:00	11-Aug-2017 00:00	11-Aug-2017 00:00	11-Aug-2017 00:00	11-Aug-2017 00:00
Compound	CAS Number	LOR	Unit	EB1716503-001	EB1716503-002	EB1716503-003	EB1716503-004	EB1716503-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.48	6.56	7.13	7.04	6.73
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	508	181	582	231	433
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	23	9	30	21	12
Total Alkalinity as CaCO3	----	1	mg/L	23	9	30	21	12
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	2	2	2	1	1
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	8	3	16	7	9
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	119	35	147	48	117
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	3	<1	7	4	3
Magnesium	7439-95-4	1	mg/L	5	<1	7	3	5
Sodium	7440-23-5	1	mg/L	65	28	75	29	60
Potassium	7440-09-7	1	mg/L	1	<1	2	1	1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.02	2.42	0.02	0.05	0.06
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	0.002	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<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	<0.001	0.002	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	<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
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	0.002	0.018	0.012	0.005	0.004
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	0.042	0.007	0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC1	KLC2	KLC3	KLC4	KLC5
				Client sampling date / time	11-Aug-2017 00:00	11-Aug-2017 00:00	11-Aug-2017 00:00	11-Aug-2017 00:00	11-Aug-2017 00:00
Compound	CAS Number	LOR	Unit		EB1716503-001	EB1716503-002	EB1716503-003	EB1716503-004	EB1716503-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.16**	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		<0.05	**0.38**	<0.05	<0.05	<0.05
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.3**	<0.1	<0.1	<0.1
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**3.98**	**1.23**	**5.08**	**1.92**	**3.73**
Total Cations	----	0.01	meq/L		**3.41**	**1.22**	**4.24**	**1.73**	**3.20**
Ionic Balance	----	0.01	%		**7.69**	**----**	**9.02**	**----**	**7.67**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC6	----	----	----	----
			Client sampling date / time	11-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1716503-006	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.39**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**218**	----	----	----	----
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	**29**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**29**	----	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**1**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**16**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**33**	----	----	----	----
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	**31**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**1**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.58**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.008**	----	----	----	----
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	**0.002**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.009**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC6	----	----	----	----
				Client sampling date / time	11-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1716503-006	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.07**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	----	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**1.84**	----	----	----	----
Total Cations	----	0.01	meq/L		**1.37**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1718214**	Page	: 1 of 6
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo West	Date Samples Received	: 05-Sep-2017 17:05
Order number	: ----	Date Analysis Commenced	: 06-Sep-2017
C-O-C number	: ----	Issue Date	: 12-Sep-2017 18:37
Sampler	: MARY MACELROY		
Site	: ----		
Quote number	: BNBQ/218/16		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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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 no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component.

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

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ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG020-F (Dissolved Metals): Sample EB1718212-002 (KLC 2) has poor spike recovery due to matrix interference. Confirmed by re-analysis.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
			Client sampling date / time	05-Sep-2017 00:00	05-Sep-2017 00:00	05-Sep-2017 00:00	05-Sep-2017 00:00	05-Sep-2017 00:00
Compound	CAS Number	LOR	Unit	EB1718214-001	EB1718214-002	EB1718214-003	EB1718214-004	EB1718214-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.98	6.59	7.07	7.14	6.32
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	195	175	424	352	425
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	8	6	12	14	5
Total Alkalinity as CaCO3	----	1	mg/L	8	6	12	14	5
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	<1	<1	<1	<1	1
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	7	2	20	16	17
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	43	42	105	84	114
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	1	<1	6	6	4
Magnesium	7439-95-4	1	mg/L	2	<1	5	5	6
Sodium	7440-23-5	1	mg/L	32	34	64	52	65
Potassium	7440-09-7	1	mg/L	<1	<1	2	2	2
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.24	0.23	0.04	0.03	0.04
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	0.003	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<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	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	<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
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	0.006	0.001	0.009	0.001	0.005
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	0.029	0.014	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	05-Sep-2017 00:00	05-Sep-2017 00:00	05-Sep-2017 00:00	05-Sep-2017 00:00	05-Sep-2017 00:00
Compound	CAS Number	LOR	Unit		EB1718214-001	EB1718214-002	EB1718214-003	EB1718214-004	EB1718214-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**0.06**
Iron	7439-89-6	0.05	mg/L		**0.08**	<0.05	<0.05	<0.05	<0.05
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	**0.1**	<0.1	<0.1	<0.1
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**1.52**	**1.35**	**3.62**	**2.98**	**3.67**
Total Cations	----	0.01	meq/L		**1.61**	**1.48**	**3.54**	**3.02**	**3.57**
Ionic Balance	----	0.01	%		**----**	**----**	**1.01**	**----**	**1.35**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC 6	----	----	----	----
			Client sampling date / time	05-Sep-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1718214-006	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.07**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**63**	----	----	----	----
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	**8**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**8**	----	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**8**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**10**	----	----	----	----
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	**11**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.54**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.006**	----	----	----	----
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	**0.001**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.005**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 6	----	----	----	----
				Client sampling date / time	05-Sep-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1718214-006	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.07**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	----	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**0.61**	----	----	----	----
Total Cations	----	0.01	meq/L		**0.48**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1720293**	Page	: 1 of 6
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo west	Date Samples Received	: 03-Oct-2017 14:05
Order number	: ----	Date Analysis Commenced	: 04-Oct-2017
C-O-C number	: ----	Issue Date	: 09-Oct-2017 14:15
Sampler	: MARY MACELROY		
Site	: ----		
Quote number	: BNBQ/218/16		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)			Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
			Client sampling date / time	03-Oct-2017 00:00	03-Oct-2017 00:00	03-Oct-2017 00:00	03-Oct-2017 00:00	03-Oct-2017 00:00
Compound	CAS Number	LOR	Unit	EB1720293-001	EB1720293-002	EB1720293-003	EB1720293-004	EB1720293-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.47	7.06	7.29	7.22	6.65
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	281	207	282	135	859
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	11	4	12	10	5
Total Alkalinity as CaCO3	----	1	mg/L	11	4	12	10	5
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	<1	<1	2	<1	2
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	7	3	15	10	21
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	75	58	67	26	275
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	<1	3	2	5
Magnesium	7439-95-4	1	mg/L	<1	<1	3	2	9
Sodium	7440-23-5	1	mg/L	50	37	42	19	140
Potassium	7440-09-7	1	mg/L	<1	<1	2	1	3
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.90	0.51	0.13	0.11	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	0.002	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<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	0.001	0.002	0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	<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
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	0.007	0.009	0.010	0.002	0.006
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	0.024	0.006	0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	03-Oct-2017 00:00	03-Oct-2017 00:00	03-Oct-2017 00:00	03-Oct-2017 00:00	03-Oct-2017 00:00
Compound	CAS Number	LOR	Unit		EB1720293-001	EB1720293-002	EB1720293-003	EB1720293-004	EB1720293-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**0.09**
Iron	7439-89-6	0.05	mg/L		**0.13**	**0.08**	<0.05	<0.05	<0.05
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.2**	<0.1	<0.1	**0.1**

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)				Client sample ID	KLC 6	----	----	----	----
				Client sampling date / time	03-Oct-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1720293-006	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.07**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**32**	----	----	----	----
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		**5**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**5**	----	----	----	----
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		<1	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**4**	----	----	----	----
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		**5**	----	----	----	----
Potassium	7440-09-7	1	mg/L		<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.25**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L		<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.004**	----	----	----	----
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		**0.002**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.002**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)				Client sample ID	**KLC 6**	----	----	----	----
				Client sampling date / time	03-Oct-2017 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1720293-006**	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1723258**	Page	: 1 of 6
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo west	Date Samples Received	: 07-Nov-2017 15:00
Order number	: ----	Date Analysis Commenced	: 08-Nov-2017
C-O-C number	: ----	Issue Date	: 15-Nov-2017 16:48
Sampler	: MARY MACELROY		
Site	: ----		
Quote number	: BNBQ/218/16		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EG020-F (Dissolved Metals): Sample EB1723252-002 has poor spike recovery due to matrix interference. Confirmed by re-analysis.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	07-Nov-2017 00:00	07-Nov-2017 00:00	07-Nov-2017 00:00	07-Nov-2017 00:00	07-Nov-2017 00:00
Compound	CAS Number	LOR	Unit		EB1723258-001	EB1723258-002	EB1723258-003	EB1723258-004	EB1723258-005
					Result	Result	Result	Result	Result
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.64	6.97	7.43	7.45	7.04
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		190	116	254	303	320
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		12	5	14	16	12
Total Alkalinity as CaCO3	----	1	mg/L		12	5	14	16	12
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		<1	<1	2	1	3
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		3	2	13	36	12
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		44	27	55	52	82
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		<1	<1	4	7	<1
Magnesium	7439-95-4	1	mg/L		<1	<1	3	4	1
Sodium	7440-23-5	1	mg/L		33	20	37	42	49
Potassium	7440-09-7	1	mg/L		<1	<1	2	2	1
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.27	0.36	0.10	0.04	0.26
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	0.003	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<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		0.001	0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	<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
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L		0.014	0.021	0.006	0.006	0.001
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	0.015	0.011	0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	07-Nov-2017 00:00	07-Nov-2017 00:00	07-Nov-2017 00:00	07-Nov-2017 00:00	07-Nov-2017 00:00
Compound	CAS Number	LOR	Unit		EB1723258-001	EB1723258-002	EB1723258-003	EB1723258-004	EB1723258-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**0.09**	**0.10**	<0.05	<0.05	**0.17**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	**0.2**	<0.1	<0.1	**0.2**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC 6	----	----	----	----
			Client sampling date / time	07-Nov-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1723258-006	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.39**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**67**	----	----	----	----
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	**10**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**10**	----	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**1**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**10**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**8**	----	----	----	----
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	**10**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.21**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.007**	----	----	----	----
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	**0.002**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.003**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**KLC 6**	----	----	----	----
				Client sampling date / time	07-Nov-2017 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1723258-006**	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.05**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1725752**	Page	: 1 of 6
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo west	Date Samples Received	: 05-Dec-2017 16:00
Order number	: ----	Date Analysis Commenced	: 05-Dec-2017
C-O-C number	: ----	Issue Date	: 11-Dec-2017 21:51
Sampler	: MARY MACELROY		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 6		
No. of samples analysed	: 6		

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Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Ionic Balance out of acceptable limits due to analytes not quantified in this report.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
			Client sampling date / time	05-Dec-2017 00:00	05-Dec-2017 00:00	05-Dec-2017 00:00	05-Dec-2017 00:00	05-Dec-2017 00:00
Compound	CAS Number	LOR	Unit	EB1725752-001	EB1725752-002	EB1725752-003	EB1725752-004	EB1725752-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.52	7.12	8.69	7.77	7.06
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	131	106	267	230	237
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	8	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	17	9	23	24	9
Total Alkalinity as CaCO3	----	1	mg/L	17	9	31	24	9
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	1	<1	<1	1	2
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	3	18	30	9
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	27	25	56	39	62
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	<1	4	4	<1
Magnesium	7439-95-4	1	mg/L	<1	<1	3	4	1
Sodium	7440-23-5	1	mg/L	22	20	42	33	41
Potassium	7440-09-7	1	mg/L	<1	<1	2	2	1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.51	0.42	0.21	0.08	0.46
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	0.003	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<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	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	<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
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	0.005	0.009	0.005	0.006	0.002
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.015	0.007	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	05-Dec-2017 00:00	05-Dec-2017 00:00	05-Dec-2017 00:00	05-Dec-2017 00:00	05-Dec-2017 00:00
Compound	CAS Number	LOR	Unit		EB1725752-001	EB1725752-002	EB1725752-003	EB1725752-004	EB1725752-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**0.17**	**0.07**	<0.05	<0.05	**0.19**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	**0.1**	<0.1	<0.1	<0.1
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**1.18**	**0.95**	**2.57**	**2.20**	**2.12**
Total Cations	----	0.01	meq/L		**0.96**	**0.87**	**2.32**	**2.02**	**1.89**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC 6	----	----	----	----
			Client sampling date / time	05-Dec-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1725752-006	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.52**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**56**	----	----	----	----
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	**8**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**8**	----	----	----	----
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	**9**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**9**	----	----	----	----
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	**10**	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.41**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.005**	----	----	----	----
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	**0.003**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.002**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 6	----	----	----	----
				Client sampling date / time	05-Dec-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1725752-006	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.07**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	----	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**0.60**	----	----	----	----
Total Cations	----	0.01	meq/L		**0.43**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1801935**	Page	: 1 of 6
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
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2017002 Dingo west	Date Samples Received	: 16-Jan-2018 17:15
Order number	: 2017002	Date Analysis Commenced	: 18-Jan-2018
C-O-C number	: ----	Issue Date	: 22-Jan-2018 14:32
Sampler	: VERONICA CANALES		
Site	: ----		
Quote number	: EN/222/17		
No. of samples received	: 6		
No. of samples analysed	: 6		

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ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Greg Vogel	Laboratory Manager	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Ionic Balance out of acceptable limits due to analytes not quantified in this report.

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)			Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
			Client sampling date / time	16-Jan-2018 00:00	16-Jan-2018 00:00	16-Jan-2018 00:00	16-Jan-2018 00:00	16-Jan-2018 00:00
Compound	CAS Number	LOR	Unit	EB1801935-001	EB1801935-002	EB1801935-003	EB1801935-004	EB1801935-005
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.74	7.06	8.42	7.68	6.82
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	95	139	229	220	176
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	3	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	11	4	27	45	5
Total Alkalinity as CaCO3	----	1	mg/L	11	4	30	45	5
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	<1	<1	<1	<1	1
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	3	3	21	34	7
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	22	36	40	30	44
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	<1	4	4	<1
Magnesium	7439-95-4	1	mg/L	<1	<1	2	3	<1
Sodium	7440-23-5	1	mg/L	18	26	37	33	31
Potassium	7440-09-7	1	mg/L	<1	<1	2	2	1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	1.07	0.77	0.22	0.11	0.88
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	0.002	<0.001	0.003	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<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	0.002	0.001	0.002	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	<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
Zinc	7440-66-6	0.005	mg/L	0.007	0.012	0.006	<0.005	0.179
Manganese	7439-96-5	0.001	mg/L	0.003	0.010	0.003	0.006	<0.001
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.014	0.008	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	KLC 5
				Client sampling date / time	16-Jan-2018 00:00	16-Jan-2018 00:00	16-Jan-2018 00:00	16-Jan-2018 00:00	16-Jan-2018 00:00
Compound	*CAS Number*	*LOR*	*Unit*		**EB1801935-001**	**EB1801935-002**	**EB1801935-003**	**EB1801935-004**	**EB1801935-005**
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.06**	**0.06**	<0.05	<0.05	**0.06**
Iron	7439-89-6	0.05	mg/L		**0.21**	**0.13**	<0.05	<0.05	**0.32**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	**0.2**	<0.1	<0.1	<0.1

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)			Client sample ID	KLC 6	----	----	----	----
			Client sampling date / time	16-Jan-2018 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1801935-006	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.51**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**67**	----	----	----	----
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	**12**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**12**	----	----	----	----
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	**10**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**7**	----	----	----	----
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	**13**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**1**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**1.29**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.008**	----	----	----	----
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	**0.002**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.002**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----

Analytical Results

Sub-Matrix: **LEACHATE** (Matrix: **WATER**)				Client sample ID	**KLC 6**	----	----	----	----
				Client sampling date / time	16-Jan-2018 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1801935-006**	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.16**	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	----	----	----	----

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