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Geochemical Assessment of Potential Spoil and Coal Reject Materials

BARALABA SOUTH PROJECT

Prepared for:

Baralaba South Pty Ltd

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EXECUTIVE SUMMARY

Terrenus Earth Sciences (Terrenus) has completed a geochemical assessment of potential mine spoil (overburden and interburden) and potential coal reject (seam roof, parting and floor) from the Baralaba South Project (the Project), being developed by Baralaba South Pty Ltd. The Project is located in the south-east of the Bowen Basin in Central Queensland, approximately eight kilometres (km) south of Baralaba township and approximately 115 km west of Rockhampton. The geochemical assessment was completed to assist with mine planning and as part of the environmental regulatory documentation for the Project.

Coal will be mined by conventional open-cut methods and spoil (waste rock) will be placed behind the active mining face. The management of overburden and interburden (spoil) materials generated by the Project will comprise the disposal of overburden and interburden initially into an out-of-pit emplacement area until space is available within the pit for in-pit disposal as low-wall spoil. Run-of-mine (ROM) coal would be processed on site at a coal handling and preparation plant (CHPP), with coal reject (coarse and fine rejects) disposed on site within spoil emplacement areas. Coal reject is expected to comprise less than 5 percent (%) of all mineral waste for the Project.

Terrenus has geochemically assessed overburden and interburden samples (collectively called spoil) and coal seam roof, parting and floor samples (collectively called potential coal reject). The assessment of coal seam roof, parting and floor samples from drill-core applies to, and is indicative of, potential coal reject generally, however it does tend to more closely represent potential coarse coal reject. The drilling and sampling program targets the potential open-pit areas likely to be disturbed during the first 10 years of operation.

Samples were assessed with respect to their ability to generate acid and metalliferous drainage (AMD) and salinity. AMD includes acid/acidic drainage (AD), neutral and metalliferous drainage (NMD) and saline drainage from sulfide oxidation (SD). Selected spoil samples also underwent assessment for sodicity and dispersion potential.

The geochemical characteristics associated with mineral waste materials are discussed by type (spoil versus potential coal reject) and by lithological characteristic as outlined below:

- Non-carbonaceous samples (n=155 samples) – estimated to represent about 95 % of spoil and only indicatively about 20-30 % of coal reject.
- Carbonaceous samples (n=11 samples) – estimated to represent about 5 % of spoil and indicatively about 70-80 % of coal reject. Of this, essentially all will be unweathered (fresh). This material type comprises materials described as carbonaceous and/or coaly (excluding coal from target seams).

Geochemical Characteristics of Spoil

AMD Potential of Spoil

- Spoil, as a bulk material, is expected to generate pH-alkaline to highly alkaline surface water run-off and seepage.
- The total sulfur (total S) concentration of spoil is very low in materials that will become spoil, with a 90th percentile total S concentration of 0.09 %. As such, and combined with acid

neutralising capacity (ANC) values (median 42 kilograms of sulfuric acid per tonne of rock [kg H_2SO_4/t]), which is significantly higher than the maximum potential acidity (MPA) (median 0.9 kg H_2SO_4/t), almost all (99 % of) spoil samples were classified as non-acid forming (NAF).

- Total metal and metalloid concentrations from 28 spoil samples is generally very low compared to average element abundance in soil in the earth's crust. That is to say, spoil has low enrichment in total metals and metalloids compared to unmineralised rocks.
- Soluble multi-element results indicate that leachate from spoil is expected to contain low concentrations of soluble metals and metalloids.

Spoil – which is expected to represent about 95 % of the total mineral waste at the Project – has a negligible potential to generate AMD as either AD and/or NMD and/or SD.

Salinity Potential of Spoil

Spoil has electrical conductivity (EC) values ranging from 12 to 713 microSiemens per centimetre (μS/cm), with median and 90th percentile values of 302 and 505 μS/cm, respectively.

Surface water run-off and seepage from spoil is expected to be non-saline to slightly saline, as a result of dissolution of geogenic salts. Salinity caused by sulfide oxidation (sulfate salinity) would be expected to be negligible due to the very low total S concentration.

Sodicity and Dispersion Potential of Spoil

Spoil samples (n=28) had modest cation exchange capacity (CEC) values and wide range of exchangeable sodium percentage (ESP) values, resulting in just over half of spoil samples being classified as 'sodic' or 'strongly sodic'. Generally, the highest ESP values were associated with the carbonaceous material, which typically represents a small proportion of general spoil (most spoil being non-carbonaceous). The CEC and ESP values suggest that spoil may be subject to some degree of dispersion.

Spoil is expected to be sodic, to varying degrees, with potential for dispersion.

Geochemical Characteristics of Potential Coal Reject

AMD Potential of Coal Reject

- Coal reject, as a bulk material, is expected to generate pH-alkaline (to highly alkaline) surface water run-off and seepage.
- The total S concentration of potential coal reject is generally low-moderate, with a 90th percentile total S concentration of 0.60 %, which has resulted in generally low MPA values (median 6 kg H_2SO_4/t). About 40 % of the total S is present as sulfide (Scr). When combined with generally low ANC values (median 9 kg H_2SO_4/t), approximately 29 % of samples (12 out of 42 samples) were classified as potentially acid forming (PAF) [or a PAF variant – refer to report body]. However, the bulk of the potential coal reject samples (71 % of samples) were classified as NAF.

- Total metal and metalloid concentrations from 14 potential coal reject samples tested are low compared to average element abundance in soil in the earth's crust.
- Soluble multi-element results from 14 samples tested indicate that leachate from potential coal reject is expected to generally contain low concentrations of soluble metals and metalloids – similar spoil.

As a bulk material, coal reject – which is expected to represent about 5 % of the total mineral waste at the Project – has a generally low potential to generate AMD as either AD and/or NMD and/or SD. About 30 % of potential coal reject samples have been conservatively assessed as posing a low-moderate potential to generate AD, however this material will be naturally distributed throughout bulk coal reject material, and broadly disposed throughout NAF spoil.

Salinity Potential of Coal Reject

Potential coal reject samples (n=42) have EC values ranging from 97 to 740 μS/cm, with median and 90th percentile values of 259 and 392 μS/cm, respectively.

Consistent with spoil, surface water run-off and seepage from coal reject is expected to be non-saline to slightly saline, as a result of dissolution of geogenic salts. Salinity caused by sulfide oxidation (sulfate salinity) would be expected to be negligible due to the generally low total S concentration.

Geochemical Characteristics of ROM Coal

Potential ROM coal samples have not been assessed (as part of this assessment). These materials are not regarded as waste and would remain on site for a relatively short period of time.

ROM coal is expected to have similar environmental geochemical characteristics to potential coal rejects, and would likely produce low-salinity, pH-alkaline run-off and seepage at the ROM stockpile.

Management and Mitigation of Spoil

The significant majority (indicatively 95 %) of mineral waste at the Project is likely to be spoil, of which most will be non-carbonaceous material.

The management of overburden and interburden (spoil) materials generated by the Project will comprise the disposal of overburden and interburden initially into an out-of-pit emplacement area until space is available within the pit for in-pit disposal as low-wall spoil. Coal reject is expected to comprise less than 5 % (approximately) of all mineral waste and will be disposed into spoil emplacement areas. Spoil emplacement areas would be progressively rehabilitated – with run-off and seepage captured by the mine water management system.

Spoil is overwhelmingly NAF with excess ANC and has a negligible risk of developing AMD, including AD, NMD or SD. Surface water run-off and seepage from spoil is expected to have generally low salinity with low soluble metal/metalloid concentrations. However, spoil is expected to be sodic (to varying degrees) with potential for dispersion and erosion.

Where highly sodic and/or dispersive spoil is identified it should, wherever practicable, not report to final landform surfaces and should not be used in construction activities. Tertiary spoil has generally been found to be unsuitable for construction use or on final landform surfaces (Australian Coal Association Research Program [ACARP], 2004 and 2019).

It is unlikely that sodic and potentially dispersive spoil will be able to be selectively handled and emplaced during operation of the Project. Therefore, in the absence of such selective handling, spoil landforms would need to be constructed with short and low (shallow) slopes and progressively rehabilitated to minimise erosion. Where practical, and where competent rock is available, armouring of slopes should be considered.

Surface water run-off and seepage from spoil, including any rehabilitated areas, should be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, major anions (SO_4, Cl and alkalinity/acidity), major cations (Ca, K, Mg, Na), total dissolved solids (TDS) and a broad suite of soluble metals/metalloids at high resolution analysis.

With the implementation of the proposed management and mitigation measures spoil is regarded as posing a low risk of environmental harm. The decommissioning, closure and post-closure aspects of the out-of-pit and in-pit spoil emplacement areas would be addressed by a Progressive Rehabilitation and Closure Plan (PRCP).

Management and Mitigation of Coal Reject

Based on the results, about one-third of potential coal reject (based on a conservative classification) has potential to generate low-level AD. Material with potential for AMD will be well distributed amongst the bulk NAF material and, therefore, it is predicted that bulk coal reject will be NAF and will pose a low risk of environmental harm. Coal reject is expected to comprise less than 5 % of all mineral waste at the Project, and will be disposed amongst overwhelmingly NAF spoil. Therefore, disposed coal reject is expected to pose a low AMD hazard.

The management measures for coal reject would be addressed by a Mineral Waste Management Plan, with the concepts outlined below.

Management of Dewatered Coal Reject (Dewatered Tailings)

The CHPP will utilise a belt filter press to dewater the CHPP waste material to enable disposal of the majority of the CHPP waste streams in pit, mixed with the overburden spoil material.

Management of Wet Coal Reject (Tailings)

A small proportion of the CHPP waste stream with a high ash content will not be suitable for the belt filter press (or will be collected during failure of the belt filter press system) and will be deposited into drying cells within the Mine Infrastructure Area. Once the tailings has sufficiently dried, it will be excavated and trucked for final disposal within spoil in out-of-pit emplacement areas and/or recently completed pit workings (within in-pit emplacement areas).

Management of Coarse Reject

Coarse coal reject will be trucked from the CHPP and placed in compacted layers within spoil in out-of-pit emplacement areas and/or recently completed pit workings (within in-pit emplacement areas).

Management of Out-of-Pit Coal Reject Emplacement Areas

During Operations

Coal reject materials placed in the out-of-pit emplacement area would be buried by at least 5 m of spoil within generally three months of placement. During operations, run-off and seepage from out-of-pit emplacements would be directed to the mine water management system.

During Decommissioning, Rehabilitation and Closure

The decommissioning, closure and post-closure aspects of the out-of-pit spoil emplacement areas would be addressed by a PRCP. However, as coal reject within out-of-pit spoil emplacements would be covered by a minimum of 5 m final thickness of spoil and would not report to final landform surfaces (or near-surfaces), the management of out-of-pit emplacement coal reject would not be expected to be significant to mine or pit decommissioning and rehabilitation.

Management of In-Pit Coal Reject Emplacement Areas

During Operations

Coal reject materials will be disposed into an in-pit emplacement area and buried by at least 5 m of spoil.

During Decommissioning, Rehabilitation and Closure

The decommissioning, closure and post-closure aspects of the partially back-filled pit (and subsequent final void) would be addressed by a PRCP. However, as coal reject would be buried by a minimum of 5 m final thickness of spoil and would not report to final landform surfaces (or near-surfaces), the management of in-pit emplacement coal reject would not be expected to be relevant to mine or pit decommissioning and rehabilitation.

Management of ROM Coal and Product Coal Stockpiles

ROM coal and product coal is not mining waste, and surface water run-off and seepage from ROM and product coal stockpiles would be contained or recycled on site as part of the mine water management system. The available information from this Project, and from Terrenus' significant experience assessing mineral wastes from the Bowen Basin, suggests that ROM coal and product coal generated by the Project is expected to have a low degree of risk associated with potential acid, salt and soluble metals generation.

ROM coal and product coal would be stored on-site for a relatively short period of time (days to weeks) compared to mineral waste materials, which would be stored at the site in perpetuity. Management practices are therefore different for ROM coal and product coal (compared to spoil and coal rejects) and would largely be based around the operational (day-to-day) management of surface water run-off from ROM coal and product coal stockpiles, as is currently accepted practice at coal mines in Australia.

Surface water run-off from ROM coal and product coal stockpiles will be captured by the mine water management system and will be monitored as a part of the broader site water monitoring program.

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BARALABA SOUTH PROJECT

TABLE of CONTENTS

LIST of TABLES, FIGURES and APPENDICES

List of Tables

Refer to Appendix C for geochemical results tables.

List of Figures

List of Appendices

GLOSSARY of TERMS

Acid	A measure of hydrogen ion (H^+) concentration in water; generally expressed as pH.
Acid-Base Account	Evaluation of the balance between acid generation and acid neutralisation processes. Generally determined by the maximum potential acidity (MPA) and the inherent acid neutralising capacity (ANC), as defined below. See also "MPA" and "ANC".
AMD	Acid and metalliferous drainage from mining waste material. A process of sulphide oxidation generating a drainage of variable chemistry depending on the balance between acid generating and acid neutralising capacity of a material. It includes acid(ic) drainage (AD), pH-neutral and metalliferous drainage (NMD), or saline drainage (SD). The term AMD is used more recently to replace the term acid rock drainage (ARD) as metalliferous and saline drainage can occur under pH-neutral conditions.
ANC	Acid neutralising capacity, expressed as kg H_2SO_4 per tonne of rock/material. A measure of a sample's maximum potential ability to neutralise acid.
ANC/MPA ratio	Ratio of the acid neutralising capacity (ANC) to the maximum potential acidity (MPA) of a sample. Used to assess the risk of a sample generating acid conditions. See also "ANC" and "MPA".
CEC	Cation exchange capacity.
CHPP	Coal handling and preparation plant.
Coal reject	The general term given to solid waste produced during the processing of coal, typically from a CHPP. Coal reject is produced in different size fractions – fine (such as tailings) through to very coarse (such as breaker rejects) and combinations thereof.
Coarse reject	Coarse solid waste materials (typically greater than 1.5 mm grain size) produced from the CHPP as part of the processing of coal. See also "Fine reject".
EC	Electrical conductivity, expressed as μS/cm.
ESP	Exchangeable sodium percentage.
Fine reject	Also known as "tailings". Very fine to medium grained sand, silt and clay-sized material (typically less than 1.5 mm grain size), which is commonly coaly and carbonaceous, produced from the CHPP as part of the processing and washing of ROM coal. Se also "Coarse reject".
Interburden	Potential spoil material between mined coal seams. See also "overburden", "mining waste" and "spoil".

Kinetic test	Procedure used to measure the geochemical/weathering behaviour of a sample of mine material over time.
Mineral waste	Overburden, interburden and similar 'waste rock' material mined during extraction of coal. In this report, the definition of Mineral Waste also extends to coal reject materials (see "Coal reject").
MPA	Maximum potential acidity. Calculated by multiplying the total sulfur (S) or sulfide-sulfur (Scr) content of a sample by 30.6 (stoichiometric factor) and expressed as kg H_2SO_4 per tonne of rock/material.
NAF	Non-acid forming. Geochemical classification criterion for a sample that would not generate acid conditions. A sample classified as NAF may, or may not, have a significant sulfur content but the availability of neutralising material within the sample is more than adequate to neutralise all the acid that theoretically could be produced by any contained sulfide minerals. As such, material classified as NAF is considered unlikely to be a source of acidic drainage, however NAF material may still develop NMD and/or SD.
NAPP	Net acid producing potential, expressed as kg H_2SO_4 per tonne of rock/material. Calculated by subtracting the ANC from the MPA.
NATA accreditation	Accreditation by the National Association of Testing Authorities (Australia). NATA accreditation for a specific analytical test indicates that the test method and means of undertaking the test (following the method and achieving valid results) by the laboratory has been independently recognised by NATA. Accreditation provides a means of determining and formally recognising the competence of facilities to perform specific types of testing, inspection, calibration, and other related activities, on a routine basis.
NMD	Neutral and metalliferous drainage. A component of AMD, NMD occurs where drainage is pH-neutral or higher yet contains elevated trace metals and metalloids in solution.
Org S	Organic sulfur.
Overburden	Potential spoil material overlying the uppermost mined (economic) coal seam. See also "spoil".
PAF	Potentially acid forming. Geochemical classification criterion for a sample that has the potential to generate acid conditions. A sample classified as PAF has an acid generating potential (MPA) that exceeds the inherent acid neutralising capacity (ANC) of the material. This means there is a high risk that such a material, even if pH circum-neutral when freshly mined or processed, could oxidise and generate acidic drainage if exposed to atmospheric conditions. See also PAF-LC.
PAF-LC	Potentially acid forming (low capacity). Geochemical classification criterion for a sample that has the potential to generate relatively low-level AMD.
Rejects	In this report, 'rejects' refers to all coal reject other than tailings.

ROM	Run of mine. Coal as it comes from the mine, including any impurities.
S	Sulfur.
Scr	Chromium reducible sulfur. Analytical procedure to determine the sulfide-sulfur concentration in a sample.
SD	Saline drainage. A component of AMD, SD occurs where drainage is saline due to elevated sulfate as a result of sulfide oxidation.
SO_4	Sulfate.
Spoil	Also called 'waste rock'. Rock material overlying and between 'target' coal seams, which will report as waste. Waste rock overlying a mined coal seam is called overburden. Waste rock between mined coal seams is called interburden.
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.
Tailings	Also known as "fine reject". Very fine-grained mining waste material produced from the CHPP as part of the processing and washing of coal, and which have not been dewatered. Tailings typically comprises mud/clay, silt and fine coal present in CHPP wastewater.
Uncertain	In the context of classifying a material (sample) as NAF or PAF. An 'Uncertain' classification (UC) applies when there is an apparent conflict in results such that neither NAF nor PAF classification can be given, or there is insufficient information to unequivocally classify as NAF or PAF. Uncertain samples are sometimes given a tentative sub-classification, such as UC(NAF) or UC(PAF) where preliminary data suggests the sample may be NAF or PAF, respectively.
Water extract	A method to determine the water-soluble parameters in soil. Solid samples undergo a bottle leach method where 10 g of pulped solid (85 per cent passing 75 μm) is combined with 50 grams of de-ionised water into a glass bottle. The 1:5 solution (1 part solid to 5 parts water) is tumbled end-over-end for one hour. Solutes are leached from the soil by the continuous suspension and agitation. The water extract solution is measured for pH and electrical conductivity (EC) prior to filtering for solute analysis (*eg.* metals/metalloids and major ions).

1 Introduction and Context

Terrenus Earth Sciences (Terrenus) has completed a geochemical assessment of potential mine spoil (overburden and interburden) and potential coal reject (seam roof, parting and floor) from the Baralaba South Project (the Project), being developed by Baralaba South Pty Ltd as part of the 2023 Environmental Impact Statement (EIS) for the Project. The Project is located in the south-east of the Bowen Basin in Central Queensland, approximately eight kilometres (km) south of Baralaba township and approximately 115 km west of Rockhampton. The geochemical assessment was completed to assist with mine planning and as part of the environmental regulatory documentation for the Project.

Coal will be mined by conventional open-cut methods and spoil (waste rock) will be placed behind the active mining face. The management of overburden and interburden (spoil) materials generated by the Project will comprise the disposal of overburden and interburden initially into an out-of-pit emplacement area until space is available within the pit for in-pit disposal as low-wall spoil. Run-of-mine (ROM) coal would be processed on site at a coal handling and preparation plant (CHPP), with coal reject (coarse and fine rejects) disposed on site within spoil emplacement areas. Coal reject is expected to comprise less than 5 per cent (%) of all mineral waste for the Project.

Terrenus has geochemically assessed overburden and interburden samples (collectively called spoil) and coal seam roof, parting and floor samples (collectively called potential coal reject). The assessment of coal seam roof, parting and floor samples from drill-core applies to, and is indicative of, potential coal reject generally, however it does tend to more closely represent potential coarse coal reject.

1.1 Objective

The overall objective of this geochemical assessment was to:

Evaluate the geochemical nature of potential spoil and coal reject likely to be produced from the Project and identify any environmental issues that may be associated with mining, handling and storing this material.

1.2 Geological Background

The lithology within the Project area is characterised by typical basin-fill sediments, comprising mudstone, claystone, siltstone, sandstone (fine to coarse), carbonaceous sediments and coal seams. The depth to base of weathering averages about 20 metres (m) below natural surface, but does vary depending on the local topography.

The principal coal bearing sequence at the Project is the Permian-age Baralaba Coal Measures – the lateral equivalent of the Rangal Coal Measures. Immediately underlying the Baralaba Coal Measures is the Burngrove Formation (Kaloola Formation) also containing minor coal horizons. There are nine major coal-bearing seams within the Project area. The seam positions in the proposed pit are represented in two geological cross-sections (Figure 2-2). Refer to Figure 2-1 for the location of the cross-sections.

Coal seam roof and floor zones, and minor interseams between plys, of the Baralaba Coal Measures are typically comprised of fine-grained sedimentary lithologies, such as mudstones, siltstones and very fine-grained sandstone, which is typical of the 'low energy' depositional environment of coal. These thin roof and floor zones are also commonly carbonaceous, containing wispy coal laminations.

Overlying the Baralaba Coal Measures is the Rewan Formation of Triassic age.

2 Geochemical Assessment Methodology

This section provides the methodology used for the geochemical assessment of potential spoil and coal reject expected to be generated by the Project.

2.1 Information Review

A desktop review of available project data and information was completed to provide a better understanding of the Project. The review primarily comprised discussions with Project geologists and mine planning personnel regarding geological information, potential mining methods and mine plan, proposed coal handling and processing methods, and mining waste disposal and management strategies.

2.2 Sample Collection

Geochemical data was derived from exploration drill-core samples collected from the northern and central zones of the deposit. The drilling, sampling and associated laboratory work was undertaken in 2012 on behalf of Cockatoo Coal Ltd, the previous owners of the Project. All samples were collected in 2012 by Cockatoo Coal geologists. The location of drillholes (sample collection sites) was based on the likely pit/disturbance area of the original project (2012).

Since 2012 the Project has been scaled down to the eastern section of MLA 570007 to largely remove activity from the floodplain and, as such, the far northern part of the deposit is no longer proposed to be mined. However, the same geological units and coal seams are proposed to be mined/disturbed as the original 2012 proposed mine plan. Therefore, using the original geological and environmental geochemical data (from 2012) for the current assessment (EIS) is directly relevant and appropriate. Furthermore, most of the sampled drillholes within the new pit extent (shown on Figure 2-1) are in the area that will be mined during the first 10 years (approximately) of operations. Additional sampling of the southern area of the pit, representing the late-stages of mining, can be undertaken as the Project develops.

There are currently no specific regulatory requirements regarding the number of samples required to be tested for coal, spoil (waste rock) or potential coal reject material for mines in Queensland. Whilst historical guidelines do exist in Queensland (Department of Minerals and Energy [DME] 1995), more recent Australian and international guidelines (Department of Industry, Innovation and Science [DIIS] 2016; International Network on Acid Prevention [INAP] 2009) advocate a risk-based approach to sampling, especially for proposed coal mines/projects where the geology and environmental geochemistry is well understood (from primary and secondary information sources).

Geochemical data is available for 155 drill-core samples collected from 20 drill-holes, comprising 113 overburden/interburden samples and 42 potential coal reject samples.

Spoil samples

113 spoil samples representing overburden spoil above upper seams and interburden spoil between seams. Samples comprised:

- 3 weathered samples (all non-carbonaceous);
- 103 'fresh' non-carbonaceous samples; and
- 7 'fresh' carbonaceous samples.

Carbonaceous spoil refers to lithologies such as carbonaceous claystone or [carb.] siltstone, which typically contain appreciable concentrations of organic carbon. Comparatively, non-carbonaceous lithologies are essentially void of (or have negligible) carbonaceous material. Generally, carbonaceous Permian- and Tertiary-age materials in the Bowen Basin often have a higher AMD hazard compared (due to generally having a higher total sulfur [total S] and sulfide concentration) compared to non-carbonaceous materials.

Potential coal reject samples

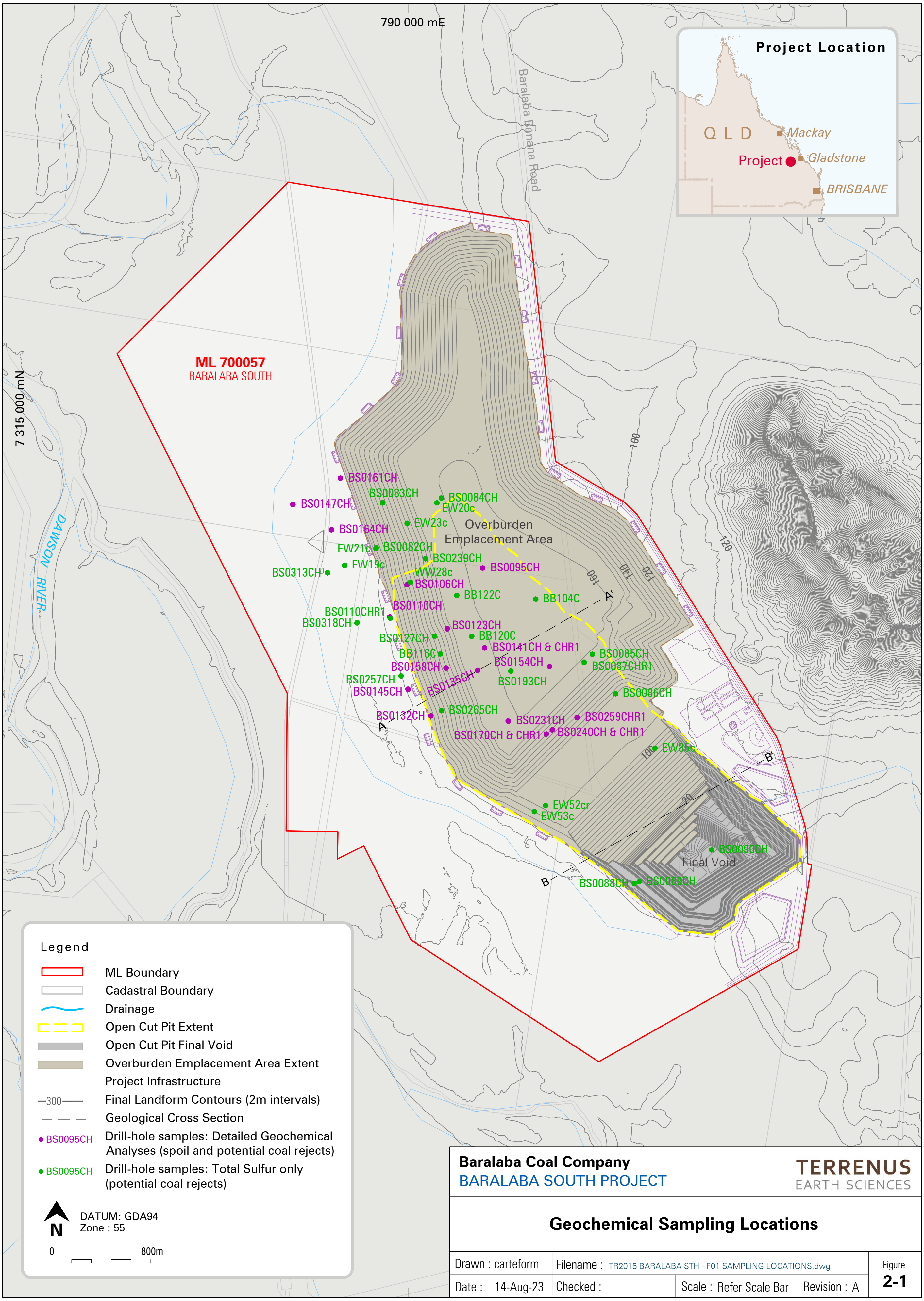
42 potential coal reject samples from immediate roof and floor (typically within 0.2 m of top and base of coal) and coal partings from nine coal seams:

- 3 roof, parting and floors sample from the Reid (RD) seam;
- 4 roof and floor samples from the Doubtful (DBT) seam;
- 6 roof and floor samples from the Dawson (DAW) seam;
- 7 roof, parting and floor samples from the Dunstan (DUN) seam;
- 4 roof and floor samples from the Sub-Dunstan (SDUN) seam;
- 6 roof, parting and floor samples from the Wright (WRI) seam;
- 6 roof and floor samples from the Double (DBL) seam;
- 4 roof and floor samples from the Coolum (COO) seam; and
- 2 roof and floor samples from the Dirty (DRT) seam.

Of the above, 26 samples were carbonaceous and 16 were non-carbonaceous.

In addition to the above samples, total S data was available for a further 270 potential coal reject (roof, parting and floor) samples collected from 49 drill-holes as part of the resource coal quality program (20 of these drill-holes are the same holes as per the geochemical sampling).

Drill-hole information is provided in Appendix A and the drill-hole (sampling) locations are shown on Figure 2-1. Sample descriptions are provided in the geochemical data tables in Appendix C.



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Geochemical Sampling Locations

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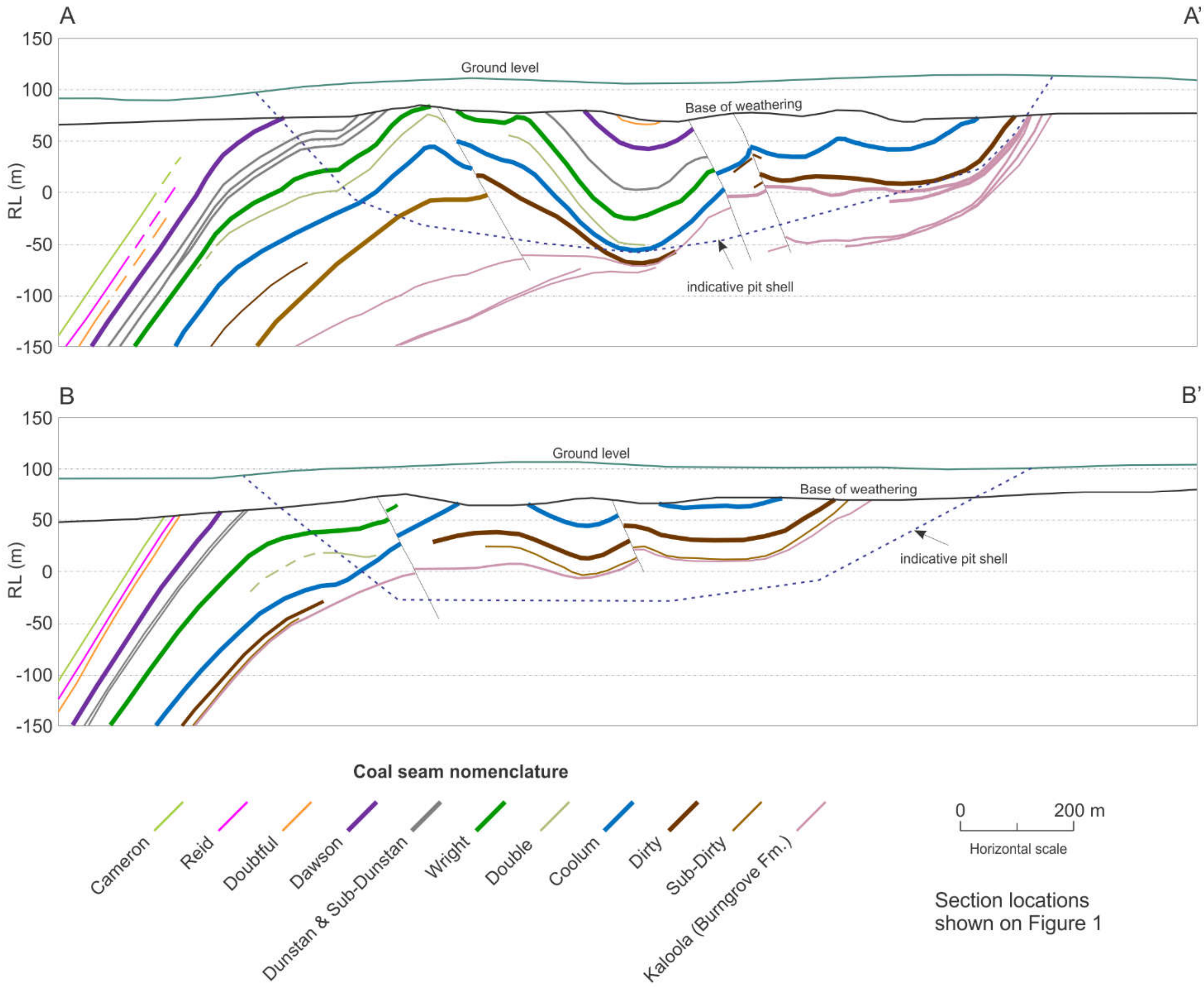
Figure 2-2. Typical West-East Geological Cross-Sections Through the Project
(Modified figures from geological data provided by Project geologists)



2.3 Sample Characterisation

The samples were characterised using static geochemical test methods, which provide the fundamental geochemical characteristics of a sample. Static tests involve discrete analytical tests undertaken on samples, where the results represent the geochemical characteristics of the sample at a single point in time and under simple experimental conditions as a 'snapshot' of the sample's likely environmental geochemical characteristics.

Static Test Methodology

The geochemical test-work program has been undertaken in stages, with stage 1 (screening tests) comprising 'standard' test-work, and subsequent stages involving more advanced and specialised test-work. All samples have undergone 'screening' tests for:

- pH and electrical conductivity (EC) – an end-over-end bottle leach at 1:5 weight:volume [w:v] solid:water ratio using deionised water.
- net acid producing potential (NAPP), which comprises total sulfur (S) and acid neutralising capacity (ANC). The NAPP test provides the fundamental information about the theoretical maximum amount of acid-producing and acid-neutralising material that a sample could produce.

Based on the results of the screening tests, selected samples (or composite samples) were subjected to some or all of the following tests:

- sulfur as sulfide [chromium reducible sulfur (Scr)]
- total metals and metalloids by 2-acid (aqua regia) digest with analysis by Flow Injection Mercury System (FIMS) for mercury and Inductively Coupled Plasma Atomic Emission Spectroscopy [ICP-AES] for all other elements.
- deionised water extract leach procedure – a 1 hour end-over-end bottle leach at 1:5 w:v (solid:water) ratio using de-ionised water, with filtered leachate analysed for:
  - major and minor ions [calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), sulfate (SO_4) and chloride (Cl)];
  - alkalinity [total alkalinity, bicarbonate (HCO_3) and carbonate (CO_3)];
  - soluble metals and metalloids [19 elements by ICP-AES and FIMS].
- Exchangeable cations (Ca, Mg, Na, K) with pre-treatment for salinity, if required. Results were used to calculate the cation exchange capacity (CEC).

Summary of Test-Work Program

The geochemical test work program is summarised in **Table 2-1**. Laboratory test work was undertaken by ALS Environmental and ALS Minerals (Brisbane), using National Association of Testing Authorities (NATA) accredited methods (where such accreditation exists).

Table 2-1. Summary of the Geochemical Test-Work Undertaken
(Number of samples subjected to each test regime)

Analytical tests	Samples
pH and EC in 1:5 (w:v) deionised water extract	All 155 samples
Total sulfur (S)	All 155 samples
Sulfide (Scr)	42 samples (samples with total S ≥0.1 %)
ANC	All 155 samples
Total elements in solids – aqua-regia (2-acid) digest; ICP-AES	15 discrete samples and 27 composite samples
Soluble parameters in 1:5 (w:v) deionised water extract ICP-AES / FIMS	15 discrete samples and 27 composite samples
Exchangeable cations	28 samples (potential spoil only)

2.4 Geochemical Source Hazard Assessment

The data was assessed with regard to the samples potential to generate acid and metalliferous drainage (AMD). Only after making such an assessment to understand the potential AMD hazard can appropriate management measures be formulated to adequately mitigate the risks. The term 'AMD' is used to describe low-quality seepage or drainage that has been affected by the oxidation of sulfide minerals (primarily pyrite and marcasite) and/or by the dissolution of acid generating sulfate minerals (such as jarosite and alunite), regardless of final drainage chemistry.

AMD may be produced when sulfide minerals (such as pyrite) are exposed to oxygen and water. Oxidation of sulfide minerals may result in the production of acid(ity), sulfate (SO_4) and, depending on mineralogy, the release of metals and salinity. AMD can be acidic, pH circum-neutral, alkaline and/or saline (INAP, 2009[1], DIIS, 2016[2]). Whether contact water is acidic and metalliferous (acid drainage [AD]), pH-neutral/alkaline and metalliferous (neutral and metalliferous drainage [NMD]) or saline due to elevated sulfate (saline drainage [SD]) largely depends on the relative proportion of sulfide minerals (acid generating) and carbonate minerals (acid neutralising) in the source materials. In this assessment unless specified otherwise, the term AMD is broadly used to describe AD, NMD and/or SD.

AMD Classification

The Acid-Base Account (ABA) method was used to assess the acid-neutralising and acid-generating characteristics of the samples in order to determine an acid (AD) classification for the mineral waste materials.

The maximum potential acidity (MPA) and acid neutralising capacity (ANC) represent each side of the acid-base account. MPA is calculated from total S and is the theoretical maximum potential acidity that can be generated if all of the S, assumed to be associated entirely with pyrite sulfide, is able to oxidise and generate acid (H_2SO_4). ANC represents the theoretical maximum amount of acid-neutralising capacity of a sample assuming all neutralising material is in a readily available form. The net acid producing potential (NAPP) is the difference between the MPA and the ANC. In simple terms, a negative NAPP indicates an excess of ANC and the sample is likely to be non-acid forming (NAF) and a positive NAPP indicates an excess of MPA and the sample is likely to be potentially acid forming (PAF) – though there can be exceptions to this simplified interpretation. Note that NAF samples have the potential to generate NMD and SD, depending on the sulphur concentration.

Sample classification of mineral waste material follows some general rules. Samples were initially classified, with respect to acid generation, using NAPP and ANC/MPA ratio (and NAG data, where available) into three broad categories:

1 INAP, 2009. Global Acid Rock Drainage Guide.

2 DIIS, 2016, Preventing Acid and Metalliferous Drainage. Handbook from Australian Federal Government's Leading Practice Sustainable Development Program for the Mining Industry. https://www.industry.gov.au/data-and-publications/leading-practice-handbook-preventing-acid-and-metalliferous-drainage.

- NAF Non-acid Forming;
- PAF Potentially Acid Forming;
- Uncertain Those samples with inconclusive results, leading to a degree of uncertainty about their ability to generate acid.

Where available, sulfide (Scr) and lithology was taken into consideration to resolve acid classification uncertainties. The general approach was to build in a level of conservatism in the preliminary classification, as shown in **Table 2-2**.

Table 2-2. Preliminary Acid Classification

Preliminary Classification	Sulfur %	NAPP kg H_2SO_4/t	ANC/MPA ratio
NAF	≤ 1	< 0	≥ 2
	≤ 1	< 0	-
NAF-Sulfur (NAF-S)	> 1	< 0	≥ 2
	> 1	< 0	-
PAF – Low Capacity (PAF-LC)	≤ 1	≥ 0 and < 10	< 2
	-	≥ 0 and < 10	-
PAF	-	≥ 10	< 2
	-	≥ 10	-
Uncertain (UC)	Any result outside of the above criteria, or results that appear to significantly conflict with the expected result based on lithology or mineralogy. Samples with an 'uncertain' (UC) classification, but expected to be NAF are assigned a preliminary UC(NAF) classification. Similarly, UC samples expected to be PAF are assigned a preliminary UC(PAF) classification. Where there is considerable uncertainty, a UC(PAF) classification has been conservatively applied.		

Sulfur Category

To ensure a consistent approach to describe the samples' geochemical characteristics, specific total S cut-off values were used to discuss sulfur data, as shown **Table 2-3**.

Table 2-3. Sulfur Classification

Sulfur Category	Total S wt %
Very low	< 0.1
Low	0.1 – 0.5
Low-moderate	0.5 – 1.0
Moderate	1.0 – 1.5
High	> 1.5

ANC Category

To ensure a consistent approach to describe the samples' geochemical characteristics, specific ANC cut-off values were used to discuss ANC data, as shown **Table 2-4**.

Table 2-4. ANC Classification

ANC Category	ANC kg H_2SO_4/t
Very low	< 5
Low	5 - 15
Moderate	15 - 30
High	30 - 50
Very high	> 50

Soil Salinity

Classifying whether a sample/material is non-saline, highly saline, or somewhere in between will depend upon the methods used to measure soil salinity. Soil salinity data is obtained from a 1:5 (w:v) water extract procedure on pulp samples (pulping the sample minimises the potential to underestimate salinity on sandy samples/materials). The soil salinity classes shown in Table 2-5 are expressed in units of microSiemens per centimetre (μS/cm). These soil salinity classes are used as an indicative guide.

Table 2-5. Soil Salinity Classification

Soil Salinity Classification	$EC_{1:5}$ μS/cm
Non-saline	< 450
Slightly saline	450 - 900
Moderately saline	900 - 2000
Saline	2000 - 4000
Strongly saline	> 4000

Soil pH Type

Classifying whether a sample/material is acid, pH-neutral or alkaline will depend upon the methods used to measure soil pH. Soil pH data is obtained from a 1:5 (w:v) water extract procedure on pulp samples. The soil pH types shown in Table 2-6. These soil pH types are used as an indicative guide.

Table 2-6. Soil pH Classification

Soil pH Classification	$pH_{1:5}$
High acid	< 3.0
Moderately acid	3.0 – 4.5
Weakly acid	4.5 – 6.0
Near neutral	6.0 – 7.5
Alkaline	7.5 – 9.0
Highly alkaline	> 9.0

Element Enrichment

The total concentration result for each element were compared to average element abundance in soil in the earth's crust (AusIMM 2011; Bowen 1979) to measure how the total elemental concentrations in the samples compare against average elemental concentrations in unmineralised soil (worldwide). Such a comparison is undertaken to identify samples that contain what may be regarded as 'elevated' concentrations of metals and metalloids to assess any potential concerns related to disposal and rehabilitation. However, enrichment in metals/metalloids in the solids does not translate to enhanced leachability or mobilisation of that specific element.

From the comparison with average crustal abundance in rocks a geochemical abundance index (GAI) was calculated. The GAI quantifies an assay result for a particular element in terms of the average abundance for that element. The index, based on a log 2 scale, is expressed in seven integer increments (0 to 6), which correspond to enrichment factors from 0 to over 96 times average crustal abundance, as shown in Table 2-7.

Table 2-7. Geochemical Abundance Index (GAI)

GAI	Description	GAI	Description
0	Less than 3-fold enrichment	4	24 to 48-fold enrichment
1	3 to 6-fold enrichment	5	48 to 96-fold enrichment
2	6 to 12-fold enrichment	6	Greater than 96-fold enrichment
3	12 to 24-fold enrichment		

As a general rule, a GAI greater than or equal to three indicates enrichment to a level that potentially warrants further investigation or provides an indication of which elements may potentially be problematic with respect to environmental impacts.

Elements identified as enriched may not necessarily be a concern for revegetation and rehabilitation, human and animal health or drainage water quality, but their significance should be evaluated. Similarly, if an element is not enriched it does not mean it would never be a concern, as GAI is a measure of element abundance against a non-mineralised terrain and does not provide any insight into metal/metalloid mobilisation and bioavailability.

Initial Solubility

The solubility data from bottle leaching provides an indication of likely solubility/release of salt and metals/metalloids under field pH and redox (oxidation) conditions (and/or saline or low-pH conditions, where applicable).

The leaching tests were performed on pulped samples (85 % passing 75 micrometres (μm) in diameter [<0.075 mm]). This is a standard preparation method that provides a homogenous sample for testing and creates a large surface contact area. This, in turn, provides a large potential for sample dissolution and reaction. All solubility data is obtained from a 1:5 (w:v) water extract procedure on pulp samples.

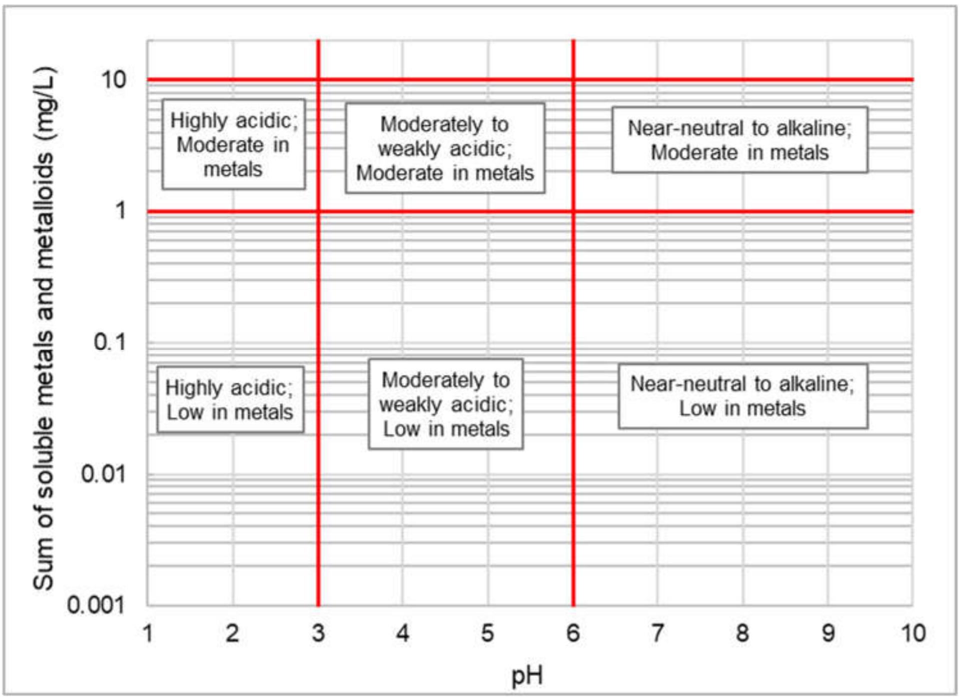
To ensure a consistent approach to describe the samples' geochemical characteristics, specific concentration cut-off values were used to discuss leachate composition as shown in Table 2-8.

Table 2-8. Soluble Trace Element Classification

Classification	Trace Element Soluble Concentration mg/L
Close to detection	≤ 0.001
Very low	> 0.001 – 0.05
Low	> 0.05 – 0.1
Moderate	> 0.1 – 1.0
High	> 1.0 – 10
Very high	> 10

A classification scheme initially developed by Ficklin *et al*. (1992) has been adapted to summarise major attributes of the solubility data by plotting pH against soluble metal and metalloid concentrations for groups of elements, with the classification scheme shown in Figure 2-3. The soluble metal and metalloid concentrations are shown as the sum of soluble metal concentrations for base metals (cadmium [Cd] + cobalt [Co] + copper [Cu] + nickel [Ni] + lead [Pb] + zinc [Zn]) and/or the sum of soluble arsenic [As] + manganese [Mn] + molybdenum [Mo] + selenium [Se]. These two groups of elements are chosen because they remain in solution across a wide range of pH and are not only associated with AD conditions, but also with NMD/SD conditions.

Figure 2-3. Classification of Soluble Metals and Metalloids as a Function of pH



No comparison is made between leachate results and water quality guideline values, such as ANZG (2018), as such a comparison is inappropriate. The guideline values provided in ANZG (2018) are for receiving water environments (eg. creeks and rivers), whereas the soluble element data in this assessment is 'point source' obtained from a finely pulped sample subjected to rigorous and artificial extraction to obtain a concentration approaching 'near maximum'. Furthermore, contact water will undergo a number of geochemical reactions along a pathway from source to receptor, including: retardation, adsorption and precipitation – and also likely dilution, which will attenuate the concentration as seepage/contact water migrates from the source. These processes are not accounted for in a laboratory setting.

Sodicity and Dispersion

Potential spoil samples (representing material that is likely to report to final landform surface) are broadly classified with respect to sodicity on the basis of the exchangeable sodium percentage (ESP) value, as shown in Table 2-9 (after Northcote and Skene, 1972; Isbell, 2002).

Table 2-9. Sodicity Classification

Sodicity Classification	ESP %
Non-sodic	≤ 6
Sodic	6 - 14
Strongly sodic	> 14

The sodicity will depend upon a range of factors, such as clay mineralogy, soil sodium concentration, soil salinity and irrigation water (rainwater) chemistry, which may enhance or limit the potential for soil to be sodic or become sodic over time. Therefore, values of 6 % ESP and 14 % ESP to represent soils as being non-sodic, sodic or strongly sodic are used as a general guide only and should not be taken as definitive. Sodicity assessments only apply to materials likely to report to final landform surfaces, such as overburden/interburden (ie. not waste coal or coal reject).

3 Geochemical Test Results

The geochemical results are tabulated in Appendix C and discussed herein.

3.1 Acid-Base Accounting (Potential for Acid Generation)

The ABA is the theoretical balance between the potential for a sample to generate acid and neutralise acid and is expressed in units of kg H_2SO_4/t.

Sulfur and Sulfide

The total sulfur (total S) concentration values of all samples were generally very low to low, as shown in Figure 3-1 for spoil samples – of which most were non-carbonaceous and Figure 3-2 for seam roof/parting/floor samples – representative of 'potential' coal reject material, of which most were carbonaceous.

Spoil samples had very low median and 90th percentile values of 0.03 % and 0.09 %, respectively. Seam roof/parting/floor samples also had very low median and moderate 90th percentile values of 0.19 % and 0.60 %, respectively. As evident, the total S concentrations were generally higher in the carbonaceous samples (broadly representative of potential coal reject) compared to the non-carbonaceous (and weathered carbonaceous) materials, however were still low. The total S distribution varied between the different coal seams (Figure 3-2).

Chromium reducible sulfur (Scr) was measured on 42 samples – all samples with total S greater than or equal to 0.1 % – and divided approximately equally between non-carbonaceous and carbonaceous samples. Scr values ranged from less than 0.01 % to 0.63 %, with very low to low median and 90th percentile Scr values of 0.11 % and 0.32 %, respectively. As a proportion of total S, Scr (sulfide) accounts for about 58 % (on average) of total S for non-carbonaceous samples, and about 35 % (on average) for carbonaceous samples – as expected, assuming that a significant proportion of coaly and carbonaceous total S is present as organic S. These results indicate that the maximum potential acidity (MPA) that could be generated by these samples is very low.

Figure 3-1. Distribution of Total Sulfur (S) in Spoil

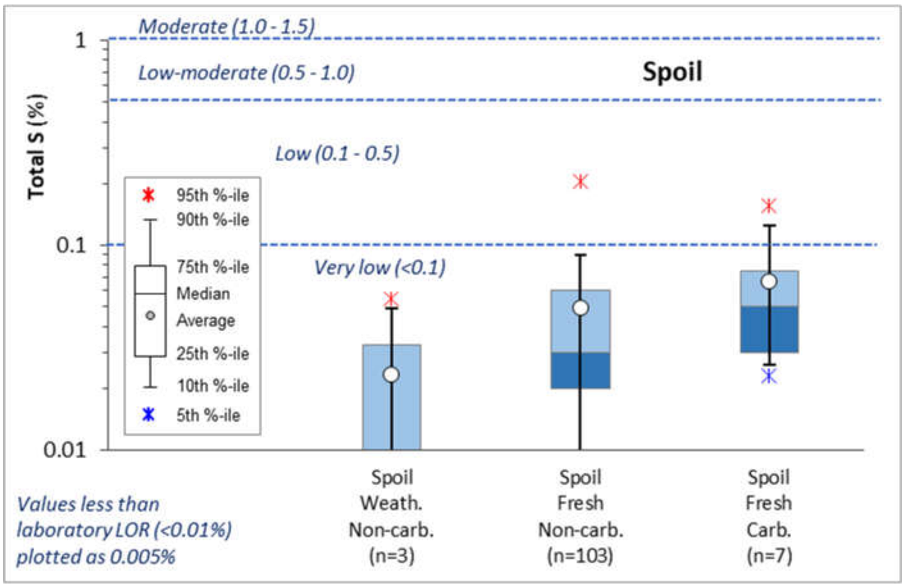
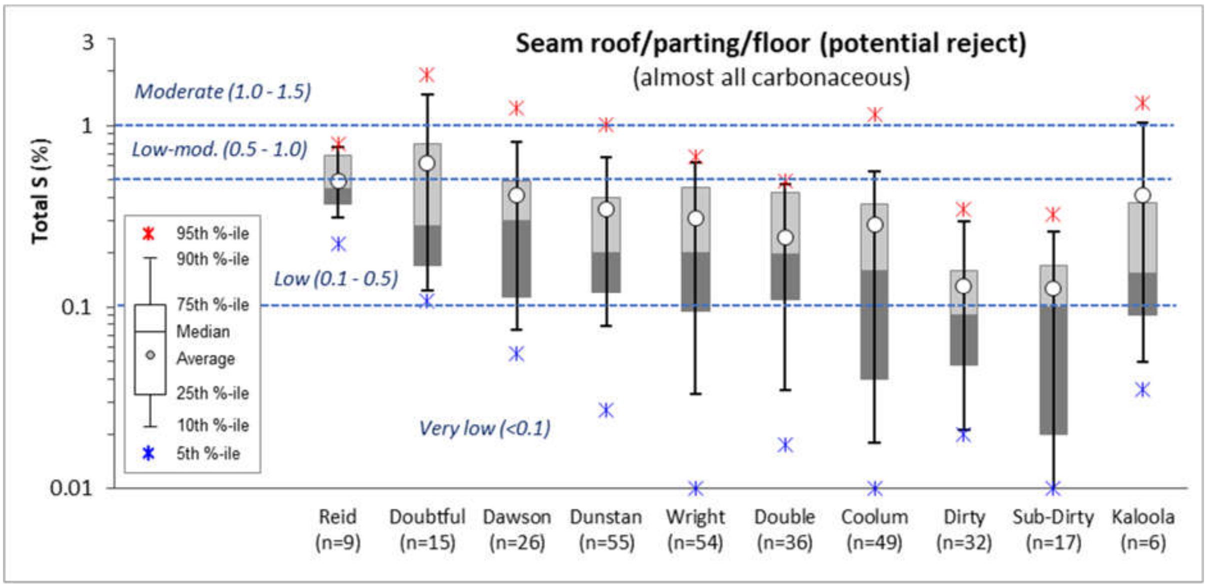


Figure 3-2. Distribution of Total Sulfur (S) in Coal Seam Roof/Parting/Floor (potential reject)

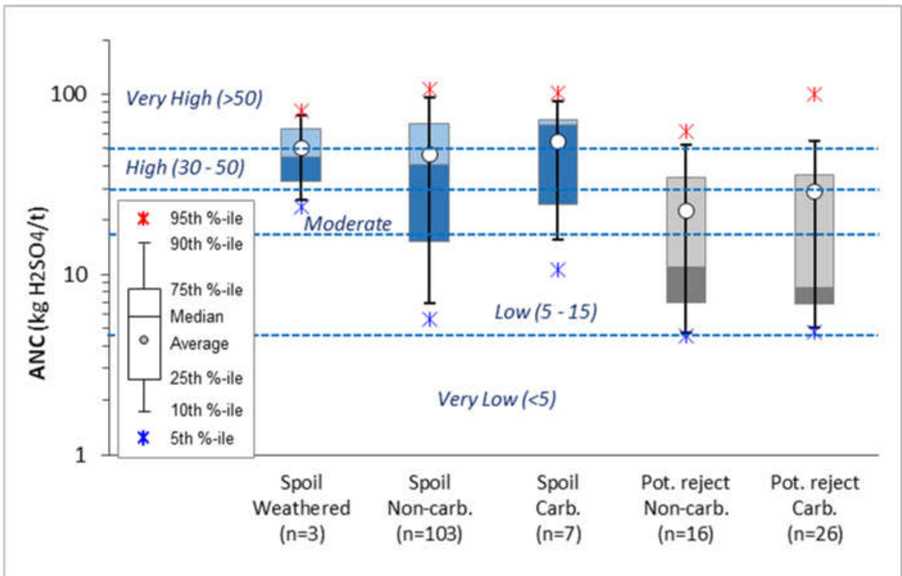


Maximum Potential Acidity and Acid Neutralising Capacity

The MPA is calculated from the total S value. Therefore, due to the generally very low to low total S values for spoil samples the MPA values are also very low to low, with a 95th percentile MPA value of 6.1 kg H_2SO_4/t (*ie*. 95 % of spoil samples have an MPA less than 6.1 kg H_2SO_4/t). The MPA values of seam roof/parting/floor samples – of which most are carbonaceous – are higher than spoil samples, as expected, with 95th percentile MPA value for seam roof/parting/floor samples of 24 kg H_2SO_4/t.

The ANC values are typically well in excess of the MPA values and span a large range, from a very low 2.7 kg H_2SO_4/t to a very high 208 kg H_2SO_4/t, with a median ANC value for all samples of 32 kg H_2SO_4/t and a low 10th percentile value of 6 kg H_2SO_4/t. Spoil samples generally have higher ANC compared to potential reject samples, as evident in Figure 3-2.

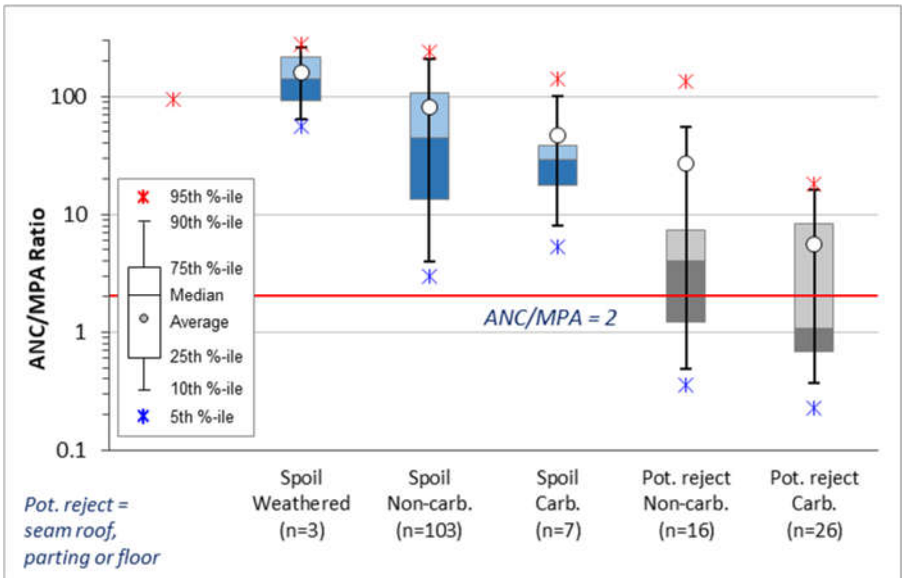
Figure 3-3. Distribution of Acid Neutralising Capacity (ANC)



ANC/MPA Ratios

Generally, those samples with an ANC/MPA mass ratio greater than two are considered to have a negligible/low risk of acid generation (DIIS, 2016; INAP, 2009[3]), especially where sulfide concentrations are very low and reactive ANC is very high (or significantly higher than the MPA). The results, illustrated in **Figure 3-4**, show that 96 % of spoil samples have an ANC/MPA ratio greater than two, and 88 % of spoil samples have ANC/MPA ratios greater than five. Of the 42 potential spoil samples, 19 samples (45 % of potential reject samples) have an ANC/MPA ratio greater than two. There is generally little difference between the ANC/MPA ratios of non-carbonaceous samples versus carbonaceous samples.

Figure 3-4. Distribution of the Ratio of Acid Neutralising Capacity (ANC) to Maximum Potential Acidity (MPA) [ANC/MPA ratio]

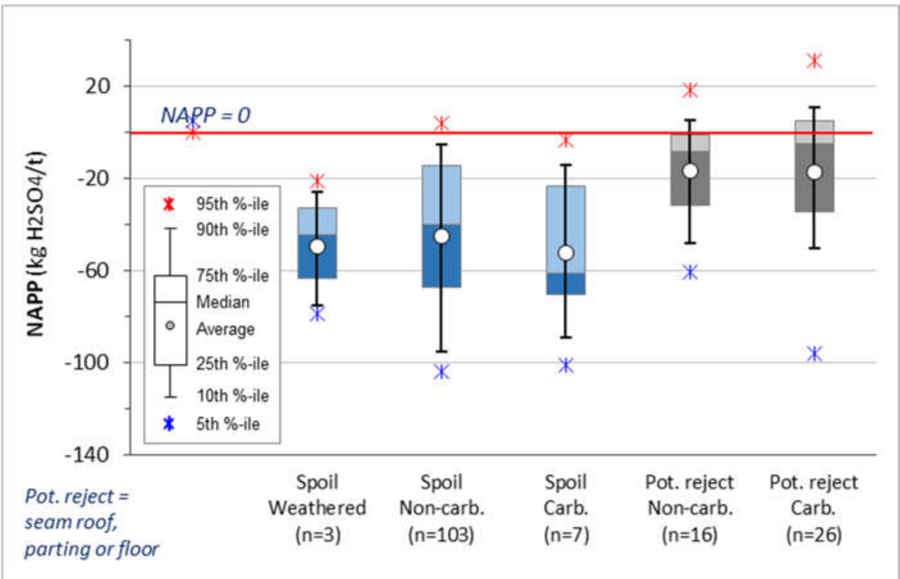


Net Acid Producing Potential

Based on the generally low MPA and significantly higher ANC values (relative to the MPA), the calculated NAPP values are negative for almost all (98 % of) spoil samples and indicate that, overall, there is significantly excess neutralising capacity (ANC) compared to potential acidity (MPA) in likely spoil material (**Figure 3-5**). Comparatively, 33 % of potential reject samples have negative NAPP values.

3 INAP (2009) considers that mine materials with an ANC/MPA ratio greater than two are likely to be NAF unless significant preferential exposure of sulfide minerals occurs along fracture planes, in combination with insufficiently reactive ANC.

Figure 3-5. Distribution of Net Acid Producing Potential (NAPP)



Geochemical Classification of Samples

The ABA results presented in this section have been used to classify the acid forming nature of the drill-hole samples following the classification criteria outlined in Section 2.4 and taking into account all additional relevant Scr data and geological/lithological. The acid forming nature of these samples is summarised in Table 3-1.

Table 3-1. Geochemical Classification

Waste Type	NAF	UC(NAF)	NAF-S	UC(PAF)	PAF-LC	PAF
	No. and % of samples					
Spoil: weathered (n=3)	3 (100%)	0	0	0	0	0
Spoil: non-carbonaceous (n=103)	101 (98%)	1 (~1%)	0	1 (~1%)	0	0
Spoil: carbonaceous (n=7)	7 (100%)	0	0	0	0	0
Spoil: all samples (n=113)	111 (98%)	1 (~1%)	0	1 (~1%)	0	0
	112 (99%)		1 (1%)			
Potential reject: non-carbonaceous (n=16)	13 (81%)	0	0	2 (13%)	0	1 (6%)
Potential reject: carbonaceous (n=26)	17 (65%)	0	1 (4%)	6 (23%)	2 (8%)	0
Potential reject: all samples (n=42)	30 (71%)	0	1 (~2.5%)	8 (19%)	2 (5%)	1 (~2.5%)
	30 (71%)		12 (29%)			

The classifications in Table 3-1 show that greater than approximately 99 % of spoil samples and 71 % of potential reject samples were classified as NAF or were expected to be NAF (and have been classified as UC(NAF)). These samples, including non-carbonaceous and carbonaceous material represented by these samples, have very low sulfur concentration, significant excess ANC (relative to the MPA) and clearly have negligible capacity to generate AMD. Of the 12 potential reject samples classified as some type of 'PAF' or high sulfur NAF, three were non-carbonaceous and nine were carbonaceous.

From an acid generating perspective spoil, as a bulk material, would be overwhelmingly NAF. Approximately 71 % of potential reject samples were also classified as NAF or UC(NAF), indicating that most coal reject materials would also be expected to pose a very low risk of generating acid drainage. Furthermore, the generally very low sulfur concentrations in non-carbonaceous material (which is expected to comprise the majority of spoil) – and the generally low sulfur concentrations in carbonaceous material (which is broadly representative of potential coal reject) indicates that the sulfate concentration that could be generated in both spoil and potential coal reject from sulfide oxidation (in addition to any salinity unrelated to sulfide oxidation) would also be very low to low.

3.2 Total Metals and Metalloids

Multi-element (metal and metalloid) data is available for:

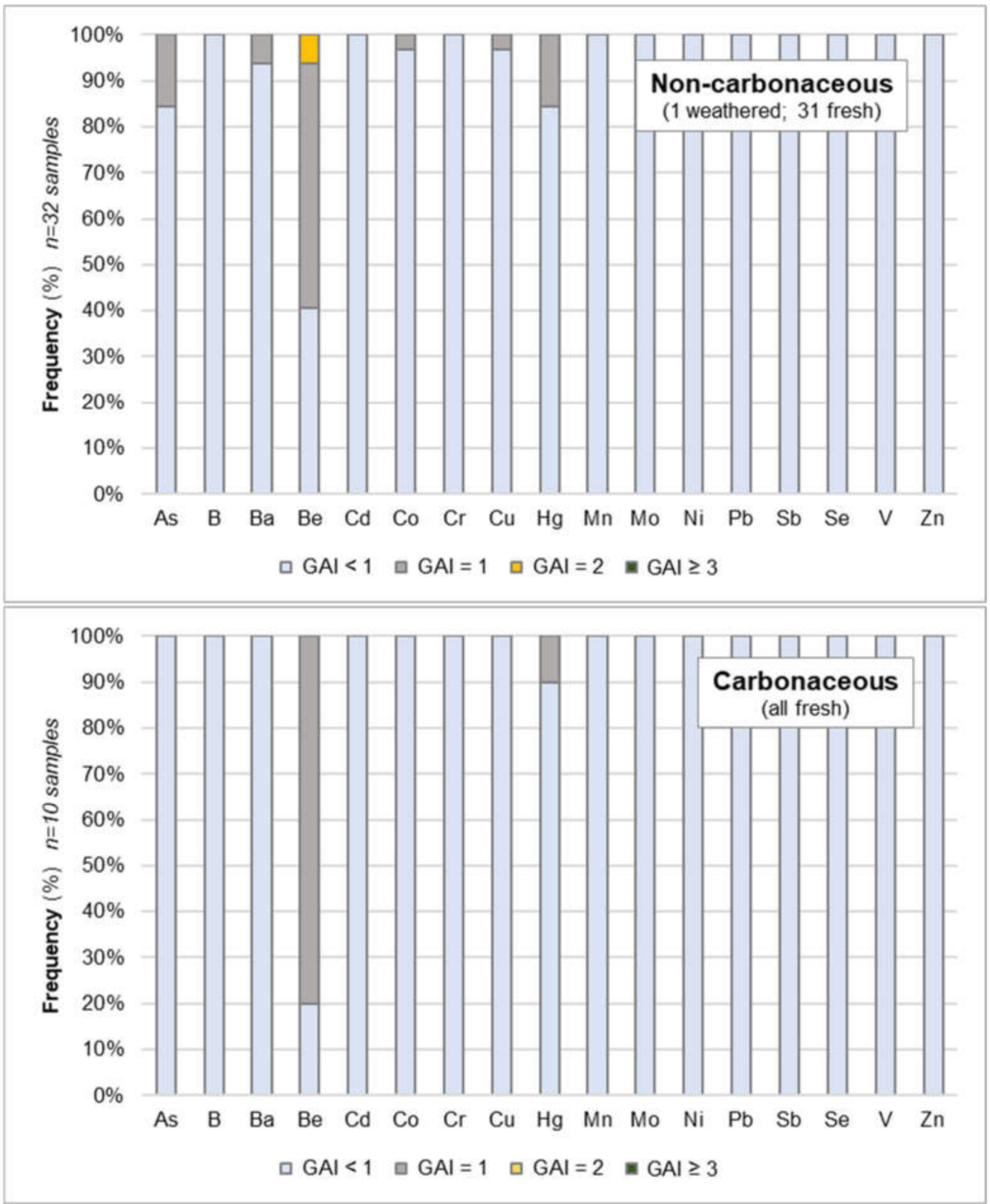
- 28 potential spoil samples: 1 weathered non-carbonaceous; 25 fresh non-carbonaceous; and 2 fresh carbonaceous.
- 14 potential coal reject samples: 6 non-carbonaceous; and 8 carbonaceous.

The above samples comprised 15 discrete samples, which were all spoil samples; and 27 composite samples. The composite samples comprised both spoil and potential reject samples. Refer to Appendix B for the make-up of composite samples.

The degree of enrichment with respect to elements potentially of environmental interest is shown in Figure 3-6. The GAI values show that no samples were significantly enriched [GAI ≥3] with regard to any of the elements for which data is available. Two fresh non-carbonaceous samples had minor enrichment [GAI=2] with regard to beryllium (Be), and most of samples tested had minor enrichment [GAI = 1] with regard to Be. A small number of samples had minor enrichment with regard to one or more of arsenic (As), barium (Ba), cobalt (Co), copper (Cu) and mercury (Hg).

Overall, the results suggest that bulk overburden and interburden (spoil) materials – and potential coal reject materials – have low levels of metal and metalloid enrichment, which is consistent with Permian-age coal measures throughout eastern Australia, and consistent with the Rangal Coal Measures in the Bowen Basin.

Figure 3-6. Frequency Distribution of Geochemical Abundance Indices (GAI) of Selected Elements in non-carbonaceous and carbonaceous materials



3.3 Solubility of Spoil and Potential Coal Reject

To evaluate the initial solubility of multi-elements in samples, water extract test results for a variety of 'typical' water quality parameters are available for 42 samples. The water extract tests were undertaken on the same 42 samples as assayed (**Section 3.2**). Refer to **Appendix B** for the make-up of composite samples. All samples underwent a 1:5 w:v (solid:water) water extract procedure on pulps.

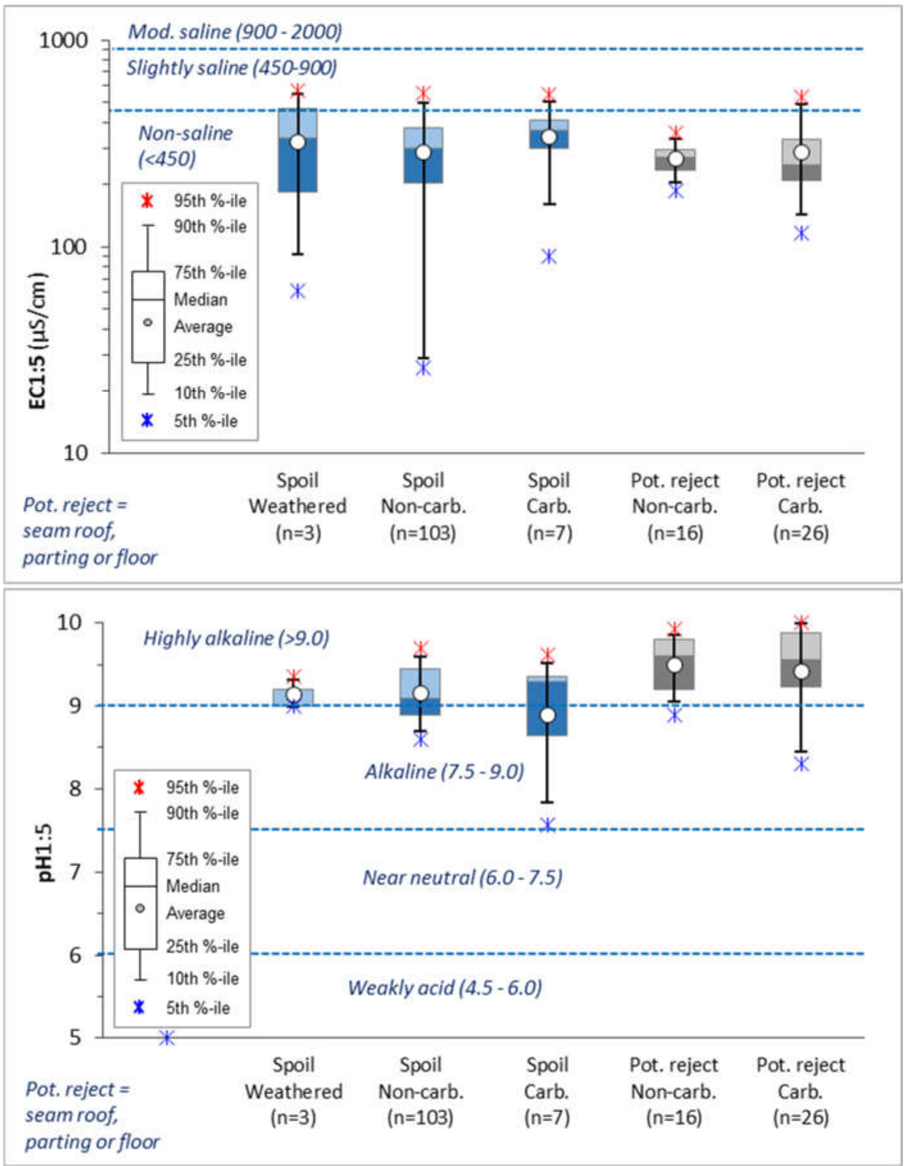
Water extract tests provide a preliminary indication of the elements that may be readily mobilised from any given material type. The results from these tests are provided in **Appendix C**, and summarised and discussed below. In addition to the 42 samples that underwent soluble metals analysis, pH and EC data is available for all 155 samples.

Electrical Conductivity (EC) and pH

EC and pH data is available for all 155 samples at 1:5 w:v on pulp. The $EC_{1:5}$ of all samples – non-carbonaceous and carbonaceous material – was low, and ranged from 12 to 740 µS/cm, with median, 75th and 90th percentile $EC_{1:5}$ values of 284, 365 and 495 µS/cm, respectively. As evident in Figure 3-7, potential spoil and potential coal reject materials represented by these samples are generally non-saline.

The pH distribution by material type (Figure 3-7) shows all materials to be generally alkaline to highly alkaline (median pH 9.2) – indicating no readily soluble acidity from these samples. These alkaline pH results are common (if not typical) for Bowen Basin Permian material based on Terrenus' significant experience in the region.

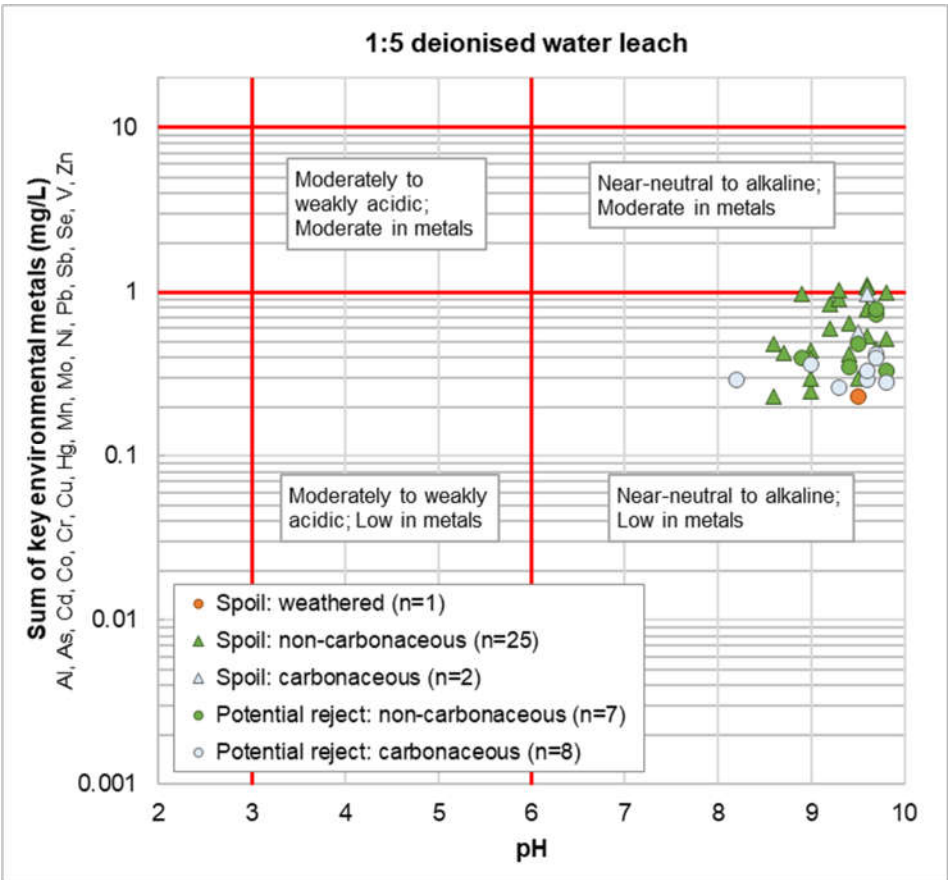
Figure 3-7. Electrical Conductivity (EC) Distribution



Metals and Metalloids

The sum of 15 environmentally important elements are plotted as a function of pH in Figure 3-8, in a modified version of what is referred to as a Ficklin plot (after Ficklin *et al*., 1992). The 15 selected metals/metalloids comprise: aluminium [Al], antimony [Sb], arsenic [As], cadmium [Cd], cobalt [Co], chromium [Cr], copper [Cu], lead [Pb], mercury [Hg], manganese [Mn], molybdenum [Mo], nickel [Ni], selenium [Se], vanadium [V] and zinc [Zn]. As evident in Figure 3-8 all 42 samples have low soluble metals concentrations and have alkaline to highly alkaline pH.

Figure 3-8. Sum of Key Environmental Metals and Metalloids versus pH in Deionised Water Extracts



In pH-neutral to alkaline waters, many metals/metalloids cannot remain in solution and, thus, trace metal/metalloid concentrations are generally low. Comparatively, in acid(ic) waters, many metals/metalloids are moderately to highly soluble and remain in solution and, thus, trace metal/metalloid concentrations are generally high. Notable exceptions to these general rules include elements such as As, Mn, Sb and Se, which remain soluble through a wide pH range. Other trace metals that are somewhat soluble under pH-neutral to alkaline conditions include Cd, Cr, Mo and Zn. As such, under the pH-alkaline conditions of the leach, the mobility of these elements would not be inhibited.

No comparison has been made between bottle leachate results and water quality guideline values, such as ANZG (2018), as such a comparison is inappropriate. The guideline values provided in ANZG (2018) are for receiving water environments (eg. creeks and rivers), whereas the soluble element data in this assessment is 'point source' obtained from a finely pulped sample subjected to rigorous and artificial extraction to obtain a concentration approaching 'near maximum'.

Furthermore, as contact water reports to the receiving environments a number of geochemical reactions will take place, including: retardation, adsorption and precipitation – and also likely dilution, which will attenuate the concentration as seepage/contact water migrates from the source. These processes are not accounted for in a laboratory setting.

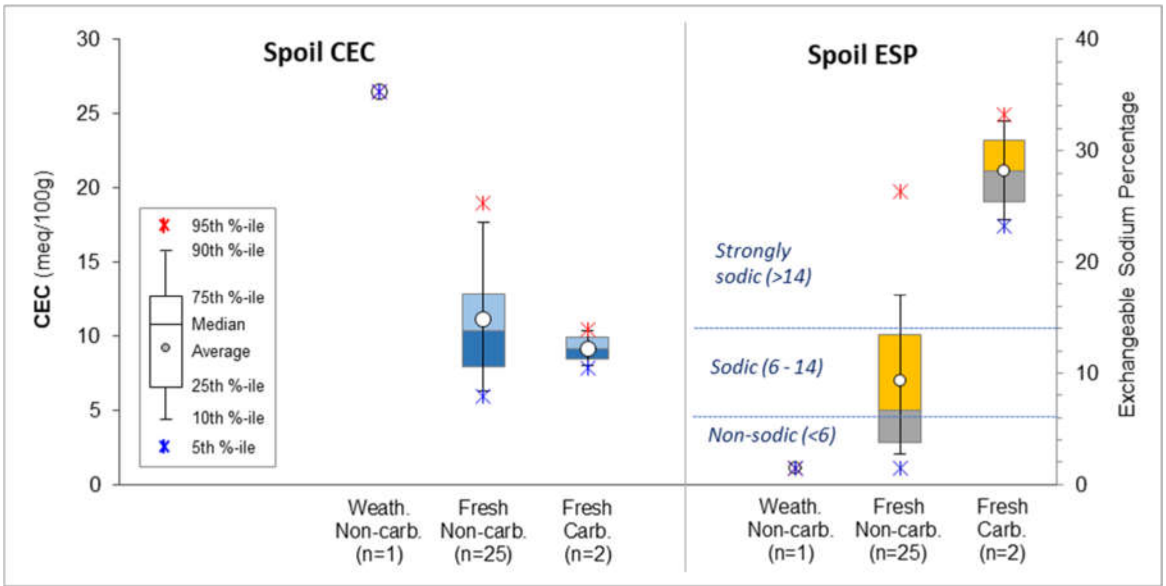
3.4 Cation Exchange Capacity, Sodicity and Dispersion of Spoil

Exchangeable cation concentrations are used to evaluate the potential 'soil quality' of materials. Exchangeable cation data is available for 28 potential spoil samples. The cation exchange capacity (CEC) and exchangeable sodium percentage (ESP) results are presented in Appendix C and summarised in Figure 3-9.

The CEC spans a large range from 5 to 28 milliequivalents per 100 grams (meq/100g), with a modest median CEC value of 10 meq/100g. The single weathered sample had a much higher CEC value and lower ESP value compared to the fresh samples.

ESP values are used as an indirect measure of the *potential* for a sample to have structural stability problems and hence *may be* dispersive. The ESP results range from 1 % to 28 %, with a relatively high median ESP of 44 % - with the two carbonaceous samples having the highest ESP values. The two carbonaceous samples and half of the non-carbonaceous samples had ESP values greater than 6 % and therefore, based on the ESP values alone, 54 % of potential spoil samples are regarded as being 'sodic' or 'strongly sodic' and, as such, a significant proportion of mine spoil at the Project can be expected to have potential for dispersion.

Figure 3-9. Cation Exchange Capacity (CEC) and Exchangeable Sodium Percentage (ESP) of Potential Spoil



These exchangeable cation results are common for Bowen Basin material based on Terrenus' significant experience in the region – and highlight that spoil is likely to have sodicity and dispersion potential.

4 Geochemical Characteristics and Hazards of Mineral Wastes

The geochemical characteristics of drillhole samples representing potential mineral wastes from the Project have been assessed. The assessment was undertaken to understand the environmental geochemical characteristics of these samples, as being representative of their respective mineral waste types, such that appropriate AMD management measures can be implemented (for the Project) during operations and post-closure.

Overburden and interburden samples (non-carbonaceous and carbonaceous) are representative of potential spoil – recognising that a significant majority of spoil will be non-carbonaceous material.

Carbonaceous samples and samples collected from coal seam roof, parting, or floor are representative of potential coal reject.

4.1 AMD Potential of Spoil and Potential Coal Reject

Spoil

Spoil, as a bulk material, is expected to generate pH-alkaline to highly alkaline surface water run-off and seepage, which is typical for Permian (and Tertiary) sedimentary materials in the Bowen Basin.

The total S concentration of spoil is very low in materials that will become spoil, with a 90th percentile total S concentration of 0.09 %. As such, and combined with high ANC values (median 42 kg H_2SO_4/t), which is significantly higher than the MPA (median 0.9 kg H_2SO_4/t), almost all (99 % of) spoil samples were classified as NAF.

Total metal and metalloid concentrations from 28 spoil samples tested is generally very low compared to average element abundance in soil in the earth's crust. That is to say, spoil has low enrichment in total metals and metalloids compared to unmineralised rocks.

Soluble multi-element results indicate that leachate from spoil is expected to contain low concentrations of soluble metals and metalloids.

Based on the results, spoil has a negligible potential to generate AMD as either AD and/or NMD and/or SD.

Potential Coal Reject

Potential coal reject, as a bulk material, is expected to generate pH-alkaline (to highly alkaline) contact water (run-off and seepage).

The total S concentration of potential coal reject is generally low-moderate, with a 90th percentile total S concentration of 0.60 %, which has resulted in generally low MPA values (median 6 kg H_2SO_4/t). About 40 % of the total S is present as sulfide (Scr). When combined with generally low ANC values (median 9 kg H_2SO_4/t), approximately 29 % of samples (12 out of 42 samples) were classified as NAF-S, PAF-LC, PAF or UC(PAF) – recognising that 8 of these 12 samples were classified as UC(PAF). The bulk of the potential coal reject samples (71 % of samples) were classified as NAF.

Total metal and metalloid concentrations from 14 potential coal reject samples tested is generally very low compared to average element abundance in soil in the earth's crust. That is to say, potential coal reject has low enrichment in total metals and metalloids compared to unmineralised rocks.

Soluble multi-element results indicate that leachate from potential coal reject is expected to contain low concentrations of soluble metals and metalloids.

Based on the results, about 70 % of potential coal reject has a low potential to generate AD and essentially all potential coal reject has a low potential to generate NMD and/or SD. However, about one-third of potential coal reject (based on a conservative classification) has potential to generate low-level AD. Material with potential for AMD will be well distributed amongst the bulk NAF material and, therefore, it is predicted that bulk coal reject will be NAF. Coal reject is expected to comprise less than 5 % of all mineral waste at the Project, and will be disposed amongst overwhelmingly NAF spoil. Therefore, it is expected that the proportion of coal reject that *may* have potential for AMD reporting to the spoil will be immaterial.

The geochemical characteristics of potential coal reject materials at the Project are consistent with the geochemical characteristics of coal reject materials for the Baralaba North Mine (Terrenus-RGS, 2012). Potential coal reject (roof, parting and floor) at Baralaba North was found to be alkaline (median pH 9.7) with low salinity (median 244 μS/cm) and low sulfur concentrations (median 0.07 %). Potential coal reject (as a bulk material) at Baralaba North was classified as NAF – with a small proportion potentially having some capacity to generate low-level AMD.

4.2 Salinity, Sodicity and Dispersion Potential of Spoil

Spoil has EC values (from 113 samples) ranging from 12 to 713 μS/cm, with low median and 90th percentile values of 302 and 505 μS/cm, respectively, and has very low total S concentrations. On this basis, contact water (run-off and seepage) is expected to be generally non-saline to slightly saline, as a result of dissolution of geogenic salts. Salinity caused by sulfide oxidation (sulfate salinity) would be expected to be negligible due to the very low total S concentration.

Spoil samples (n=28) had modest CEC values and a wide range of ESP values, resulting in just over half of spoil samples being classified as 'sodic' or 'strongly sodic'. Generally, the highest ESP values were associated with the carbonaceous material, which typically represents a small proportion of general spoil (most spoil being non-carbonaceous). As such, spoil is expected to be sodic to varying degrees with potential for dispersion (based on the high sodicity values).

4.3 Salinity of Potential Coal Reject

Potential coal reject has EC values (from 42 samples) ranging from 97 to 740 μS/cm, with low median and 90th percentile values of 259 and 392 μS/cm, respectively, and generally has low to low-moderate total S concentrations. On this basis, contact water (run-off and seepage) is expected to be generally non-saline to slightly saline, as a result of dissolution of geogenic salts. Salinity caused by sulfide oxidation (sulfate salinity) would be expected to be low due to the generally low total S concentration.

4.4 AMD Potential of ROM Coal

Potential ROM coal samples have not been assessed (as part of this assessment). These materials are not regarded as waste and would remain on site for a relatively short period of time.

ROM coal is expected to have similar environmental geochemical characteristics to potential coal rejects, and would likely produce low-salinity, pH-alkaline run-off and seepage at the ROM stockpile. The Baralaba Coal Measures are part of what are called ‘Group IV’ coals from the Bowen Basin. Group IV coals are characteristically low in sulfur (Mutton, 2003), further supporting the potentially ‘low risk’ AMD nature of coal materials.

5 Management and Mitigation Measures

The significant majority (approximately 95 % of) all mineral waste at the Project is likely to be spoil, of which most will be non-carbonaceous material.

Coal reject – whether as dewatered tailings or coarse reject – associated with coal processing is proposed to be disposed within spoil – in the out-of-pit disposal area and within in-pit spoil emplacement.

5.1 Spoil Management Strategy

The management of overburden and interburden (spoil) materials generated by the Project will comprise the disposal of overburden and interburden initially into an out-of-pit emplacement area until space is available within the pit for in-pit disposal as low-wall spoil. Coal reject is expected to comprise less than 5 % (approximately) of all mineral waste and will be disposed into spoil emplacement areas. Spoil emplacement areas would be progressively rehabilitated – with run-off and seepage captured by the mine water management system.

Spoil is overwhelmingly NAF with excess ANC and has a negligible risk of developing AMD, including AD, NMD or SD. Surface water run-off and seepage from spoil is expected to have generally low salinity with low soluble metal/metalloid concentrations. However, spoil is expected to be sodic (to varying degrees) with potential for dispersion and erosion.

Where highly sodic and/or dispersive spoil is identified it should, wherever practicable, not report to final landform surfaces and should not be used in construction activities. Tertiary spoil has generally been found to be unsuitable for construction use or on final landform surfaces (Australian Coal Association Research Program [ACARP], 2004 and 2019).

It is unlikely that sodic and potentially dispersive spoil will be able to be selectively handled and emplaced during operation of the Project. Therefore, in the absence of such selective handling, spoil landforms would need to be constructed with short and low (shallow) slopes and progressively rehabilitated to minimise erosion. Where practical, and where competent rock is available, armouring of slopes should be considered.

Surface water run-off and seepage from spoil, including any rehabilitated areas, should be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, major anions (SO_4, Cl and alkalinity/acidity), major cations (Ca, K, Mg, Na), total dissolved solids (TDS) and a broad suite of soluble metals/metalloids at high resolution analysis.

With the implementation of the proposed management and mitigation measures spoil is regarded as posing a low risk of environmental harm. The decommissioning, closure and post-closure aspects of the out-of-pit and in-pit spoil emplacement areas would be addressed by a Progressive Rehabilitation and Closure Plan (PRCP).

5.2 Coal Reject Management Strategy

Based on the results, about one-third of potential coal reject (based on a conservative classification) has potential to generate low-level AD. Material with potential for AMD will be well distributed amongst the bulk NAF material and, therefore, it is predicted that bulk coal reject will be NAF and will pose a low risk of environmental harm. Coal reject is expected to comprise less than 5 % of all mineral waste at the Project, and will be disposed amongst overwhelmingly NAF spoil. Therefore, disposed coal reject is expected to pose a low AMD hazard.

The management measures for coal reject would be addressed by a Mineral Waste Management Plan, with the concepts outlined below.

Management of Dewatered Coal Reject (Dewatered Tailings)

The CHPP will utilise a belt filter press to dewater the CHPP waste material to enable disposal of the majority of the CHPP waste streams in pit, mixed with the overburden spoil material.

Management of Wet Coal Reject (Tailings)

A small proportion of the CHPP waste stream with a high ash content will not be suitable for the belt filter press (or will be collected during failure of the belt filter press system) and will be deposited into drying cells within the Mine Infrastructure Area. Once the tailings material has sufficiently dried, it will be excavated and trucked for final disposal within spoil in out-of-pit emplacement areas and/or recently completed pit workings (within in-pit emplacement areas).

Management of Coarse Reject

Coarse coal reject will be trucked from the CHPP and placed in compacted layers within spoil in out-of-pit emplacement areas and/or recently completed pit workings (within in-pit emplacement areas).

Management of Out-of-Pit Coal Reject Emplacement Areas

During Operations

Coal reject materials placed in the out-of-pit emplacement area would be buried by at least 5 m of spoil within generally three months of placement. During operations, run-off and seepage from out-of-pit emplacements would be directed to the mine water management system.

During Decommissioning, Rehabilitation and Closure

The decommissioning, closure and post-closure aspects of the out-of-pit spoil emplacement areas would be addressed by a PRCP. However, as coal reject within out-of-pit spoil emplacements would be covered by a minimum of 5 m final thickness of spoil and would not report to final landform surfaces (or near-surfaces), the management of out-of-pit emplacement coal reject would not be expected to be significant to mine or pit decommissioning and rehabilitation.

Management of In-Pit Coal Reject Emplacement Areas

During Operations

Coal reject materials will be disposed into an in-pit emplacement area and buried by at least 5 m of spoil.

During Decommissioning, Rehabilitation and Closure

The decommissioning, closure and post-closure aspects of the partially back-filled pit (and subsequent final void) would be addressed by a PRCP. However, as coal reject would be buried by a minimum of 5 m final thickness of spoil and would not report to final landform surfaces (or near-surfaces), the management of in-pit emplacement coal reject would not be expected to be relevant to mine or pit decommissioning and rehabilitation.

5.3 ROM Coal and Product Coal Stockpiles

ROM coal and product coal is not mining waste, and surface water run-off and seepage from ROM and product coal stockpiles would be contained or recycled on site as part of the mine water management system. The available information from this Project, and from Terrenus' significant experience assessing mineral wastes from the Bowen Basin, suggests that ROM coal and product coal generated by the Project is expected to have a low degree of risk associated with potential acid, salt and soluble metals generation.

ROM coal and product coal would be stored on-site for a relatively short period of time (days to weeks) compared to mineral waste materials, which would be stored at the site in perpetuity. Management practices are therefore different for ROM coal and product coal (compared to spoil and coal rejects) and would largely be based around the operational (day-to-day) management of surface water run-off from ROM coal and product coal stockpiles, as is currently accepted practice at coal mines in Australia.

Surface water run-off from ROM coal and product coal stockpiles will be captured by the mine water management system and will be monitored as a part of the broader site water monitoring program.

6 References

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Appendix A

Drill-hole Locations

Table A1. Drill-hole Information

Drill-hole ID	Easting (GDA94)	Northing (GDA94)	Analyses
BS0095CH	790604	7313752	Static geochemistry
BS0106CH	789992	7313617	Static geochemistry
BS0110CH	789852	7313356	Static geochemistry
BS0123CH	790317	7313260	Static geochemistry
BS0132CH	790185	7312554	Static geochemistry
BS0135CH	790564	7312922	Static geochemistry
BS0141CH & CHR1	790620	7313105	Static geochemistry
BS0145CH	790000	7312770	Static geochemistry
BS0147CH	789068	7314267	Static geochemistry
BS0154CH	791146	7312954	Static geochemistry
BS0158CH	790308	7312942	Static geochemistry
BS0161CH	789452	7314480	Static geochemistry
BS0164CH	789380	7314062	Static geochemistry
BS0170CH & CHR1	791119	7312407	Static geochemistry
BS0231CH	790811	7312512	Static geochemistry
BS0240CH & CHR1	791168	7312442	Static geochemistry
BS0259CHR1	791369	7312541	Static geochemistry
BB104C	791034	7313500	Total sulfur only
BB116C	790262	7313056	Total sulfur only
BB120C	790516	7313199	Total sulfur only
BB122C	790395	7313530	Total sulfur only
BS0082CH	789742	7313917	Total sulfur only
BS0083CH	789794	7314280	Total sulfur only
BS0084CH	790270	7314319	Total sulfur only
BS0085CH	791493	7313053	Total sulfur only
BS0086CH	791681	7312734	Total sulfur only
BS0087CHR1	791426	7312989	Total sulfur only
BS0088CH	791832	7311196	Total sulfur only
BS0089CH	791872	7311212	Total sulfur only
BS0090CH	792458	7311469	Total sulfur only
BS0110CHR1	789856	7313346	Total sulfur only
BS0127CH	790214	7313200	Total sulfur only
BS0193CH	790833	7312917	Total sulfur only
BS0239CH	790142	7313827	Total sulfur only
BS0257CH	789944	7312878	Total sulfur only
BS0265CH	790272	7312597	Total sulfur only
BS0313CH	789349	7313713	Total sulfur only
BS0318CH	789587	7313308	Total sulfur only
EW19c	789488	7313774	Total sulfur only
EW20c	790234	7314280	Total sulfur only
EW21c	789741	7313910	Total sulfur only
EW23c	789993	7314114	Total sulfur only
EW52cr	791114	7311828	Total sulfur only
EW53c	791023	7311779	Total sulfur only
EW85c	791999	7312291	Total sulfur only
WW28c	790020	7313637	Total sulfur only

Appendix B

Composite Sample Details

Table B1. Composite Spoil Sample Details (spoil sample composition)

Drill-hole ID	Sample ID	Depth from (m)	Depth to (m)	Lithology	Sample Position	Composite Sample ID
BS0145CH	145-07	30.40	30.60	Sandstone, vf; calcitic	above RDR	C01
BS0145CH	145-01	37.51	37.67	Siltstone	above RDR	
BS0145CH	145-02	46.89	47.17	Sandstone, vf.	below RDL (near floor)	C02
BS0145CH	145-08	50.06	50.26	Sandstone, f	below RDL	
BS0141CH	141-04	30.13	30.35	Stoney Coal; Mudstone & Ironstone	above DBT	C03
BS0141CH	141-05	31.70	31.91	Tuff	above DBT	
BS0141CH	141-02	36.34	36.54	Sandstone, vf.; some carb.	above DBT	
BS0141CHR1	141R-01	44.10	44.42	Sandstone, vf.	below DBT	C04
BS0141CH	141-03	44.76	44.95	Sandstone, vf.	below DBT	
BS0106CH	106-05	82.98	83.18	Sandstone, vf; & Siltstone	above DAWUA	C05
BS0106CH	106-02	99.04	99.27	Sandstone, f; trace pyrite	above DAWUA	
BS0161CH	161-06	138.87	139.11	Sandstone, f	between DAWLB and DUNUA	C06
BS0161CH	161-07	156.50	156.74	Sandstone, f	between DAWLB and DUNUA	
BS0110CH	110-01	38.46	38.63	Sandstone, f-m.	above DUNUA (near roof)	C07
BS0110CH	110-03	47.23	47.42	Sandstone, vf.	above DUNLA (near roof)	
BS0259CHR1	259R-02	41.79	42.03	Siltstone; & Sandstone, vf.	below DUNL	C08
BS0259CHR1	259R-06	49.44	49.64	Sandstone, vf	between DUNL and WRIU	
BS0135CH	135-09	89.61	89.84	Sandstone, vf; and Siltstone	above DBLU	C09
BS0135CH	135-03	96.67	96.83	Siderite; & Siltstone/Sandstone, vf.	above DBLU	
BS0164CH	164-10	171.81	172.11	Sandstone, m; some Py	above DBLUA	C10
BS0164CH	164-06	180.10	180.40	Sandstone, m.	above DBLUA	
BS0240CH	240-03	80.09	80.31	Siltstone; some Sandstone, vf.	below DBLL	C11
BS0240CHR1	240R-02	83.23	83.45	Siltstone; some Sandstone, vf.	below DBLL	
BS0123CH	123-05	196.48	196.77	Siltstone; & Carb. Siltstone	above COOU	C12
BS0123CH	123-06	200.97	201.19	Carb. Siltst.; & Sandst., vf; some Coal	above COOU	
BS0231CH	231-05	120.56	120.80	Siltstone; & Sandstone, vf.	below DRTL	C13
BS0231CH	231-06	123.49	123.87	Sandstone, m.	Above SDRUA	

Table B2. Composite Potential Reject Sample Details (potential reject sample composition)

Drill-hole ID	Sample ID	Depth from (m)	Depth to (m)	Lithology	Sample Position	Composite Sample ID
BS0145CH	82524	39.35	39.50	Siltstone; some Coal; trace pyrite	RD (Reid) Roof	C14
BS0145CH	82526	40.69	41.30	Carb. Siltstone; & Stoney Coal	RD (Reid) Parting	
BS0145CH	82531	45.84	46.19	Carb. Siltstone; & Stoney Coal	RD (Reid) Floor	
BS0141CHR1	82647	40.20	40.35	Siltstone; & Coal (dull)	DBT (Doubtful) Roof	C15
BS0145CH	82532	85.29	85.56	Carb. Siltst.; & Stoney Coal; tr. pyrite	DBT (Doubtful) Roof	
BS0141CHR1	82652	43.27	43.42	Carb. Siltstone; some Coal (dull)	DBT (Doubtful) Floor	C16
BS0145CH	82535	88.80	88.96	Carb. Siltstone; some Coal (dull)	DBT (Doubtful) Floor	
BS0145CH	82536	146.44	146.59	Siltstone; with Stoney Coal	DAW (Dawson) Roof	C17
BS0106CH	82261	99.84	99.99	Siltstone; some Coal; trace pyrite	DAW (Dawson) Roof	
BS0161CH	82403	107.83	107.98	Siltstone; & Carb. Siltstone	DAW (Dawson) Roof	
BS0145CH	82541	150.15	150.34	Siltstone	DAW (Dawson) Floor	C18
BS0106CH	82266	103.13	103.28	Carb. Siltstone	DAW (Dawson) Floor	
BS0161CH	82411	112.01	112.16	Siltstone; & Coal	DAW (Dawson) Floor	
BS0161CH	82412	175.19	175.37	Siltstone	DUN (Dunstan) Roof	C19
BS0106CH	82267	143.81	143.96	Siltstone	DUN (Dunstan) Roof	
BS0259CHR1	82635	37.02	37.17	Carb. Siltstone	DUN (Dunstan) Roof	
BS0161CH	82421	180.31	180.50	Carb. Siltstone; & Coal	DUN (Dunstan) Floor	C20
BS0106CH	82273	146.89	147.04	Carb. Siltstone	DUN (Dunstan) Floor	
BS0259CHR1	82640	39.83	39.98	Carb. Shale	DUN (Dunstan) Floor	
BS0147CH	82330	105.83	105.98	Carb. Siltstone; & Sandstone, vf.	SDUN (Sub-Dunstan) Roof	C21
BS0147CH	82333	112.96	113.11	Sandstone, vf; with Coal & Siltst.	SDUN (Sub-Dunstan) Roof	
BS0147CH	82332	106.15	106.31	Carb. Siltstone; & Coal	SDUN (Sub-Dunstan) Floor	C22
BS0147CH	82335	113.31	113.51	Carb. Siltstone; & Sandstone, vf.	SDUN (Sub-Dunstan) Floor	
BS0135CH	82347	46.21	46.36	Sandstone, vf	WRI (Wright) Roof	C23
BS0164CH	82449	106.90	107.05	Siltst.; some Sandst., vf.; trace Coal	WRI (Wright) Roof	
BS0135CH	82358	50.09	50.24	Siltstone	WRI (Wright) Floor	C24
BS0164CH	82509	110.57	110.97	Stoney Coal	WRI (Wright) Floor	

Table B2. (continued) …..Composite Potential Reject Sample Details (potential reject sample composition)

Drill-hole ID	Sample ID	Depth from (m)	Depth to (m)	Lithology	Sample Position	Composite Sample ID
BS0158CH	82518	66.87	67.09	Siltst.; & Sandst., vf.; trace pyritic	DBL (Double) Roof	C25
BS0164CH	82510	182.63	182.86	Stoney Coal; trace pyrite	DBL (Double) Roof	
BS0240CH	82277	74.23	74.38	Sandstone, vf.	DBL (Double) Roof	
BS0158CH	82523	70.03	70.22	Carb. Siltstone	DBL (Double) Floor	C26
BS0164CH	82517	186.40	186.62	Carb. Siltstone; some calcite	DBL (Double) Floor	
BS0240CH	82282	78.44	78.59	Carb. Siltstone; some Coal	DBL (Double) Floor	
BS0135CH	82383	143.67	143.86	Carb. Siltstone; & Siltstone	COO (Coolum) Floor	C27
BS0170CH	82558	67.37	67.52	Carb. Siltstone	COO (Coolum) Floor	

Appendix C

Geochemical Results Tables

- Table C1 – Drill-hole Logs and Acid-Base Characteristics of Drill-hole Samples
- Table C2 – Total Element Concentrations and Geochemical Abundance Indices (GAI)
- Table C3 – Geochemical Abundance Indices (GAI)
- Table C4 – Soluble Major Ions, pH, Electrical Conductivity (EC), Metal and Metalloid Concentrations in Fresh Water Extracts
- Table C5 – Exchangeable Cations

Table C1. Acid-Base Characteristics of Drill-hole Samples

Drill-hole ID	From	To	Type	Weath.	Zone	Description	Waste Grp	Sample ID	pH 1:5	EC 1:5	S	Scr	MPA	ANC	NAPP	ANC/ MPA ratio	Acid Classification
	m	m								µS/cm	%		kg H_2SO_4/t				
BS0132CH	22.73	22.95	Spoil	Weathered	Weath. Spoil: above RDU (near roof)	Siltstone; some Calcitic veins	W-NC	132-02T	9.0	31	0.06		1.8	85	-83	46	NAF
BS0154CH	30.00	30.23	Spoil	Weathered	Weath. Spoil: above DBLUA	Sandstone, vf-f	W-NC	154-10	9.4	335	<0.01		0.2	45	-44	291	NAF
BS0164CH	19.42	19.70	Spoil	Weathered	Weath. Spoil: above DAWUA	Sandstone, m; & Clay. Fract oxidised	W-NC	164-07	9.0	598	<0.01		0.2	21	-21	140	NAF
BS0095CH	42.00	42.20	Spoil	Fresh	Spoil: above COOU	Sandstone, vf	F-NC	095-05	9.2	267	0.09		2.8	51	-48	19	NAF
BS0095CH	49.48	49.67	Spoil	Fresh	Spoil: above COOU (near roof)	Siltstone	F-NC	095-01	8.8	348	0.02		0.6	5.2	-5	8	NAF
BS0095CH	53.51	53.76	Spoil	Fresh	Spoil: below COOL (near floor)	Siltstone	F-NC	095-02	8.6	417	0.09		2.8	7.9	-5	3	NAF
BS0095CH	84.55	84.75	Spoil	Fresh	Spoil: below DRTL (near floor)	Sandstone, f; & Siltstone	F-NC	095-04	8.9	436	0.21	0.14	6.4	41	-34	6	NAF
BS0106CH	82.98	83.18	Spoil	Fresh	Spoil: above DAWUA	Sandstone, vf; & Siltstone	F-NC	106-05	9.4	321	<0.01		0.2	22	-22	145	NAF
BS0106CH	99.04	99.27	Spoil	Fresh	Spoil: above DAWUA	Sandstone, f; trace pyrite	F-NC	106-02	9.0	316	0.07		2.1	45	-43	21	NAF
BS0106CH	103.38	103.63	Spoil	Fresh	Spoil: below DAWLB (near floor)	Siltstone; some carb.	F-NC	106-01	9.1	212	0.03		0.9	9.4	-8	10	NAF
BS0106CH	130.40	130.60	Spoil	Fresh	Spoil: between DAWLB and DUNUA	Sandstone, m	F-NC	106-06	9.6	239	0.01		0.3	61	-61	200	NAF
BS0106CH	143.09	143.25	Spoil	Fresh	Spoil: above DUNUA	Sandstone, vf; & Siltstone	F-NC	106-04	9.1	336	0.03		0.9	105	-104	114	NAF
BS0106CH	143.81	143.96	Pot. reject	Fresh	DUN (Dunstan) Roof	Siltstone	F-NC	82267	9.8	240	0.07		2.1	13	-11	6	NAF
BS0106CH	147.50	147.80	Spoil	Fresh	Spoil: below DUNLB (near floor)	Siltstone; & Carb. Siltstone	F-NC	106-03	9.2	220	0.02		0.6	9.0	-8	15	NAF
BS0110CH	30.00	30.20	Spoil	Fresh	Spoil: between DAW and DUNUA	Sandstone, f	F-NC	110-07	9.2	244	0.02		0.6	49	-48	80	NAF
BS0110CH	38.46	38.63	Spoil	Fresh	Spoil: above DUNUA (near roof)	Sandstone, f-m.	F-NC	110-01	9.0	29	0.02		0.6	30	-30	50	NAF
BS0110CH	40.97	41.19	Spoil	Fresh	Spoil: below DUNUB (near floor)	Sandstone, f-m.	F-NC	110-02	9.0	28	0.04		1.2	47	-46	38	NAF
BS0110CH	47.23	47.42	Spoil	Fresh	Spoil: above DUNLA (near roof)	Sandstone, vf.	F-NC	110-03	8.6	31	0.10		3.1	14	-11	4	NAF
BS0110CH	54.90	55.08	Spoil	Fresh	Spoil: below DUNLR	Sandstone, f-vf.	F-NC	110-04	8.8	24	0.07		2.1	9.3	-7	4	NAF
BS0110CH	71.00	71.20	Spoil	Fresh	Spoil: between DAW and DUNUA	Sandstone, f-m; with Conglomerate	F-NC	110-08	9.5	232	0.02		0.6	51	-50	83	NAF
BS0110CH	79.94	80.18	Spoil	Fresh	Spoil: above WRIU	Siltstone	F-NC	110-05	9.4	29	0.03		0.9	107	-106	116	NAF
BS0110CH	84.11	84.42	Spoil	Fresh	Spoil: below WRIL (near floor)	Sandstone, vf.	F-NC	110-06	9.5	32	0.01		0.3	18	-18	59	NAF
BS0123CH	30.71	31.03	Spoil	Fresh	Spoil: above DUNUA (near roof)	Sandstone, vf.	F-NC	123-01	8.7	39	0.06		1.8	51	-49	28	NAF
BS0123CH	35.38	35.63	Spoil	Fresh	Spoil: below DUNLB (near floor)	Sandstone, vf.; Coal (10%)	F-NC	123-02	8.4	29	0.06		1.8	31	-29	17	NAF
BS0123CH	59.50	59.70	Spoil	Fresh	Spoil: above WRIU	Sandstone, m; with Siltstone	F-NC	123-08	9.4	191	0.01		0.3	72	-72	235	NAF
BS0123CH	69.29	69.54	Spoil	Fresh	Spoil: below WRIL	Siltstone; & Siderite (40%)	F-NC	123-03	8.8	30	0.03		0.9	20	-19	22	NAF
BS0123CH	117.90	118.10	Spoil	Fresh	Spoil: above DBLU	Sandstone, c; carbonaceous.	F-NC	123-09	9.3	205	<0.01		0.2	36	-36	238	NAF
BS0123CH	176.06	176.33	Spoil	Fresh	Spoil: below DBLL	Siltstone & Sandstone, f; calcitic	F-NC	123-11	9.8	326	<0.01		0.2	17	-16	108	NAF
BS0123CH	196.48	196.77	Spoil	Fresh	Spoil: above COOU	Siltstone; & Carb. Siltstone	F-NC	123-05	9.2	24	0.05		1.5	21	-19	13	NAF
BS0123CH	210.22	210.42	Spoil	Fresh	Spoil: below COOL (near floor)	Sandstone, vf; & Siltstone. [5% Py]	F-NC	123-07	9.4	12	0.01		0.3	15	-14	48	NAF
BS0132CH	31.30	31.59	Spoil	Fresh	Spoil: below RDL (near floor)	Siltstone; & Sandstone, vf.	F-NC	132-04T	8.8	24	0.04		1.2	16	-14	13	NAF
BS0132CH	54.17	54.39	Spoil	Fresh	Spoil: between RDL and DBTU	Sandstone, f; micaceous	F-NC	132-08T	9.6	192	<0.01		0.2	69	-69	453	NAF
BS0132CH	67.75	67.98	Spoil	Fresh	Spoil: above DBTU	Siltstone; & Sandstone, vf.	F-NC	132-06T	9.2	33	0.03		0.9	100	-99	109	NAF
BS0132CH	76.80	77.00	Spoil	Fresh	Spoil: below DBTL	Siltstone; & Sandstone, vf.	F-NC	132-07T	9.2	30	0.08		2.5	33	-30	13	NAF
BS0135CH	45.40	45.77	Spoil	Fresh	Spoil: above WRIUR (near roof)	Sandstone, vf.	F-NC	135-01	8.6	27	0.02		0.6	17	-16	27	NAF
BS0135CH	46.21	46.36	Pot. reject	Fresh	WRI (Wright) Roof	Sandstone, vf; trace carb. siltstone	F-NC	82347	8.6	384	0.78	0.63	23.9	5.8	18	0.2	PAF
BS0135CH	50.09	50.24	Pot. reject	Fresh	WRI (Wright) Floor	Siltstone	F-NC	82358	9.1	260	0.19	0.07	5.8	7.4	-2	1.3	NAF
BS0135CH	50.95	51.19	Spoil	Fresh	Spoil: below WRIL (near floor)	Sandstone, vf-f.	F-NC	135-02	8.5	29	0.07		2.1	31	-29	14	NAF
BS0135CH	89.61	89.84	Spoil	Fresh	Spoil: above DBLU	Sandstone, vf; and Siltstone	F-NC	135-09	9.4	202	0.03		0.9	41	-40	45	NAF
BS0135CH	96.67	96.83	Spoil	Fresh	Spoil: above DBLU	Siderite; & Siltstone/Sandstone, vf.	F-NC	135-03	9.1	26	0.02		0.6	113	-112	184	NAF
BS0135CH	102.89	103.15	Spoil	Fresh	Spoil: below DBLL (near floor)	Sandstone, vf-f.	F-NC	135-04	8.9	17	0.01		0.3	15	-15	49	NAF
BS0135CH	134.31	134.55	Spoil	Fresh	Spoil: above COOUA	Sandstone, vf	F-NC	135-10	9.7	265	0.01		0.3	30	-30	98	NAF
BS0135CH	140.06	140.21	Spoil	Fresh	Spoil: above COOUA (near roof)	Siltstone; & Sandstone, vf.	F-NC	135-05	8.8	454	<0.01		0.2	5.6	-5	37	NAF
BS0135CH	140.61	140.76	Pot. reject	Fresh	COO (Coolum) Roof	Siltstone; trace carbonaceous	F-NC	82374	9.0	152	<0.01		0.2	43	-43	282	NAF

Table C1. Acid-Base Characteristics of Drill-hole Samples

Drill-hole ID	From	To	Type	Weath.	Zone	Description	Waste Grp	Sample ID	pH 1:5	EC 1:5	S	Scr	MPA	ANC	NAPP	ANC/MPA ratio	Acid Classification
	m	m								µS/cm	%		kg H_2SO_4/t				
BS0135CH	143.67	143.86	Pot. reject	Fresh	COO (Coolum) Floor	Sandstone, vf; minor Siltstone & Carb. Siltstone	F-NC	82383	9.8	256	0.07		2.1	9.2	-7	4	NAF
BS0135CH	145.01	145.19	Spoil	Fresh	Spoil: below COOL	Sandstone, vf.; some Siltstone	F-NC	135-06	9.0	570	0.01		0.3	17	-16	54	NAF
BS0135CH	168.75	168.89	Spoil	Fresh	Spoil: above DRTU	Siltstone; & Sandstone, vf.	F-NC	135-07	9.6	500	0.02		0.6	33	-32	53	NAF
BS0135CH	173.02	173.26	Spoil	Fresh	Spoil: below DRTL	Sandstone, vf.; some Siltstone	F-NC	135-08	9.1	623	0.04		1.2	34	-32	27	NAF
BS0141CH	31.70	31.91	Spoil	Fresh	Spoil: above DBT	Tuff	F-NC	141-05	9.0	540	0.16	0.08	4.9	106	-101	22	NAF
BS0141CH	36.34	36.54	Spoil	Fresh	Spoil: above DBT	Sandstone, vf.; some carb.	F-NC	141-02	9.6	681	0.03		0.9	43	-42	47	NAF
BS0141CHR1	44.10	44.42	Spoil	Fresh	Spoil: below DBT	Sandstone, vf.	F-NC	141R-01	8.5	713	0.03		0.9	19	-18	21	NAF
BS0141CH	44.76	44.95	Spoil	Fresh	Spoil: below DBT	Sandstone, vf.	F-NC	141-03	8.8	322	0.04		1.2	14	-13	11	NAF
BS0145CH	30.40	30.60	Spoil	Fresh	Spoil: above RDR	Sandstone, vf; calcitic	F-NC	145-07	9.4	277	0.02		0.6	47	-46	76	NAF
BS0145CH	37.51	37.67	Spoil	Fresh	Spoil: above RDR	Siltstone	F-NC	145-01	8.7	550	0.04		1.2	42	-40	34	NAF
BS0145CH	39.35	39.50	Pot. reject	Fresh	RD (Reid) Roof	Siltstone; some Coal; trace pyrite	F-NC	82524	9.7	285	0.12	0.06	3.7	91	-87	25	NAF
BS0145CH	46.89	47.17	Spoil	Fresh	Spoil: below RDL (near floor)	Sandstone, vf.	F-NC	145-02	9.2	204	0.02		0.6	24	-24	40	NAF
BS0145CH	50.06	50.26	Spoil	Fresh	Spoil: below RDL	Sandstone, f	F-NC	145-08	9.5	244	0.02		0.6	62	-61	100	NAF
BS0145CH	73.18	73.39	Spoil	Fresh	Spoil: between RDL and DBT	Sandstone, vf-f	F-NC	145-09	9.4	247	0.02		0.6	38	-37	61	NAF
BS0145CH	84.76	84.95	Spoil	Fresh	Spoil: above DBT (near roof)	Sandstone, vf.; some Siltstone	F-NC	145-03	9.5	350	0.05		1.5	73	-72	48	NAF
BS0145CH	89.09	89.28	Spoil	Fresh	Spoil: below DBT (near floor)	Sandstone, vf.; some Siltstone	F-NC	145-04	9.5	176	0.06		1.8	6.4	-5	3	NAF
BS0145CH	128.99	129.19	Spoil	Fresh	Spoil: between DBT and DAWUA	Sandstone, vf; trace coal	F-NC	145-10	9.9	261	0.01		0.3	31	-31	102	NAF
BS0145CH	145.50	145.80	Spoil	Fresh	Spoil: above DAWUA	Sandstone, vf.	F-NC	145-05	9.5	367	0.02		0.6	81	-80	132	NAF
BS0145CH	150.15	150.34	Pot. reject	Fresh	DAW (Dawson) Floor	Siltstone	F-NC	82541	9.9	197	0.11	0.05	3.4	31	-28	9	NAF
BS0145CH	150.66	150.92	Spoil	Fresh	Spoil: below DAWLB (near floor)	Siltstone	F-NC	145-06	9.6	171	0.01		0.3	63	-63	206	NAF
BS0147CH	69.50	69.72	Spoil	Fresh	Spoil: above DAWUA (near roof)	Sandstone, vf.; trace Calcitic	F-NC	147-01	8.9	392	0.08		2.5	94	-91	38	NAF
BS0147CH	74.83	74.98	Spoil	Fresh	Spoil: below DAWLB	Siltstone; & Sandstone, vf.	F-NC	147-02	9.2	335	0.03		0.9	97	-96	105	NAF
BS0147CH	91.38	91.61	Spoil	Fresh	Spoil: above DUNUA	Sandstone, vf.; Siderite (10%)	F-NC	147-03	8.8	361	0.06		1.8	119	-117	65	NAF
BS0147CH	95.85	96.07	Spoil	Fresh	Spoil: below DUNUB	Sandstone, vf-f.	F-NC	147-04	8.9	406	0.04		1.2	52	-50	42	NAF
BS0147CH	103.87	104.07	Spoil	Fresh	Spoil: below DUNLB (near floor)	Siltstone; & Sandstone, vf.	F-NC	147-05	8.8	327	0.08		2.5	8.2	-6	3	NAF
BS0147CH	105.83	105.98	Pot. reject	Fresh	SDUN (Sub-Dunstan) Roof	Sandstone, vf. & Siltstone; minor Carb. Siltstone	F-NC	82330	9.2	295	0.38	0.07	11.6	4.6	7	0.4	NAF
BS0147CH	112.96	113.11	Pot. reject	Fresh	SDUN (Sub-Dunstan) Roof	Sandstone, vf; with Siltstone; trace Coal	F-NC	82333	9.5	294	0.11	0.07	3.4	4.9	-2	1.5	NAF
BS0147CH	113.31	113.51	Pot. reject	Fresh	SDUN (Sub-Dunstan) Floor	Sandstone, vf.; and Carb. Siltstone	F-NC	82335	9.4	257	0.25	0.12	7.7	4.5	3	0.6	UC(PAF)
BS0147CH	149.98	150.17	Spoil	Fresh	Spoil: above WRIU	Siltstone; & Sandstone, vf.; some Siderite	F-NC	147-06	9.4	352	0.06		1.8	31	-29	17	NAF
BS0154CH	37.79	38.05	Spoil	Fresh	Spoil: above DBLUA (near roof)	Siltstone	F-NC	154-01	8.8	369	0.05		1.5	66	-64	43	NAF
BS0154CH	42.84	43.01	Spoil	Fresh	Spoil: below DBLL (near floor)	Sandstone, vf.	F-NC	154-02	8.9	220	0.04		1.2	3.6	-2	3	NAF
BS0154CH	99.50	99.71	Spoil	Fresh	Spoil: above COOUA	Sandstone, m	F-NC	154-11	9.7	255	<0.01		0.2	51	-51	332	NAF
BS0154CH	108.18	108.43	Spoil	Fresh	Spoil: above COOUA (near roof)	Siltstone; & Sandstone, f.	F-NC	154-06	9.1	297	0.03		0.9	8.4	-7	9	NAF
BS0154CH	115.02	115.32	Spoil	Fresh	Spoil: below COOL (near floor)	Siltstone; & Coal (10%)	F-NC	154-07	9.1	303	0.22	0.19	6.7	8.4	-2	1.2	UC(NAF)
BS0158CH	66.87	67.09	Pot. reject	Fresh	DBL (Double) Roof	Siltstone; & Sandstone, vf.; trace pyritic	F-NC	82518	9.5	214	0.11	0.11	3.4	13	-10	4	NAF
BS0161CH	86.73	86.93	Spoil	Fresh	Spoil: between DBT and DAWUA	Sandstone, vf-f	F-NC	161-05	9.5	282	<0.01		0.2	63	-63	412	NAF
BS0161CH	107.47	107.74	Spoil	Fresh	Spoil: above DAWUA (near roof)	Sandstone, vf.; some Siltstone	F-NC	161-01	9.0	362	0.06		1.8	81	-80	44	NAF
BS0161CH	107.83	107.98	Pot. reject	Fresh	DAW (Dawson) Roof	Siltstone; & Carb. Siltstone	F-NC	82403	9.8	313	0.13	0.11	4.0	14	-10	4	NAF
BS0161CH	112.01	112.16	Pot. reject	Fresh	DAW (Dawson) Floor	Siltstone; some Coal	F-NC	82411	9.7	278	0.25	0.10	7.7	52	-44	7	NAF
BS0161CH	112.71	112.88	Spoil	Fresh	Spoil: below DAWLB (near floor)	Siltstone	F-NC	161-02	9.3	245	0.08		2.5	9.6	-7	4	NAF
BS0161CH	138.87	139.11	Spoil	Fresh	Spoil: between DAWLB and DUNUA	Sandstone, f	F-NC	161-06	9.6	336	0.02		0.6	51	-50	83	NAF
BS0161CH	156.50	156.74	Spoil	Fresh	Spoil: between DAWLB and DUNUA	Sandstone, f	F-NC	161-07	9.8	323	0.01		0.3	60	-60	196	NAF
BS0161CH	173.87	174.11	Spoil	Fresh	Spoil: above DUNUA	Siltstone	F-NC	161-03	9.5	461	0.05		1.5	94	-93	61	NAF
BS0161CH	175.19	175.37	Pot. reject	Fresh	DUN (Dunstan) Roof	Siltstone	F-NC	82412	10.0	223	0.06		1.8	7.9	-6	4	NAF

Table C1. Acid-Base Characteristics of Drill-hole Samples

Drill-hole ID	From	To	Type	Weath.	Zone	Description	Waste Grp	Sample ID	pH 1:5	EC 1:5	S	Scr	MPA	ANC	NAPP	ANC/ MPA ratio	Acid Classification
	m	m								µS/cm	%		kg H_2SO_4/t				
BS0161CH	181.28	181.50	Spoil	Fresh	Spoil: below DUNLB	Sandstone, vf.	F-NC	161-04	9.6	248	<0.01		0.2	13	-12	82	NAF
BS0164CH	24.69	24.93	Spoil	Fresh	Spoil: above DAWUA	Sandstone, f; & Siltstone. Calcitic	F-NC	164-01	8.8	438	0.06		1.8	28	-26	15	NAF
BS0164CH	30.07	30.40	Spoil	Fresh	Spoil: below DAWLB	Sandstone, vf. & Siltstone. Calcitic veins	F-NC	164-02	9.0	449	0.02		0.6	66	-65	108	NAF
BS0164CH	98.77	99.03	Spoil	Fresh	Spoil: between SDUN and WRIU	Sandstone, f; & Siderite	F-NC	164-08	9.6	281	0.08		2.5	56	-54	23	NAF
BS0164CH	105.78	106.05	Spoil	Fresh	Spoil: above WRIU	Siltstone; & Sandstone, vf.	F-NC	164-05	9.1	418	0.06		1.8	76	-74	41	NAF
BS0164CH	106.90	107.05	Pot. reject	Fresh	WRI (Wright) Roof	Siltstone; some Sandstone, vf.; trace Coal	F-NC	82449	9.2	348	0.25	0.16	7.7	8.0	-0.3	1.0	UC(PAF)
BS0164CH	114.30	114.54	Spoil	Fresh	Spoil: below WRIL	Sandstone, m	F-NC	164-09	9.7	289	0.02		0.6	99	-98	161	NAF
BS0164CH	171.81	172.11	Spoil	Fresh	Spoil: above DBLUA	Sandstone, m; some Py	F-NC	164-10	9.8	302	<0.01		0.2	72	-72	471	NAF
BS0164CH	180.10	180.40	Spoil	Fresh	Spoil: above DBLUA	Sandstone, m.	F-NC	164-06	8.4	595	0.22	0.17	6.7	58	-51	9	NAF
BS0170CHR1	64.20	64.50	Spoil	Fresh	Spoil: above COOU (near roof)	Sandstone, vf.; Coal (20%)	F-NC	170R-01	9.1	233	0.05		1.5	5.6	-4	4	NAF
BS0170CH	68.00	68.21	Spoil	Fresh	Spoil: below COOL (near floor)	Siltstone	F-NC	170-01	8.9	303	0.15	0.07	4.6	6.2	-2	1	NAF
BS0170CHR1	69.72	69.92	Spoil	Fresh	Spoil: below COOL (near floor)	Sandstone, vf.	F-NC	170R-02	8.8	361	0.28	0.06	8.6	7.1	1	0.8	NAF
BS0170CH	94.03	94.23	Spoil	Fresh	Spoil: above DAWUA (near roof)	Siltstone	F-NC	170-02	9.1	298	0.03		0.9	76	-75	83	NAF
BS0170CH	97.59	97.85	Spoil	Fresh	Spoil: below DAWLB (near floor)	Siltstone; some carb.	F-NC	170-03	9.4	220	0.02		0.6	6.8	-6	11	NAF
BS0231CH	37.44	37.64	Spoil	Fresh	Spoil: above DBLU	Sandstone, vf	F-NC	231-07	9.3	175	0.02		0.6	54	-53	88	NAF
BS0231CH	47.63	47.85	Spoil	Fresh	Spoil: below DBLL	Siltstone	F-NC	231-01	8.6	135	0.01		0.3	63	-62	204	NAF
BS0231CH	76.00	76.21	Spoil	Fresh	Spoil: above COOU	Sandstone, vf	F-NC	231-08	9.0	251	0.34	0.26	10.4	78	-68	8	NAF
BS0231CH	81.57	81.77	Spoil	Fresh	Spoil: above COOU (near roof)	Siltstone; some Sandstone, vf.	F-NC	231-02	8.4	401	0.02		0.6	5.4	-5	9	NAF
BS0231CH	97.70	97.87	Spoil	Fresh	Spoil: below COOR	Siltstone; some carb.	F-NC	231-04	8.7	409	0.01		0.3	67	-67	218	NAF
BS0231CH	106.96	107.16	Spoil	Fresh	Spoil: between COOR and DRTU	Siltstone; some carb.	F-NC	231-09	9.7	236	0.05		1.5	36	-35	24	NAF
BS0231CH	120.56	120.80	Spoil	Fresh	Spoil: below DRTL	Siltstone; & Sandstone, vf.	F-NC	231-05	9.0	447	0.02		0.6	95	-95	155	NAF
BS0231CH	123.49	123.87	Spoil	Fresh	Spoil: above SDRUA	Sandstone, m.	F-NC	231-06	9.1	506	<0.01		0.2	36	-36	234	NAF
BS0240CH	27.07	27.31	Spoil	Fresh	Spoil: above SWRI	Sandstone, vf.	F-NC	240-01	8.9	554	0.02		0.6	103	-102	168	NAF
BS0240CH	73.96	74.15	Spoil	Fresh	Spoil: above DBLU (near roof)	Siltstone	F-NC	240-02	9.0	488	0.10		3.1	75	-72	25	NAF
BS0240CHR1	76.81	77.07	Spoil	Fresh	Spoil: above DBLU (near roof)	Siltstone	F-NC	240R-01	8.8	521	0.02		0.6	85	-84	139	NAF
BS0240CH	74.23	74.38	Pot. reject	Fresh	DBL (Double) Roof	Sandstone, vf.	F-NC	82277	9.7	291	0.02		0.6	53	-52	86	NAF
BS0240CH	80.09	80.31	Spoil	Fresh	Spoil: below DBLL	Siltstone; some Sandstone, vf.	F-NC	240-03	9.3	309	0.05		1.5	5.8	-4	4	NAF
BS0240CHR1	83.23	83.45	Spoil	Fresh	Spoil: below DBLL	Siltstone; some Sandstone, vf.	F-NC	240R-02	9.0	309	0.26	0.14	8.0	4.4	4	1	UC(PAF)
BS0259CHR1	33.00	33.21	Spoil	Fresh	Spoil: above DUNU	Sandstone, vf; some Siltstone	F-NC	259R-05	9.7	300	0.03		0.9	106	-105	115	NAF
BS0259CHR1	36.69	36.85	Spoil	Fresh	Spoil: above DUNU (near roof)	Siltstone; & Sandstone, vf.	F-NC	259R-01	8.9	388	0.03		0.9	60	-59	65	NAF
BS0259CHR1	41.79	42.03	Spoil	Fresh	Spoil: below DUNL	Siltstone; & Sandstone, vf.	F-NC	259R-02	9.1	287	0.02		0.6	6.5	-6	11	NAF
BS0259CHR1	49.44	49.64	Spoil	Fresh	Spoil: between DUNL and WRIU	Sandstone, vf	F-NC	259R-06	9.6	305	<0.01		0.2	80	-79	520	NAF
BS0259CHR1	57.42	57.81	Spoil	Fresh	Spoil: above WRIU (near roof)	Siltstone; & Sandstone, vf.	F-NC	259R-03	9.4	322	0.05		1.5	8.1	-7	5	NAF
BS0259CHR1	61.75	61.95	Spoil	Fresh	Spoil: below WRIL	Sandstone, vf.; some Siltstone	F-NC	259R-04	9.3	417	0.03		0.9	208	-207	226	NAF
BS0095CH	80.43	80.67	Spoil	Fresh	Spoil: above DRTU (near roof)	Carb. Shale	F-C	095-03	9.1	449	0.03		0.9	27	-26	29	NAF
BS0106CH	99.84	99.99	Pot. reject	Fresh	DAW (Dawson) Roof	Siltstone; some Coal; trace pyrite	F-C	82261	9.3	213	0.39	0.28	11.9	9.0	3	1	UC(PAF)
BS0106CH	103.13	103.28	Pot. reject	Fresh	DAW (Dawson) Floor	Carb. Siltstone	F-C	82266	9.6	237	0.32	0.29	9.8	8.4	1	1	PAF-LC
BS0106CH	146.89	147.04	Pot. reject	Fresh	DUN (Dunstan) Floor	Carb. Siltstone	F-C	82273	9.6	205	0.19	0.03	5.8	6.7	-1	1.2	NAF
BS0123CH	200.97	201.19	Spoil	Fresh	Spoil: above COOU	Carb. Siltstone; & Sandstone, vf; some Coal	F-C	123-06	9.4	21	0.03		0.9	22	-21	24	NAF
BS0135CH	47.86	48.22	Pot. reject	Fresh	WRI (Wright) Parting	Carb. Silstone; & Coal	F-C	82353	9.2	247	0.13	0.03	4.0	34	-30	9	NAF
BS0135CH	141.45	141.54	Pot. reject	Fresh	COO (Coolum) Parting	Carb. Siltstone	F-C	82378	8.3	110	0.12	<0.005	3.7	61	-58	17	NAF
BS0135CH	170.26	170.41	Pot. reject	Fresh	DRT (Dirty) Roof	Carb. Siltstone, trace calcitic	F-C	82384	10.0	343	0.13	<0.005	4.0	113	-109	28	NAF
BS0135CH	171.44	171.63	Pot. reject	Fresh	DRT (Dirty) Floor	Carb. Siltstone; minor Siltstone	F-C	82388	9.9	266	0.08		2.5	46	-43	19	NAF
BS0141CH	30.13	30.35	Spoil	Fresh	Spoil: above DBT	Stoney Coal; Mudstone & Ironstone	F-C	141-04	7.3	367	0.07		2.1	5.7	-4	3	NAF

Table C1. Acid-Base Characteristics of Drill-hole Samples

Drill-hole ID	From	To	Type	Weath.	Zone	Description	Waste Grp	Sample ID	pH 1:5	EC 1:5	S	Scr	MPA	ANC	NAPP	ANC/ MPA ratio	Acid Classification
	m	m								µS/cm	%		kg H_2SO_4/t				
BS0141CHR1	40.20	40.35	Pot. reject	Fresh	DBT (Doubtful) Roof	Siltstone; & Coal (dull)	F-C	82647	9.3	210	0.35	0.12	10.7	5.2	6	0	UC(PAF)
BS0141CHR1	43.27	43.42	Pot. reject	Fresh	DBT (Doubtful) Floor	Carb. Siltstone; some Coal (dull)	F-C	82652	9.3	360	0.15	0.07	4.6	8.5	-4	2	NAF
BS0145CH	40.69	41.30	Pot. reject	Fresh	RD (Reid) Parting	Carb. Siltstone; & Stoney Coal	F-C	82526	9.2	154	0.44	0.12	13.5	196	-183	15	NAF
BS0145CH	45.84	46.19	Pot. reject	Fresh	RD (Reid) Floor	Carb. Siltstone; & Stoney Coal	F-C	82531	9.5	214	0.34	0.08	10.4	8.1	2	1	NAF
BS0145CH	85.29	85.56	Pot. reject	Fresh	DBT (Doubtful) Roof	Carb. Siltstone; & Stoney Coal; trace pyrite	F-C	82532	8.3	531	1.44	0.33	44.1	49	-5	1	NAF-S
BS0145CH	88.80	88.96	Pot. reject	Fresh	DBT (Doubtful) Floor	Carb. Siltstone; some Coal (dull)	F-C	82535	9.9	210	0.28	0.23	8.6	7.8	1	1	UC(PAF)
BS0145CH	146.44	146.59	Pot. reject	Fresh	DAW (Dawson) Roof	Siltstone; and Stoney Coal	F-C	82536	9.8	134	0.14	0.03	4.3	31	-27	7	NAF
BS0147CH	106.15	106.31	Pot. reject	Fresh	SDUN (Sub-Dunstan) Floor	Carb. Siltstone; & Coal	F-C	82332	7.8	740	0.66	0.28	20.2	25	-5	1.2	NAF
BS0154CH	117.00	117.23	Spoil	Fresh	Spoil: between COOL and DRTU	Carb. Siltstone with Coal	F-C	154-12	9.7	350	0.02		0.6	113	-112	184	NAF
BS0154CH	119.63	119.90	Spoil	Fresh	Spoil: above DRTU (near roof)	Carb. Siltstone; & Coal (5%)	F-C	154-08	9.3	368	0.08		2.5	77	-74	31	NAF
BS0154CH	122.45	122.65	Spoil	Fresh	Spoil: below DRTL (near floor)	Carb. Siltstone; & Coal (10%)	F-C	154-09	9.3	252	0.05		1.5	68	-67	45	NAF
BS0158CH	70.03	70.22	Pot. reject	Fresh	DBL (Double) Floor	Carb. Siltstone	F-C	82523	9.6	193	0.09		2.8	43	-41	16	NAF
BS0161CH	177.59	177.71	Pot. reject	Fresh	DUN (Dunstan) Parting	Carb. Siltstone; some Coal	F-C	82417	10.0	284	0.08		2.5	36	-34	15	NAF
BS0161CH	180.31	180.50	Pot. reject	Fresh	DUN (Dunstan) Floor	Carb. Siltstone; & Coal	F-C	82421	9.5	97	0.49	0.01	15.0	2.7	12	0.2	NAF
BS0164CH	70.32	70.54	Spoil	Fresh	Spoil: above DUNLA (near roof)	Carb. Siltstone/Sandstone	F-C	164-04	8.2	584	0.19	0.16	5.8	67	-61	12	NAF
BS0164CH	109.74	110.32	Pot. reject	Fresh	WRI (Wright) Parting	Stoney Coal; & Coal (dull)	F-C	82507	8.6	514	0.65	0.34	19.9	7.4	13	0	PAF-LC
BS0164CH	110.57	110.97	Pot. reject	Fresh	WRI (Wright) Floor	Stoney Coal	F-C	82509	9.1	467	0.79	0.32	24.2	16	8	0.7	UC(PAF)
BS0164CH	182.63	182.86	Pot. reject	Fresh	DBL (Double) Roof	Stoney Coal; trace pyrite	F-C	82510	9.9	252	0.04		1.2	7.9	-7	6	NAF
BS0164CH	186.40	186.62	Pot. reject	Fresh	DBL (Double) Floor	Carb. Siltstone; some calcite	F-C	82517	10.1	274	0.24	0.03	7.4	7.4	0	1	NAF
BS0170CH	67.37	67.52	Pot. reject	Fresh	COO (Coolum) Floor	Carb. Siltstone	F-C	82558	9.5	260	1.23	0.38	37.7	6.6	31	0	UC(PAF)
BS0240CH	78.44	78.59	Pot. reject	Fresh	DBL (Double) Floor	Carb. Siltstone; some Coal	F-C	82282	9.8	300	0.48	0.17	14.7	5.5	9	0	UC(PAF)
BS0259CHR1	37.02	37.17	Pot. reject	Fresh	DUN (Dunstan) Roof	Carb. Siltstone	F-C	82635	9.6	393	0.41	0.07	12.6	4.9	8	0.4	NAF
BS0259CHR1	39.83	39.98	Pot. reject	Fresh	DUN (Dunstan) Floor	Carb. Shale	F-C	82640	10.0	246	0.15	0.02	4.6	4.7	0	1.0	NAF

Waste Group: W-NC = weathered, non-carbonaceous; F-NC = fresh, non-carbonaceous; F-C = fresh, carbonaceous

pH & EC 1:5 (w:v) water extracts [on pulp]; S = total sulfur; Scr = sulfide [chromium reducible sulfur]; MPA = maximum potential acidity [calculated from total S]; ANC = acid neutralising capacity; NAPP = net acid producing potential [calculated from MPA and ANC]. Refer to report body for further explanation.

Table C2. Total Element Concentrations

Sample ID	Type	Waste Grp	Zone	Description	Al	As	B	Ba	Be	Cd	Co	Cr	Cu	Hg	Mn	Mo	Ni	Pb	Sb	Se	V	Zn
					%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
154-10	Spoil	W-NC	Weath. Spoil: above DBLUA	Sandstone, vf-f	0.41	23	<50	290	<1	<1	20	<2	50	0.1	1220	<2	13	24	<5	<5	10	133
110-04	Spoil	F-NC	Spoil: below DUNLR	Sandstone, f-vf.	0.45	<5	<50	480	1	<1	9	<2	41	<0.1	309	<2	9	32	<5	<5	5	60
135-02	Spoil	F-NC	Spoil: below WRIL (near floor)	Sandstone, vf-f.	0.41	11	<50	630	<1	<1	27	<2	63	0.1	326	2	28	24	<5	<5	11	91
135-04	Spoil	F-NC	Spoil: below DBLL (near floor)	Sandstone, vf-f.	0.35	6	<50	150	1	<1	4	<2	30	<0.1	579	<2	3	28	<5	<5	6	54
145-03	Spoil	F-NC	Spoil: above DBT (near roof)	Sandstone, vf.; some Siltstone	0.52	12	<50	1590	<1	<1	8	4	32	0.2	307	<2	8	23	<5	<5	11	90
145-06	Spoil	F-NC	Spoil: below DAWLB (near floor)	Siltstone	0.77	<5	<50	270	2	<1	3	5	65	<0.1	148	<2	7	24	<5	<5	13	87
154-07	Spoil	F-NC	Spoil: below COOL (near floor)	Siltstone; & Coal (10%)	0.43	6	<50	60	<1	<1	4	<2	58	0.1	<5	<2	7	28	<5	<5	7	83
161-01	Spoil	F-NC	Spoil: above DAWUA (near roof)	Sandstone, vf.; some Siltstone	0.50	11	<50	120	1	<1	8	3	51	0.2	112	2	11	26	<5	<5	9	94
164-02	Spoil	F-NC	Spoil: below DAWLB	Sandstone, vf. & Siltstone. Calcitic veins	0.38	13	<50	20	1	<1	6	<2	65	0.2	167	<2	10	31	<5	<5	8	105
164-05	Spoil	F-NC	Spoil: above WRIU	Siltstone; & Sandstone, vf.	0.55	22	<50	400	1	<1	13	3	66	0.1	1140	<2	13	26	<5	<5	17	86
170R-01	Spoil	F-NC	Spoil: above COOU (near roof)	Sandstone, vf.; Coal (20%)	0.33	6	<50	990	1	<1	2	<2	28	0.1	26	<2	3	34	<5	<5	<5	67
170R-02	Spoil	F-NC	Spoil: below COOL (near floor)	Sandstone, vf.	0.42	20	<50	2780	2	<1	4	<2	52	<0.1	29	<2	15	18	<5	<5	7	97
231-09	Spoil	F-NC	Spoil: between COOR and DRTU	Siltstone; some carb.	0.33	28	<50	130	<1	<1	13	4	61	0.1	146	<2	18	19	<5	<5	18	104
240-01	Spoil	F-NC	Spoil: above SWRI	Sandstone, vf.	0.37	13	<50	210	1	<1	6	<2	46	<0.1	459	<2	6	28	<5	<5	6	80
C01	Spoil	F-NC	Spoil: above RDR	Sandstone, vf; calcitic; and Siltstone	1.56	22	<50	130	1	<1	12	6	56	<0.1	319	<2	14	21	<5	<5	20	71
C02	Spoil	F-NC	Spoil: below RDL	Sandstone, vf.	0.78	13	<50	30	1	<1	11	8	50	0.1	303	<2	16	22	<5	<5	18	89
C03	Spoil	F-NC	Spoil: above DBT	Stoney Coal; Mudstone & Ironstone; Tuff; Sandstone, vf., some carb.	0.36	8	<50	950	1	<1	8	4	25	0.3	698	<2	4	10	<5	<5	9	73
C04	Spoil	F-NC	Spoil: below DBT	Sandstone, vf.	0.32	12	<50	160	<1	<1	7	<2	63	0.1	206	<2	9	23	<5	<5	7	93
C05	Spoil	F-NC	Spoil: above DAWUA	Sandstone, f; with Siltstone; trace pyrite	0.31	7	<50	20	<1	<1	9	4	35	0.1	418	<2	11	23	<5	<5	10	64
C06	Spoil	F-NC	Spoil: between DAWLB and DUNUA	Sandstone, f	0.41	10	<50	180	<1	<1	8	11	23	<0.1	557	<2	9	18	<5	<5	13	60
C07	Spoil	F-NC	Spoil above DUN	Sandstone, vf-m.	0.48	11	<50	150	1	<1	11	3	59	<0.1	147	<2	14	23	<5	<5	11	96
C08	Spoil	F-NC	Spoil: between DUNL and WRIU	Sandstone, vf.; with Siltstone	0.23	9	<50	30	<1	<1	8	4	18	0.1	418	<2	7	24	<5	<5	6	71
C09	Spoil	F-NC	Spoil: above DBLU	Sandstone, vf; and Siltstone; sideritic	0.31	16	<50	30	1	<1	9	<2	47	<0.1	473	<2	9	22	<5	<5	9	80
C10	Spoil	F-NC	Spoil: above DBLUA	Sandstone, m; trace Py	0.84	<17	<170	<170	<17	<8	<17	<17	<17	<0.8	1290	<17	<17	22	<17	<17	40	56
C11	Spoil	F-NC	Spoil: below DBLL	Siltstone; some Sandstone, vf.	0.30	7	<50	1160	1	<1	2	<2	37	0.1	6	<2	4	29	<5	<5	<5	53
C13	Spoil	F-NC	Spoil: below DRTL & above SDRUA	Siltstone; & Sandstone, vf.	0.31	14	<50	120	<1	<1	6	3	34	0.2	304	<2	7	21	<5	<5	10	85
C18	Pot. reject	F-NC	DAW (Dawson) Floor	Siltstone; some Carb. Siltstone & Coal	0.42	<5	<50	360	1	<1	4	4	56	<0.1	156	<2	6	22	<5	<5	9	54
C19	Pot. reject	F-NC	DUN (Dunstan) Roof	Siltstone; some Carb. Siltstone	0.37	5	<50	1460	1	<1	5	3	92	<0.1	51	<2	7	20	<5	<5	8	81
C21	Pot. reject	F-NC	SDUN (Sub-Dunstan) Roof	Sandstone, vf. & Siltstone; minor Carb. Siltstone; trace Coal	0.16	5	<50	60	<1	<1	6	2	35	<0.1	17	2	5	24	<5	<5	<5	49
C23	Pot. reject	F-NC	WRI (Wright) Roof	Siltstone; Sandstone, vf.; trace Coal; trace carb. Siltstone	0.34	6	<50	600	<1	<1	6	3	44	0.1	68	<2	7	27	<5	<5	6	70
C25	Pot. reject	F-NC	DBL (Double) Roof	Sandstone; Stoney Coal; Siltstone; trace Py	0.32	8	<50	170	1	<1	4	2	55	0.1	426	<2	4	27	<5	<5	8	78
C27	Pot. reject	F-NC	COO (Coolum) Floor	Sandstone, vf; minor Siltstone + Carb. Siltstone	0.20	<5	<50	900	1	<1	4	<2	40	<0.1	68	<2	4	11	<5	<5	7	50
154-08	Spoil	F-C	Spoil: above DRTU (near roof)	Carb. Siltstone; & Coal (5%)	0.37	<5	<50	160	<1	<1	4	<2	58	<0.1	591	<2	6	17	<5	<5	17	82
C12	Spoil	F-C	Spoil: above COOU	Carb. Siltstone; some Siltstone and Sandstone; trace Coal	0.39	8	<50	270	1	<1	4	<2	49	<0.1	424	<2	6	16	<5	<5	14	104
C14	Pot. reject	F-C	RD (Reid) Roof, parting, floor	Carb. Siltstone; & Stoney Coal; trace pyrite	0.75	<5	<50	590	1	<1	<2	3	45	<0.1	456	<2	3	13	<5	<5	15	44
C15	Pot. reject	F-C	DBT (Doubtful) Roof	Carb. Siltstone; & Stoney Coal; trace pyrite	0.29	<5	<50	130	<1	<1	2	3	37	<0.1	632	<2	3	16	<5	<5	12	48
C16	Pot. reject	F-C	DBT (Doubtful) Floor	Carb. Siltstone; some Coal (dull); minor Siltstone	0.32	<5	<50	380	1	<1	3	3	56	<0.1	289	<2	5	20	<5	<5	7	71
C17	Pot. reject	F-C	DAW (Dawson) Roof	Siltstone; some Coal; some Carb. Siltstone; trace pyrite	0.38	<5	<50	80	1	<1	<2	4	56	0.2	178	<2	3	21	<5	<5	7	46
C20	Pot. reject	F-C	DUN (Dunstan) Floor	Carb. Siltstone; some Coal	0.18	<5	<50	130	1	<1	5	<2	39	<0.1	17	2	3	24	<5	<5	<5	65
C22	Pot. reject	F-C	SDUN (Sub-Dunstan) Floor	Carb. Siltstone; Sandstone, vf; & Coal	0.15	<5	<50	160	1	<1	4	<2	37	<0.1	91	2	3	25	<5	<5	<5	49
C24	Pot. reject	F-C	WRI (Wright) Floor	Stoney Coal; some Siltstone	0.20	7	<50	340	1	<1	4	<2	68	<0.1	81	<2	5	20	<5	<5	<5	94
C26	Pot. reject	F-C	DBL (Double) Floor	Carb. Siltstone; some calcite; some Coal	0.17	<5	<50	750	1	<1	<2	<2	37	<0.1	87	<2	<2	26	<5	<5	<5	62

W-NC = weath., non-carbonaceous; F-NC = fresh, non-carb.; F-C = fresh, carbonaceous.

Table C3. Geochemical Abundance Indices (GAI)

Sample ID	Type	Waste Grp	Zone	Description	Al	As	B	Ba	Be	Cd	Co	Cr	Cu	Hg	Mn	Mo	Ni	Pb	Sb	Se	V	Zn
				Avg. abundance in soil (units shown)	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
					7.1	6	10	500	0.3	0.35	8	70	30	0.06	1000	1.2	50	35	1	0.4	90	90
154-10	Spoil	W-NC	Weath. Spoil: above DBLUA	Sandstone, vf-f	-	1.4	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-
110-04	Spoil	F-NC	Spoil: below DUNLR	Sandstone, f-vf.	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
135-02	Spoil	F-NC	Spoil: below WRIL (near floor)	Sandstone, vf-f.	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-
135-04	Spoil	F-NC	Spoil: below DBLL (near floor)	Sandstone, vf-f.	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
145-03	Spoil	F-NC	Spoil: above DBT (near roof)	Sandstone, vf.; some Siltstone	-	-	-	1.1	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-
145-06	Spoil	F-NC	Spoil: below DAWLB (near floor)	Siltstone	-	-	-	-	2.2	-	-	-	0.5	-	-	-	-	-	-	-	-	-
154-07	Spoil	F-NC	Spoil: below COOL (near floor)	Siltstone; & Coal (10%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
161-01	Spoil	F-NC	Spoil: above DAWUA (near roof)	Sandstone, vf.; some Siltstone	-	-	-	-	1.2	-	-	-	-	1.2	-	-	-	-	-	-	-	-
164-02	Spoil	F-NC	Spoil: below DAWLB	Sandstone, vf. & Siltstone. Calcitic veins	-	0.5	-	-	1.2	-	-	-	0.5	1.2	-	-	-	-	-	-	-	-
164-05	Spoil	F-NC	Spoil: above WRIU	Siltstone; & Sandstone, vf.	-	1.3	-	-	1.2	-	-	-	0.6	-	-	-	-	-	-	-	-	-
170R-01	Spoil	F-NC	Spoil: above COOU (near roof)	Sandstone, vf.; Coal (20%)	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
170R-02	Spoil	F-NC	Spoil: below COOL (near floor)	Sandstone, vf.	-	1.2	-	1.9	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-
231-09	Spoil	F-NC	Spoil: between COOR and DRTU	Siltstone; some carb.	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
240-01	Spoil	F-NC	Spoil: above SWRI	Sandstone, vf.	-	0.5	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C01	Spoil	F-NC	Spoil: above RDR	Sandstone, vf; calcitic; and Siltstone	-	1.3	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C02	Spoil	F-NC	Spoil: below RDL	Sandstone, vf.	-	0.5	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C03	Spoil	F-NC	Spoil: above DBT	Stoney Coal; Mudstone & Ironstone; Tuff; Sandstone, vf., some carb.	-	-	-	-	1.2	-	-	-	-	1.7	-	-	-	-	-	-	-	-
C04	Spoil	F-NC	Spoil: below DBT	Sandstone, vf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C05	Spoil	F-NC	Spoil: above DAWUA	Sandstone, f; with Siltstone; trace pyrite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C06	Spoil	F-NC	Spoil: between DAWLB and DUNUA	Sandstone, f	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C07	Spoil	F-NC	Spoil above DUN	Sandstone, vf-m.	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C08	Spoil	F-NC	Spoil: between DUNL and WRIU	Sandstone, vf.; with Siltstone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C09	Spoil	F-NC	Spoil: above DBLU	Sandstone, vf; and Siltstone; sideritic	-	0.8	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C10	Spoil	F-NC	Spoil: above DBLUA	Sandstone, m; trace Py	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C11	Spoil	F-NC	Spoil: below DBLL	Siltstone; some Sandstone, vf.	-	-	-	0.6	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C13	Spoil	F-NC	Spoil: below DRTL & above SDRUA	Siltstone; & Sandstone, vf.	-	0.6	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-
C18	Pot. reject	F-NC	DAW (Dawson) Floor	Siltstone; some Carb. Siltstone & Coal	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C19	Pot. reject	F-NC	DUN (Dunstan) Roof	Siltstone; some Carb. Siltstone	-	-	-	1.0	1.2	-	-	-	1.0	-	-	-	-	-	-	-	-	-
C21	Pot. reject	F-NC	SDUN (Sub-Dunstan) Roof	Sandstone, vf. & Siltstone; minor Carb. Siltstone; trace Coal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C23	Pot. reject	F-NC	WRI (Wright) Roof	Siltstone; Sandstone, vf.; trace Coal; trace carb. Siltstone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C25	Pot. reject	F-NC	DBL (Double) Roof	Sandstone; Stoney Coal; Siltstone; trace Py	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C27	Pot. reject	F-NC	COO (Coolum) Floor	Sandstone, vf; minor Siltstone + Carb. Siltstone	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
154-08	Spoil	F-C	Spoil: above DRTU (near roof)	Carb. Siltstone; & Coal (5%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C12	Spoil	F-C	Spoil: above COOU	Carb. Siltstone; some Siltstone and Sandstone; trace Coal	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C14	Pot. reject	F-C	RD (Reid) Roof, parting, floor	Carb. Siltstone; & Stoney Coal; trace pyrite	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C15	Pot. reject	F-C	DBT (Doubtful) Roof	Carb. Siltstone; & Stoney Coal; trace pyrite	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C16	Pot. reject	F-C	DBT (Doubtful) Floor	Carb. Siltstone; some Coal (dull); minor Siltstone	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C17	Pot. reject	F-C	DAW (Dawson) Roof	Siltstone; some Coal; some Carb. Siltstone; trace pyrite	-	-	-	-	1.2	-	-	-	-	1.2	-	-	-	-	-	-	-	-
C20	Pot. reject	F-C	DUN (Dunstan) Floor	Carb. Siltstone; some Coal	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C22	Pot. reject	F-C	SDUN (Sub-Dunstan) Floor	Carb. Siltstone; Sandstone, vf; & Coal	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
C24	Pot. reject	F-C	WRI (Wright) Floor	Stoney Coal; some Siltstone	-	-	-	-	1.2	-	-	-	0.6	-	-	-	-	-	-	-	-	-
C26	Pot. reject	F-C	DBL (Double) Floor	Carb. Siltstone; some calcite; some Coal	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-

W-NC = weath., non-carbonaceous; F-NC = fresh, non-carb.; F-C = fresh, carbonaceous.
Geochemical abundance index (GAI) was calculated from the average element abundance in soil in the earth's crust (AusIMM 2011; Bowen 1979). " - " = GAI <1. Refer to report body for further explanation.

Table C4. Soluble Major Ions, pH, Electrical Conductivity (EC), Metal and Metalloid Concentrations in Fresh Water Extracts

Sample ID	Type	Waste Grp	Zone	Description	pH 1:5	EC 1:5	Total Alk.	HCO_3	CO_3	SO_4	Cl	Ca	Mg	Na	K	Al	As	B	Ba	Be
						µS/cm	mg CaCO3/L			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
154-10	Spoil	W-NC	Weath. Spoil: above DBLUA	Sandstone, vf-f	9.5	345	118.4	90.6	27.8	8	38	<2	<2	66	8	<0.2	<0.02	<0.2	<0.2	<0.02
110-04	Spoil	F-NC	Spoil: below DUNLR	Sandstone, f-vf.	8.6	210	38.2	31.2	7	28	24	<2	<2	32	14	0.2	0.04	<0.2	<0.2	<0.02
135-02	Spoil	F-NC	Spoil: below WRIL (near floor)	Sandstone, vf-f.	8.7	248	52.2	45.2	7	56	12	2	<2	36	18	<0.2	0.06	<0.2	<0.2	<0.02
135-04	Spoil	F-NC	Spoil: below DBLL (near floor)	Sandstone, vf-f.	9	145	66.2	52.2	14	12	6	<2	<2	24	10	0.2	0.06	<0.2	<0.2	<0.02
145-03	Spoil	F-NC	Spoil: above DBT (near roof)	Sandstone, vf.; some Siltstone	9.6	306	137.4	74.8	62.6	32	4	<2	<2	60	6	0.4	0.22	<0.2	<0.2	<0.02
145-06	Spoil	F-NC	Spoil: below DAWLB (near floor)	Siltstone	9.6	138	74.8	12.2	62.6	6	4	<2	<2	28	2	0.8	0.14	<0.2	<0.2	<0.02
154-07	Spoil	F-NC	Spoil: below COOL (near floor)	Siltstone; & Coal (10%)	9.2	234	48.8	41.8	7	22	36	<2	<2	46	2	0.4	0.28	<0.2	<0.2	<0.02
161-01	Spoil	F-NC	Spoil: above DAWUA (near roof)	Sandstone, vf.; some Siltstone	9.2	290	78.4	64.4	14	42	22	<2	<2	56	8	0.2	0.18	<0.2	<0.2	<0.02
164-02	Spoil	F-NC	Spoil: below DAWLB	Sandstone, vf. & Siltstone. Calcitic veins	9	379	45.2	31.2	14	28	78	<2	<2	72	8	<0.2	<0.02	<0.2	<0.2	<0.02
164-05	Spoil	F-NC	Spoil: above WRIU	Siltstone; & Sandstone, vf.	9.4	348	146.2	111.4	34.8	26	18	<2	<2	64	14	<0.2	0.14	<0.2	<0.2	<0.02
170R-01	Spoil	F-NC	Spoil: above COOU (near roof)	Sandstone, vf.; Coal (20%)	9.3	178	55.6	41.6	14	30	8	<2	<2	32	4	0.6	0.08	<0.2	<0.2	<0.02
170R-02	Spoil	F-NC	Spoil: below COOL (near floor)	Sandstone, vf.	8.9	301	52.2	45.2	7	68	20	<2	<2	56	8	<0.2	0.74	<0.2	<0.2	<0.02
231-09	Spoil	F-NC	Spoil: between COOR and DRTU	Siltstone; some carb.	9.6	219	95.8	61	34.8	30	6	<2	<2	44	<2	0.4	0.52	<0.2	<0.2	<0.02
240-01	Spoil	F-NC	Spoil: above SWRI	Sandstone, vf.	9.4	308	118.4	83.6	34.8	16	26	<2	<2	60	8	0.2	0.28	<0.2	<0.2	<0.02
C01	Spoil	F-NC	Spoil: above RDR	Sandstone, vf; calcitic; and Siltstone	9.6	289	107.8	80	27.8	20	18	<2	<2	58	4	0.2	0.68	<0.2	<0.2	<0.02
C02	Spoil	F-NC	Spoil: below RDL	Sandstone, vf.	9.6	245	97.4	69.6	27.8	24	18	<2	<2	50	4	0.4	0.22	<0.2	<0.2	<0.02
C03	Spoil	F-NC	Spoil: above DBT	Stoney Coal; Mudstone & Ironstone; Tuff; Sandstone, vf., some carb.	8.6	217	69.6	69.6	<0.2	16	32	2	2	42	4	<0.2	<0.02	<0.2	<0.2	<0.02
C04	Spoil	F-NC	Spoil: below DBT	Sandstone, vf.	9	349	59.2	55.8	3.4	32	66	<2	<2	66	8	<0.2	0.06	<0.2	<0.2	<0.02
C05	Spoil	F-NC	Spoil: above DAWUA	Sandstone, f; with Siltstone; trace pyrite	9.6	295	107.8	73	34.8	22	30	<2	<2	56	10	0.2	0.14	<0.2	<0.2	<0.02
C06	Spoil	F-NC	Spoil: between DAWLB and DUNUA	Sandstone, f	9.8	331	146.2	90.6	55.6	18	14	<2	<2	68	12	0.2	0.2	<0.2	<0.2	<0.02
C07	Spoil	F-NC	Spoil above DUN	Sandstone, vf-m.	9	274	73	73	<0.2	36	32	2	<2	44	16	<0.2	0.12	<0.2	<0.2	<0.02
C08	Spoil	F-NC	Spoil: between DUNL and WRIU	Sandstone, vf.; with Siltstone	9.7	338	104.4	83.6	20.8	26	30	<2	<2	64	12	<0.2	0.16	<0.2	<0.2	<0.02
C09	Spoil	F-NC	Spoil: above DBLU	Sandstone, vf; and Siltstone; sideritic	9.5	212	66.2	45.4	20.8	20	6	2	<2	38	8	<0.2	0.26	<0.2	<0.2	<0.02
C10	Spoil	F-NC	Spoil: above DBLUA	Sandstone, m; trace Py	9.5	381	114.8	92	20.8	84	24	2	<2	68	16	<0.2	0.06	<0.2	<0.2	<0.02
C11	Spoil	F-NC	Spoil: below DBLL	Siltstone; some Sandstone, vf.	9.3	277	80	59.2	20.8	38	22	<2	<2	54	8	0.4	0.42	<0.2	<0.2	<0.02
C13	Spoil	F-NC	Spoil: below DRTL & above SDRUA	Siltstone; & Sandstone, vf.	9.8	329	170.6	135.8	34.8	20	6	<2	<2	70	6	0.4	0.36	<0.2	<0.2	<0.02
C18	Pot. reject	F-NC	DAW (Dawson) Floor	Siltstone; some Carb. Siltstone & Coal	9.8	302	114.8	66	48.8	26	12	<2	<2	68	4	<0.2	0.08	<0.2	<0.2	<0.02
C19	Pot. reject	F-NC	DUN (Dunstan) Roof	Siltstone; some Carb. Siltstone	9.7	310	80	52.2	27.8	32	34	<2	<2	66	4	0.4	0.18	<0.2	<0.2	<0.02
C21	Pot. reject	F-NC	SDUN (Sub-Dunstan) Roof	Sandstone, vf. & Siltstone; minor Carb. Siltstone; trace Coal	9.4	282	45.2	31.2	14	28	42	<2	<2	54	8	<0.2	0.06	<0.2	<0.2	<0.02
C23	Pot. reject	F-NC	WRI (Wright) Roof	Siltstone; Sandstone, vf.; trace Coal; trace carb. Siltstone	8.9	368	41.8	38.4	3.4	72	38	<2	<2	66	14	<0.2	0.12	<0.2	<0.2	<0.02
C25	Pot. reject	F-NC	DBL (Double) Roof	Sandstone; Stoney Coal; Siltstone; trace Py	9.7	285	121.8	73	48.8	18	16	<2	<2	58	6	0.2	0.36	<0.2	<0.2	<0.02
C27	Pot. reject	F-NC	COO (Coolum) Floor	Sandstone, vf; minor Siltstone + Carb. Siltstone	9.5	290	87	59.2	27.8	40	12	<2	<2	60	2	<0.2	0.2	<0.2	<0.2	<0.02
154-08	Spoil	F-C	Spoil: above DRTU (near roof)	Carb. Siltstone; & Coal (5%)	9.5	294	132.2	114.8	17.4	4	22	<2	<2	62	2	0.4	<0.02	<0.2	<0.2	<0.02
C12	Spoil	F-C	Spoil: above COOU	Carb. Siltstone; some Siltstone and Sandstone; trace Coal	9.6	171	80	59.2	20.8	16	6	<2	<2	40	<2	0.6	0.2	<0.2	<0.2	<0.02
C14	Pot. reject	F-C	RD (Reid) Roof, parting, floor	Carb. Siltstone; & Stoney Coal; trace pyrite	9.6	260	76.6	59.2	17.4	22	20	<2	<2	52	2	<0.2	0.04	<0.2	<0.2	<0.02
C15	Pot. reject	F-C	DBT (Doubtful) Roof	Carb. Siltstone; & Stoney Coal; trace pyrite	9.3	327	80	69.6	10.4	90	16	4	<2	74	6	<0.2	<0.02	<0.2	<0.2	<0.02
C16	Pot. reject	F-C	DBT (Doubtful) Floor	Carb. Siltstone; some Coal (dull); minor Siltstone	9.7	288	90.4	62.6	27.8	18	24	<2	<2	62	4	<0.2	0.18	<0.2	<0.2	<0.02
C17	Pot. reject	F-C	DAW (Dawson) Roof	Siltstone; some Coal; some Carb. Siltstone; trace pyrite	9.8	274	97.4	69.6	27.8	20	14	<2	<2	56	6	<0.2	0.02	<0.2	<0.2	<0.02
C20	Pot. reject	F-C	DUN (Dunstan) Floor	Carb. Siltstone; some Coal	9.6	177	73	52.2	20.8	8	16	<2	<2	42	2	<0.2	0.04	<0.2	<0.2	<0.02
C22	Pot. reject	F-C	SDUN (Sub-Dunstan) Floor	Carb. Siltstone; Sandstone, vf; & Coal	8.2	540	29.6	29.6	<0.2	202	26	20	14	68	12	<0.2	<0.02	<0.2	<0.2	<0.02
C24	Pot. reject	F-C	WRI (Wright) Floor	Stoney Coal; some Siltstone	9	390	69.6	55.6	14	88	24	4	2	72	10	<0.2	0.08	<0.2	<0.2	<0.02
C26	Pot. reject	F-C	DBL (Double) Floor	Carb. Siltstone; some calcite; some Coal	9.7	263	99.2	50.4	48.8	24	8	<2	<2	56	4	<0.2	0.06	<0.2	<0.2	<0.02

W-NC = weath., non-carbonaceous; F-NC = fresh, non-carb.; F-C = fresh, carbonaceous.
Water extract tests undertaken as 1:5 (w:v). Refer to report body for further explanation of data.

Table C4. Soluble Major Ions, pH, Electrical Conductivity (EC), Metal and Metalloid Concentrations in Fresh Water Extracts

Sample ID	Type	Waste Grp	Zone	Description	Cr	Cr	Co	Cu	Fe	Hg	Mn	Mo	Ni	Pb	Sb	Se	V	Zn
					mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
154-10	Spoil	W-NC	Weath. Spoil: above DBLUA	Sandstone, vf-f	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
110-04	Spoil	F-NC	Spoil: below DUNLR	Sandstone, f-vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.12	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
135-02	Spoil	F-NC	Spoil: below WRIL (near floor)	Sandstone, vf-f.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.16	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
135-04	Spoil	F-NC	Spoil: below DBLL (near floor)	Sandstone, vf-f.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.06	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
145-03	Spoil	F-NC	Spoil: above DBT (near roof)	Sandstone, vf.; some Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	0.02	0.04	<0.02	<0.02	<0.02	<0.02	0.02	<0.02
145-06	Spoil	F-NC	Spoil: below DAWLB (near floor)	Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	0.02	<0.02
154-07	Spoil	F-NC	Spoil: below COOL (near floor)	Siltstone; & Coal (10%)	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	0.04	<0.02
161-01	Spoil	F-NC	Spoil: above DAWUA (near roof)	Sandstone, vf.; some Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.08	<0.02	<0.02	<0.02	0.04	<0.02	<0.02
164-02	Spoil	F-NC	Spoil: below DAWLB	Sandstone, vf. & Siltstone. Calcitic veins	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
164-05	Spoil	F-NC	Spoil: above WRIU	Siltstone; & Sandstone, vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.06	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
170R-01	Spoil	F-NC	Spoil: above COOU (near roof)	Sandstone, vf.; Coal (20%)	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.12	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
170R-02	Spoil	F-NC	Spoil: below COOL (near floor)	Sandstone, vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
231-09	Spoil	F-NC	Spoil: between COOR and DRTU	Siltstone; some carb.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	0.02	0.02	0.02	<0.02
240-01	Spoil	F-NC	Spoil: above SWRI	Sandstone, vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	0.04	<0.02	<0.02
C01	Spoil	F-NC	Spoil: above RDR	Sandstone, vf; calcitic; and Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	<0.02	0.04	<0.02	<0.02
C02	Spoil	F-NC	Spoil: below RDL	Sandstone, vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
C03	Spoil	F-NC	Spoil: above DBT	Stoney Coal; Mudstone & Ironstone; Tuff; Sandstone, vf., some carb.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C04	Spoil	F-NC	Spoil: below DBT	Sandstone, vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
C05	Spoil	F-NC	Spoil: above DAWUA	Sandstone, f; with Siltstone; trace pyrite	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.08	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
C06	Spoil	F-NC	Spoil: between DAWLB and DUNUA	Sandstone, f	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C07	Spoil	F-NC	Spoil above DUN	Sandstone, vf-m.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.06	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
C08	Spoil	F-NC	Spoil: between DUNL and WRIU	Sandstone, vf.; with Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C09	Spoil	F-NC	Spoil: above DBLU	Sandstone, vf; and Siltstone; sideritic	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.06	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
C10	Spoil	F-NC	Spoil: above DBLUA	Sandstone, m; trace Py	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02
C11	Spoil	F-NC	Spoil: below DBLL	Siltstone; some Sandstone, vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C13	Spoil	F-NC	Spoil: below DRTL & above SDRUA	Siltstone; & Sandstone, vf.	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.1	<0.02	<0.02	<0.02	<0.02	0.04	<0.02
C18	Pot. reject	F-NC	DAW (Dawson) Floor	Siltstone; some Carb. Siltstone & Coal	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	0.02	0.02	<0.02
C19	Pot. reject	F-NC	DUN (Dunstan) Roof	Siltstone; some Carb. Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	0.02	0.02	<0.02
C21	Pot. reject	F-NC	SDUN (Sub-Dunstan) Roof	Sandstone, vf. & Siltstone; minor Carb. Siltstone; trace Coal	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C23	Pot. reject	F-NC	WRI (Wright) Roof	Siltstone; Sandstone, vf.; trace Coal; trace carb. Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	0.02	0.02	0.02	<0.02
C25	Pot. reject	F-NC	DBL (Double) Roof	Sandstone; Stoney Coal; Siltstone; trace Py	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.08	<0.02	<0.02	<0.02	0.04	<0.02	<0.02
C27	Pot. reject	F-NC	COO (Coolum) Floor	Sandstone, vf; minor Siltstone + Carb. Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	0.04	<0.02
154-08	Spoil	F-C	Spoil: above DRTU (near roof)	Carb. Siltstone; & Coal (5%)	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	0.04	<0.02
C12	Spoil	F-C	Spoil: above COOU	Carb. Siltstone; some Siltstone and Sandstone; trace Coal	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	0.04	<0.02
C14	Pot. reject	F-C	RD (Reid) Roof, parting, floor	Carb. Siltstone; & Stoney Coal; trace pyrite	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C15	Pot. reject	F-C	DBT (Doubtful) Roof	Carb. Siltstone; & Stoney Coal; trace pyrite	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C16	Pot. reject	F-C	DBT (Doubtful) Floor	Carb. Siltstone; some Coal (dull); minor Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
C17	Pot. reject	F-C	DAW (Dawson) Roof	Siltstone; some Coal; some Carb. Siltstone; trace pyrite	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	<0.02	<0.02	<0.02	<0.02	0.04	0.02	<0.02
C20	Pot. reject	F-C	DUN (Dunstan) Floor	Carb. Siltstone; some Coal	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.08	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
C22	Pot. reject	F-C	SDUN (Sub-Dunstan) Floor	Carb. Siltstone; Sandstone, vf; & Coal	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.06	<0.02	<0.02	<0.02	0.02	<0.02	<0.02
C24	Pot. reject	F-C	WRI (Wright) Floor	Stoney Coal; some Siltstone	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.04	<0.02	<0.02	<0.02	0.04	<0.02	<0.02
C26	Pot. reject	F-C	DBL (Double) Floor	Carb. Siltstone; some calcite; some Coal	<0.02	<0.02	<0.02	<0.02	<0.2	<0.0001	<0.02	0.1	<0.02	<0.02	<0.02	0.04	<0.02	<0.02

W-NC = weath., non-carbonaceous; F-NC = fresh, non-carb.; F-C = fresh, carbonaceous.
Water extract tests undertaken as 1:5 (w:v). Refer to report body for further explanation of data.

Table C5. Exchangeable Cations

Sample ID	Type	Waste Grp	Zone	Description	pH 1:5	EC 1:5 (µS/cm)	Exch. Ca (meq/100g)	Exch. Mg (meq/100g)	Exch. K (meq/100g)	Exch. Na (meq/100g)	CEC (meq/100g)	ESP (%)	Sodicity Rating
154-10	Spoil	W-NC	Weath. Spoil: above DBLUA	Sandstone, vf-f	9.5	345	21.3	4.2	0.6	0.4	26.5	1.5	non-sodic
110-04	Spoil	F-NC	Spoil: below DUNLR	Sandstone, f-vf.	8.6	210	2.5	1.9	1.2	0.4	6	6.7	sodic
135-02	Spoil	F-NC	Spoil: below WRIL (near floor)	Sandstone, vf-f.	8.7	248	4	2.3	0.9	0.2	7.6	2.6	non-sodic
135-04	Spoil	F-NC	Spoil: below DBLL (near floor)	Sandstone, vf-f.	9	145	2.7	1.7	1	0.4	5.9	6.8	sodic
145-03	Spoil	F-NC	Spoil: above DBT (near roof)	Sandstone, vf.; some Siltstone	9.6	306	12.7	2.7	0.8	0.7	17	4.1	non-sodic
145-06	Spoil	F-NC	Spoil: below DAWLB (near floor)	Siltstone	9.6	138	2.1	1.3	1.2	2.2	6.9	31.9	strongly sodic
154-07	Spoil	F-NC	Spoil: below COOL (near floor)	Siltstone; & Coal (10%)	9.2	234	3.2	2.3	1	2.6	9.1	28.6	strongly sodic
161-01	Spoil	F-NC	Spoil: above DAWUA (near roof)	Sandstone, vf.; some Siltstone	9.2	290	4.9	2.7	1.2	1	9.8	10.2	sodic
164-02	Spoil	F-NC	Spoil: below DAWLB	Sandstone, vf. & Siltstone. Calcitic veins	9	379	3.6	3.2	0.9	1.2	8.9	13.5	sodic
164-05	Spoil	F-NC	Spoil: above WRIU	Siltstone; & Sandstone, vf.	9.4	348	7.2	3.7	1.1	0.7	12.8	5.5	non-sodic
170R-01	Spoil	F-NC	Spoil: above COOU (near roof)	Sandstone, vf.; Coal (20%)	9.3	178	2.2	0.8	1.1	0.8	4.9	16.3	strongly sodic
170R-02	Spoil	F-NC	Spoil: below COOL (near floor)	Sandstone, vf.	8.9	301	3.6	1.9	1.3	1.1	7.9	13.9	sodic
231-09	Spoil	F-NC	Spoil: between COOR and DRTU	Siltstone; some carb.	9.6	219	4.2	3.5	0.7	1.8	10.3	17.5	strongly sodic
240-01	Spoil	F-NC	Spoil: above SWRI	Sandstone, vf.	9.4	308	6.1	3.4	1	1.2	11.7	10.3	sodic
154-08	Spoil	F-C	Spoil: above DRTU (near roof)	Carb. Siltstone; & Coal (5%)	9.5	294	4.8	2.5	0.9	2.4	10.6	22.6	strongly sodic
C01	Spoil	F-NC	Spoil: above RDR	Sandstone, vf; calcitic; and Siltstone	9.6	289	18.5	4.3	0.8	0.7	24.3	2.9	non-sodic
C02	Spoil	F-NC	Spoil: below RDL	Sandstone, vf.	9.6	245	7.2	3.4	0.7	0.6	12	5.0	non-sodic
C03	Spoil	F-NC	Spoil: above DBT	Stoney Coal; Mudstone & Ironstone; Tuff; Sandstone, vf., some carb.	8.6	217	5.7	4.8	0.5	0.8	11.9	6.7	sodic
C04	Spoil	F-NC	Spoil: below DBT	Sandstone, vf.	9	349	3.3	3.2	0.8	0.9	8.3	10.8	sodic
C05	Spoil	F-NC	Spoil: above DAWUA	Sandstone, f; with Siltstone; trace pyrite	9.6	295	7.2	2.4	0.7	0.4	10.7	3.7	non-sodic
C06	Spoil	F-NC	Spoil: between DAWLB and DUNUA	Sandstone, f	9.8	331	6	3.2	0.7	0.5	10.3	4.9	non-sodic
C07	Spoil	F-NC	Spoil above DUN	Sandstone, vf-m.	9	274	4.8	2.6	1	0.3	8.7	3.4	non-sodic
C08	Spoil	F-NC	Spoil: between DUNL and WRIU	Sandstone, vf.; with Siltstone	9.7	338	9.9	1.9	0.6	0.4	12.8	3.1	non-sodic
C09	Spoil	F-NC	Spoil: above DBLU	Sandstone, vf; and Siltstone; sideritic	9.5	212	15.3	2.9	0.8	0.2	19.2	1.0	non-sodic
C10	Spoil	F-NC	Spoil: above DBLUA	Sandstone, m; trace Py	9.5	381	14	1.5	0.4	0.2	16.2	1.2	non-sodic
C11	Spoil	F-NC	Spoil: below DBLL	Siltstone; some Sandstone, vf.	9.3	277	3.3	1.2	1.1	1.1	6.7	16.4	strongly sodic
C12	Spoil	F-C	Spoil: above COOU	Carb. Siltstone; some Siltstone and Sandstone; trace Coal	9.6	171	2.5	1.3	1.2	2.6	7.7	33.8	strongly sodic
C13	Spoil	F-NC	Spoil: below DRTL & above SDRUA	Siltstone; & Sandstone, vf.	9.8	329	15.1	1.4	0.8	0.9	18.2	4.9	non-sodic

W-NC = weath., non-carbonaceous; F-NC = fresh, non-carb.; F-C = fresh, carbonaceous.
pH and EC on 1:5 (w:v) water extracts; CEC = cation exchange capacity; ESP = exchangeable sodium percentage. Refer to report body for further explanation of data.

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