REPORT

Risk Assessment for Tailings Storage Facility TD6

Peabody Australia

Submitted to:

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Submitted by:

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1.0 INTRODUCTION

1.1 Introduction

Peabody Energy Australia Pty Ltd (Peabody) engaged Golder Associates Pty Ltd (Golder) to undertake a risk assessment for tailings storage facility (TSF) TD6 at the Wilpinjong Coal Mine.

The risk assessment follows from an inspection by representatives of the NSW Resources Regulator (Regulator) at the Wilpinjong Coal Mine TSF as part of the Regulator's Target Assessment Program. Following this inspection, the Regulator issued Peabody an Assessment Outcome letter, reference ASMT0009005, dated 5 May 2020 (the letter). The NSW Resources Regulator identified items of concern and required Peabody to complete a risk assessment relating to TD6. In an email dated 12 May 2020, Clark Potter of Peabody requested Golder conduct the required Risk Assessment with the objective of addressing the items of concern presented in the letter.

1.2 Objectives

The objectives of this report are to:

- Provide a high-level qualitative risk assessment that identifies key risks for further investigation or treatment;
- Address concerns raised by the regulator in letter ASMT0009005; and
- Inform the long-term management of TD6.

2.0 BACKGROUND

2.1 Wilpinjong coal mine

Wilpinjong Coal Mine (the Mine) is owned and operated by Wilpinjong Coal Pty Limited (WCPL), a wholly owned subsidiary of Peabody Energy Australia Pty Limited. The Mine commenced operation in 2006 and operates in accordance with Development Consent SSD-6764 (as modified). The mine is located 48 km north-east of Mudge in NSW.

The mine is an open cut operation and produces up to 16 million tonnes per annum of Run-of-Mine (ROM) thermal coal. ROM coal is processed in a Coal Handling and Preparation Plant (CHPP) before being loaded and shipped via rail to Newcastle for local use and export. The mine is currently expected to be decommissioned in 2033 (WCPL 2019).

2.2 Tailings management and tailings properties

A belt press filter plant (BPFP) commenced operation on site in early 2015 to dewater the fine rejects of the CHPP. The dewatered fine coal fraction is mixed with coarse rejects and placed and compacted in a separate mined out void.

Slurried tailings from the fine coal rejects are deposited in the TSF during downtime or maintenance of the BPFP. Short-term overflow from thickeners and the CHPP during normal operation of the CHPP are also deposited into the TSF.

Tailings comprise a silt, clay or clayey silt as per the testing carried out for the TD6 design report (ATC 2013). Laboratory testing carried out between 2008 and 2010 indicates some variability in tailings properties, specifically with respect to particle size distribution, bleed and Atterberg limits (ATC 2013a). The reported settled dry density of the tailings was 0.53 t/m^3 with a shrinkage limited dry density of 0.94 t/m^3.

2.3 TD6 Design and Construction

TD6 was constructed within Pit 2 to the south of TD5. The north embankment is buttressed against the TD5 embankment. Embankments constructed within the Pit 2 void form the south and west embankments. The east embankment is over natural rock at depth, with the embankment footprint extending into the adjacent Pit 4. At the time of construction, the embankment crests varied in height between 10 and 20 m above the pit floor, with the nominal crest width varying between 60 and 70 m.

Based on a drone survey dated March 2020 and a site plan of the Pit 2 excavation:

- The Pit 2 excavated surface under the TSF slopes down from the south-western corner of TD6 to the north-eastern corner at a grade of about 2.8%.
- The narrowest embankment is the northern embankment abutting TD5 with a minimum crest width of approximately 70 m
- The minimum crest elevation of the TD6 embankment is RL 390 m along the northern and eastern embankments
- The crest elevation of the western embankment is RL 391 m
- The southern embankment partially abuts a waste rock stockpile, with the waste rock stockpile crest varying in elevation from RL 391 m to RL 419 m.

The embankments of TD6 were reportedly constructed predominantly from moderately to slightly weathered overburden rock and the upstream face was covered with a 5 m wide layer of inert soil. TD6 has a single tailings discharge point adjacent to the south-east embankment corner. Supernatant water forms a pond against the western embankment from where it evaporates or is allowed to seep through the embankment.

The tailings is deposited as a slurry with a low solids density from the south-eastern corner of TD6 and flows to the western embankment where a pond of supernatant has formed. The tailings beach slope from the point of discharge to the pond is about 0.8%. The tailings is about 20 m thick in the north-eastern corner and about 8 m thick in the south-western corner. Tailings on the beach appears to have formed a dry to damp crust, but the underlying tailings is damp to wet.

TD6's remaining capacity as of September 2020 is approximately 275,000 m^3. The current annual tailings deposition rate into TD6 is very low and the most recent capacity assessment (Golder 2020) indicates that the rate of capacity consumption between March and September 2020 was less than the accuracy of the survey provided. As such, the remaining life of TD6 based on current deposition rates cannot be provided.

Refer to Figure 1 for the location of TD6 and Figure 2 for an overview plan for TD6. As shown in Figure 1, TD6 is located approximately 1 km from the site boundary.

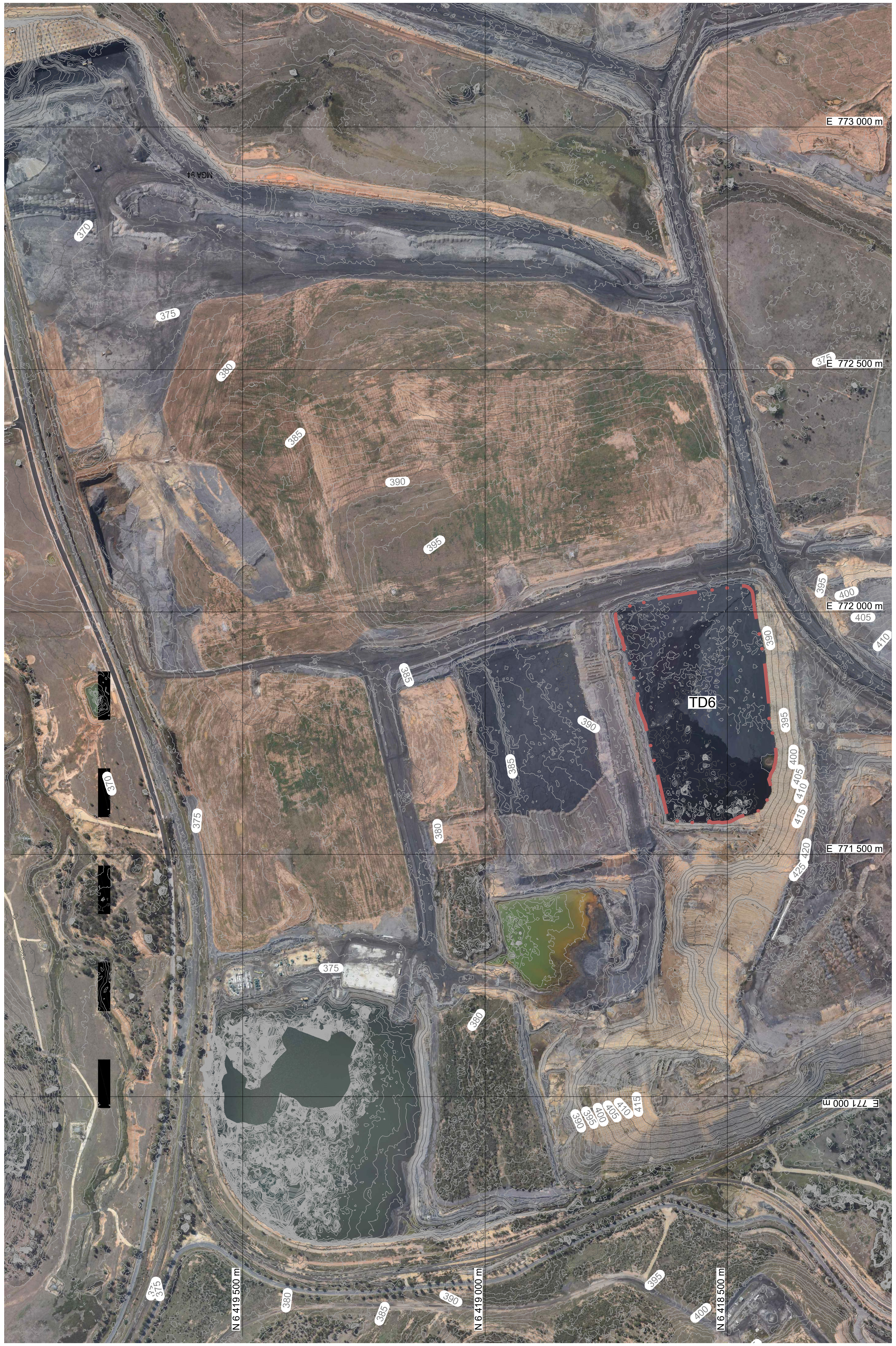
2.4 Reports relating to TD6 and tailings management

Since 2014, Golder has prepared a number of assessments and tailings management reports for TD6 at Wilpinjong, including preparation of surveillance reports, a dam break assessment, preparation of a dam safety and emergency manual and an operation manual. The following documents have been referenced for this risk assessment:

- ATC 2013, Wilpinjong Coal Mine, Design Report Tailings Storage Facility, TD6, Consultant's Reference 106021R18Rev1, August 2013
- Golder 2014. *Life of Mine Tailings Management Strategy, Wilpinjong Coal Mine*, Consultant's Reference 147625002-006-Rev0, July 2014.

- Golder 2015, Wilpinjong Coal Mine, Operating and Maintenance Manual for Tailings Storage Facility, Reference 1537767-002-R-RevA, dated 18 December 2015
- Golder 2018a, Tailings Storage Facility Annual Surveillance Report, Wilpinjong Coal Mine, Consultant's Reference 1784584-001-R-Rev0, 19 March 2018
- Golder 2018b, *Wilpinjong Geochemical Assessment of Tailings*, Consultant's Reference 1784584-003-R-RevA, 30 July 2018
- Golder 2019, Tailings Storage Facility Annual Surveillance Report, Wilpinjong Coal Mine, Consultant's Reference 1784584-005-R-Rev0, July 2019
- Golder 2020, TD6 TSF Dam Break Assessment Wilpinjong Mine, Consultant's Reference 19128879-001-R-RevA, May 2020
- WCPL 2014b. *Wilpinjong Coal Spontaneous Combustion Management Plan*, Appendix 6 to the Waste Management Plan, Document number WI-ENV-MNP-0006, June 2014.

MGA 94, ZONE 56



LEGEND

APRIL 2020 CONTOURS AT 1 m INTERVALS

APPROXIMATE EDGE OF TAILINGS SURFACE

NOTE(S)

1. ALL LEVELS ARE REFERENCED IN METRES TO AUSTRALIAN HEIGHT DATUM (m AHD).
2. AERIAL IMAGE IS APPROXIMATE AND UTILISED FOR INDICATIVE PURPOSES ONLY.

REFERENCE(S)

EXISTING CONTOURS GENERATED FROM INFORMATION PROVIDED BY PEABODY ENERGY PTY LTD ON 8 APRIL 2020 IN FILE: TAILINGS DAM POINTS.dxf

AERIAL IMAGE SHOWN AS RECEIVED ON 02 MAY 2019 FROM WILPINJONG COAL PTY LTD IN FILE: WILP-0287_DSC_PIT_PLAN.pdf

NOT FOR CONSTRUCTION

0 250 500
1:10,000 METRES

CLIENT
PEABODY ENERGY AUSTRALIA PTY. LTD.

PROJECT
WILPINJONG COAL MINE TD6 RISK ASSESSMENT

TITLE
SITE OVERVIEW

CONSULTANT
GOLDER

YYYY-MM-DD	2020-11-23
DESIGNED	DD
PREPARED	PDM
REVIEWED	BPW
APPROVED	BPW

PROJECT NO.	CONTROL	REV.	FIGURE
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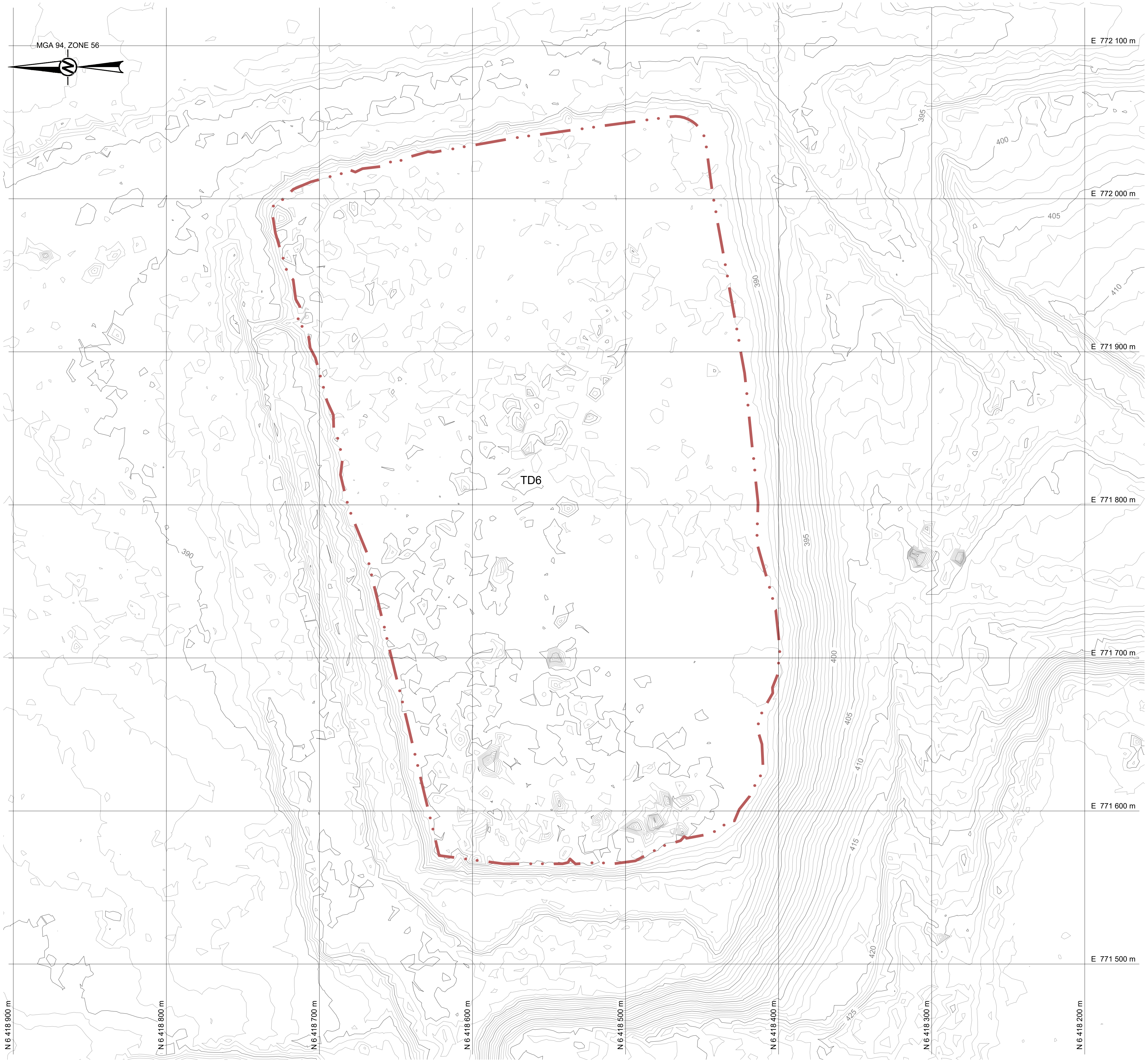
0 25 mm



LEGEND

APRIL 2020 CONTOURS AT 1 m INTERVALS

APPROXIMATE EDGE OF TAILINGS SURFACE

NOTE(S)

1. ALL LEVELS ARE REFERENCED IN METRES TO AUSTRALIAN HEIGHT DATUM (m AHD).

REFERENCE(S)

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NOT FOR CONSTRUCTION

0 50 100

1:2,500 METRES

CLIENT

PEABODY ENERGY AUSTRALIA PTY. LTD.

PROJECT

WILPINJONG COAL MINE TD6 RISK ASSESSMENT

TITLE

SITE CONDITIONS APRIL 2020

CONSULTANT

GOLDER

YYYY-MM-DD	2020-11-23
DESIGNED	DD
PREPARED	PDM
REVIEWED	BPW
APPROVED	BPW

PROJECT NO.	CONTROL	REV.	FIGURE
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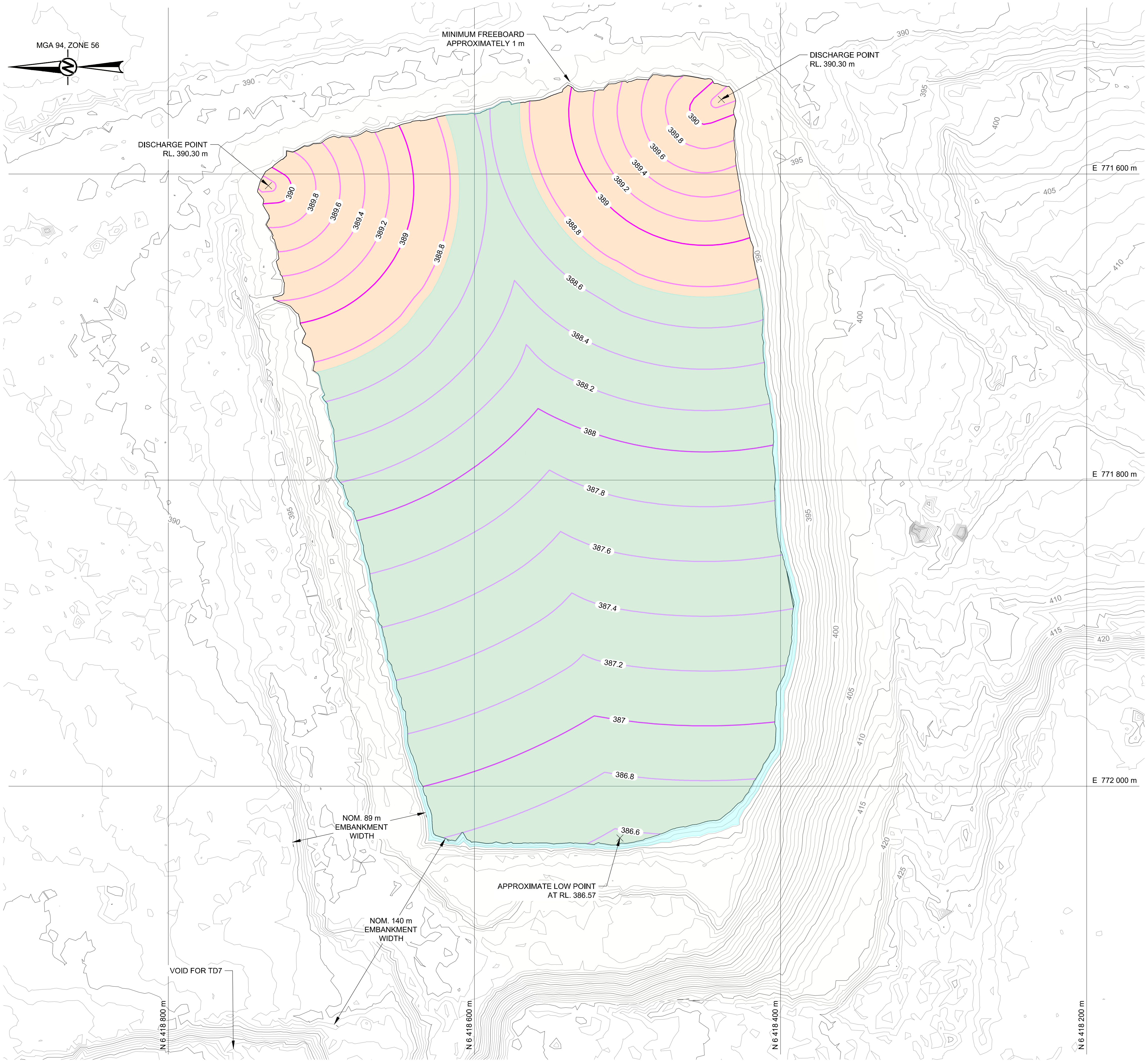

LEGEND

APRIL 2020 CONTOURS AT 1 m INTERVALS

FINAL TAILINGS CONTOURS AT 0.2 m INTERVALS

EXTENT OF WATER STORAGE, (~100,000 cu. m. CAPACITY)

NOTE(S)

1. ALL LEVELS ARE REFERENCED IN METRES TO AUSTRALIAN HEIGHT DATUM (m AHD).

REFERENCE(S)

EXISTING CONTOURS GENERATED FROM INFORMATION PROVIDED BY PEABODY ENERGY PTY LTD ON 8 APRIL 2020 IN FILE: TAILINGS DAM POINTS.dxf

NOT FOR CONSTRUCTION

0 50 100

1:2,500 METRES

CLIENT

PEABODY ENERGY AUSTRALIA PTY. LTD.

PROJECT

WILPINJONG COAL MINE TD6 RISK ASSESSMENT

TITLE

PROPOSED FINAL TAILINGS CONTOURS

CONSULTANT

GOLDER

YYYY-MM-DD	2020-11-23
DESIGNED	DD
PREPARED	PDM
REVIEWED	BPW
APPROVED	BPW

PROJECT NO.	CONTROL	REV.	FIGURE
19129935	010-R	0	3

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3.0 REGULATORY REQUIREMENTS

3.1 NSW Resources Regulator Assessment Outcome document

The NSW Resources Regulator raised specific concerns relating to TSF TD6 in a letter, reference ASMT0009005, dated 5 May 2020 (the letter). These concerns and related risks comprised:

- *'Deficient geochemical characterisation of tailings. RISK - Tailings which have not been adequately characterised for geochemical properties present a risk that the tailing may contain contaminants or have properties that adversely impact the environment if left unmitigated. Tailings can release contaminants through leachate or present a phyto-toxicity risk via transmission to roots of final landuse vegetation. Furthermore, tailings with combustibility potential present a risk for spontaneous combustion or ignition via external sources such as bushfire.*
- *There was a knowledge gap for consideration of long-term settlement risks for the final landform. RISK - Uncertain final landform design presents a risk that long term settlement is not accounted for in the final landform, resulting in deformation (including differential settlement) and impacts to final landform surface water flows, leading to erosion and/or landform depressions impacting the final landuse.*
- *There was a knowledge gap regarding capping design and performance. Limitations were also identified regarding quarantining and management of capping material. RISK - Uncertain capping design and performance presents a risk that the materials used for capping may not be a suitable growth medium (i.e phyto-toxicity) or placed at a suitable thickness to support the final landuse.'*

The regulator required Peabody to take the following actions:

- *'Wilpinjong Coal Pty Limited is required to complete a risk assessment specifically addressing the current operations of the tailings storage facilities and decommissioning / closure requirements, specifically addressing the concerns raised above.*
- *The risk assessment must incorporate input from a suitably qualified expert (or experts) and should be facilitated by an independent tailings expert in accordance with an industry accepted risk assessment framework, such as AS/NZS ISO31000:2018.'*

3.2 Australian National Committee on Large Dams (ANCOLD)

This risk assessment follows the process outlined in Australian Standard AS ISO 31000:2018 'Risk Management Guidelines'. The risk assessment also follows the ANCOLD Guidelines on Risk Assessment, dated October 2003 and related ANCOLD publications to qualitatively identify, analyse and evaluate dam specific risks.

3.3 NSW Dam Safety Regulation 2019

The NSW Dam Safety Regulation (2019) (the Regulation) seeks to apply a risk-based approach to the management of dams, which includes:

- A hazard identification process
- A risk analysis process
- A risk evaluation process; and
- A risk treatment process.

Golder has followed a risk-based approach as per AS31000:2018, which includes a risk-based assessment approach as outlined in the Regulation.

Clause 3 of the Regulation further lists a number of specific risks to be considered, which include:

a) flood events including the contents of the dam rising higher than the wall of the dam and the performance of the spillways,

b) seismic events including the impact of the event on the performance of the dam or the stability of the reservoir rim,

c) internal erosion including the effects this may have on piping through the dam, the foundation of the dam or structures abutting the dam,

d) seepage of the contents of the dam through the wall of the dam,

e) the stability of the dam through all possible conditions,

f) sabotage or vandalism,

g) fire,

h) mechanical, electrical or automated system failure that may result in an uncontrolled release of the contents of the dam, and

i) human factors.

3.4 International Council on Mining and Metals (ICMM) (2019)

Mine closure guidance recommendations are presented in the International Council on Mining and Metals (ICMM): Integrated Mine Closure Good Practice Guide (2019). ICMM recommends the following principles that should be implemented into a mine closure plan, which are also generally applicable to TSF closure:

- Safety – reshape and cover surfaces in a manner to promote physical safety for humans and animals following closure
- Physical stability – to promote stability of the perimeter embankment and internal TSF materials, including tailings and cover soils
- Chemical stability – to prevent adverse effects on the surrounding environment through acid rock drainage and metal leaching (ARD/ML)
- Socioeconomic transition – to provide a beneficial effect to the region surrounding the mine site
- Ecological stability – to ensure that the closure of the mine blends in with the surrounding environment and remains stable and sustainable
- Risk limitation – to control safety, environmental, financial, legal, compliance and social risk to an acceptable level
- Cost-effectiveness – to execute the closure activities cost-effectively and efficiently
- Long-term care – to design the closure plan to minimise or eliminate the need for long-term post-closure care and maintenance.

The ICMM guidance recommendations were included in the risk assessment schedule.

3.5 Proposed rehabilitation and rehabilitation requirements

Requirements for rehabilitation and decommissioning of the Wilpinjong mine site, including the TSFs is outlined in the Mining Operations Plan (MOP) (Peabody 2019) and the Wilpinjong Coal Mine Rehabilitation

Management Plan (RMP) (Peabody 2011). Both the MOP and RMP consider requirements made in the Development Consent (SSD-6764) for the site.

The MOP and RMP stipulate rehabilitation objectives and provide an outline of the proposed rehabilitation measures. The following rehabilitation objectives are applicable to the TSFs:

- Safe, stable and non-polluting
- Final landforms designed to incorporate micro-relief and integrate with surrounding natural landforms and adjacent mine rehabilitation
- Final landforms maximise geotechnical performance, stability and hydrological function
- Constructed landforms maximise surface water drainage to the natural environment (excluding final void catchments)
- Minimise long term groundwater seepage from the site to ensure negligible environmental consequences beyond those predicted for the development, and
- Ensure public safety.

The MOP stipulates that TSFs are rehabilitated using the following procedure:

- Once filling is complete, tailings are left to dry and undergo initial consolidation;
- Following this, the TSFs are progressively capped with inert overburden material to a minimum thickness of 2 m, creating a stable landform ready for final profiling;
- This is followed by applying a 0.1 m to 0.3 m layer of topsoil and revegetation.

The MOP identifies that rehabilitation in the area of TD6 will comprise a final landform gently sloping to the north and north-west. The proposed vegetation type is 'HU824 White Box Shrubby Woodland' as defined in the MOP. Refer to Plate 1 for an approximate location of TD6, proposed rehabilitation contours and an outline of proposed post-rehabilitation vegetation types.

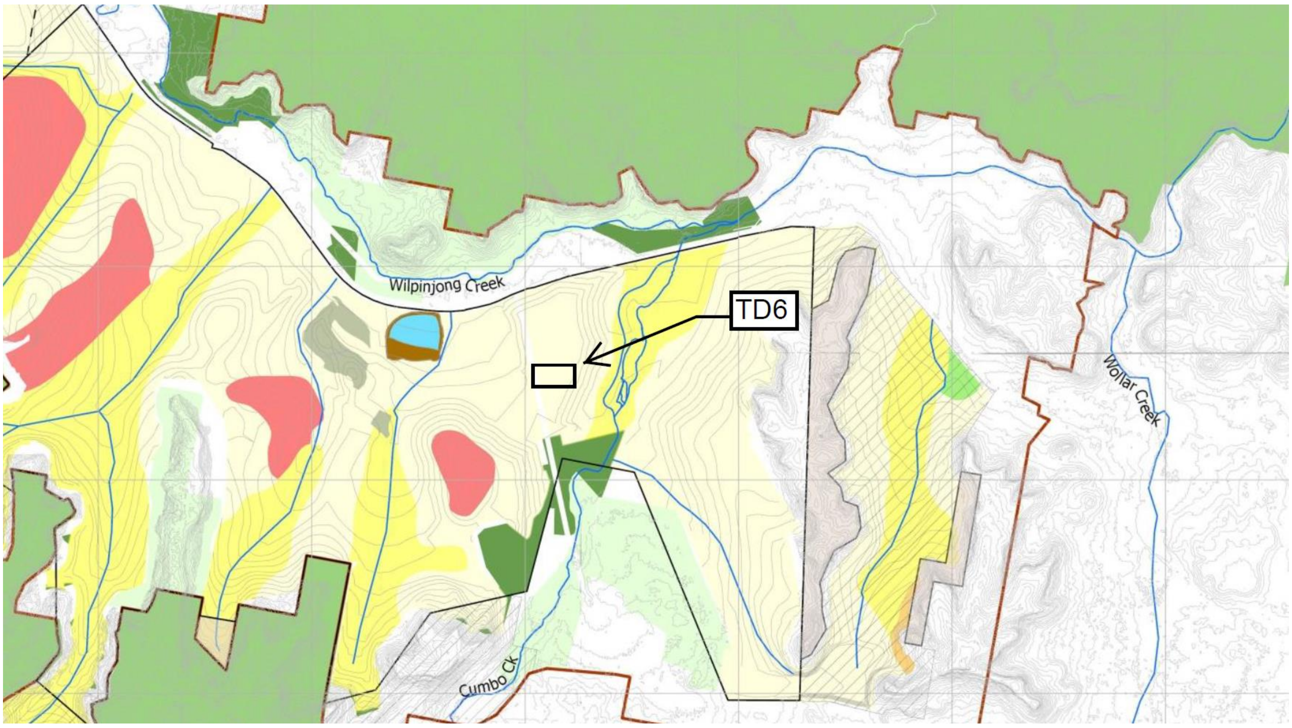

Plate 1 Proposed rehabilitation contours, proposed vegetation types and approximate location of TD6 (WCPL 2019)

Peabody provided Golder with a list of species for vegetation type HU824, which is appended to this report in APPENDIX F. The species include a number of native trees, shrubs and grasses.

4.0 RISK ASSESSMENT

4.1 Methodology

Golder followed the risk assessment process outlined in Australian Standard AS ISO 31000:2018 'Risk Management Guidelines', which includes a number of steps as reproduced in Plate 2.

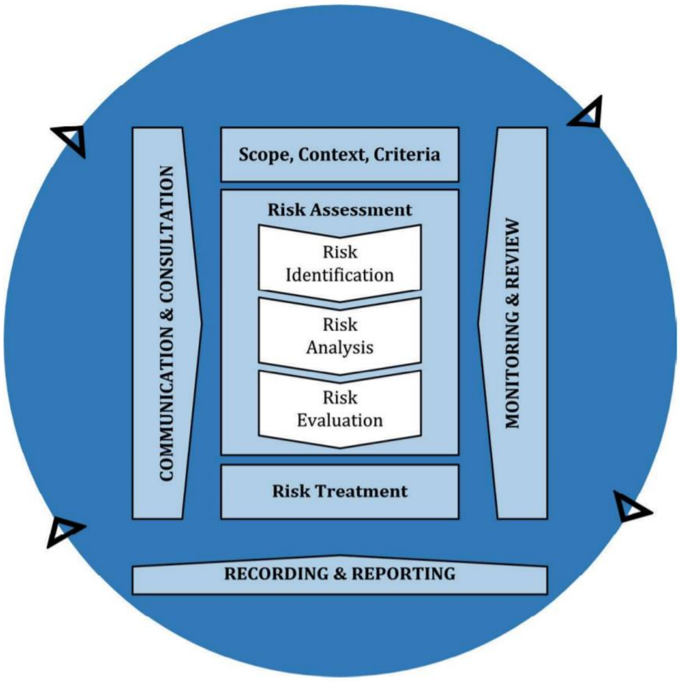

Plate 2: AS 31000:2018 Risk Assessment Process (Standards Australia)

The following tasks were undertaken for each step of the risk assessment process:

- Develop scope context and criteria:
  - Golder developed the scope, context and criteria for this risk assessment in consultation with Peabody and through a review of regulatory guidelines and communication from the regulator
- Risk assessment (identification, analysis and evaluation) and treatment:
  - For dam specific risks, Golder followed the process outlined in ANCOLD (2003) for a qualitative risk assessment;
  - Golder developed a preliminary risk register based on our understanding of the risks pertinent to the site, risks identified by the regulator, the ANCOLD (2003) guidelines and risks identified by Golder in previous assessments (refer Section 2.4);
  - Golder convened a risk workshop with key Peabody employees;
  - In the risk workshop, Golder outlined the rationale behind each identified risk and Peabody provided input on the risk register and potential risk mitigation (treatment) measures. Other potential risks identified by Peabody were also considered;
  - Following the workshop, Golder prepared the qualitative risk assessment including risk mitigation or treatment measures, and submitted a draft copy for review and comment by Peabody;
- Communication and Consultation:
  - Throughout the preparation of this document, Golder consulted extensively with key Peabody staff in phone calls and a risk workshop.
- Monitoring & Review, Recording & Reporting:

- These steps are not part of this risk assessment report but will form some of the recommendations of this report.

For a number of identified risks, Golder carried out more detailed assessments and the results are outlined in this report.

4.2 Risk assessment scope, context and criteria

Golder and Peabody defined the scope of the risk assessment on an online workshop on 30 September 2020 and agreed the risk assessment should relate to the management of tailings in TD6. Peabody also sought input from the regulator on this risk assessment.

The risk assessment scope considered concerns raised by the Regulator, risks stipulated in NSW regulation and ANCOLD and ICMM guidelines and risks identified in the review of existing dam documentation.

Golder and Peabody developed a risk ranking framework using a risk ranking matrix in which scores are assigned for both the likelihood of a risk occurring and expected consequences with regard to the operation, health and safety and/or, environment. To evaluate the risk, the likelihood score and consequence score are multiplied to arrive at a final score, based on which the risks are ranked. Table 1 and

Table 2 present descriptions of the likelihood and consequence ratings and Table 3 the ranking matrix.

Following this, Golder and Peabody developed potential risk mitigation or treatment measures which when implemented would reduce the likelihood score, the consequence score or both.

Table 1: Likelihood ranking

Score	Likelihood	Description
5	Almost Certain	Expected to occur in most circumstances
4	Likely	Will probably occur in most circumstances
3	Possible	Might occur at some time
2	Unlikely	Could occur at some time but is improbable
1	Rare	May occur only in exceptional circumstances

Table 2: Consequence ranking

Score	Conse-quence	Operational / Reputational	Health and Safety	Environmental
5	Severe	Extended site shutdown Regulatory intervention or penalty Severe community impact Reconstruction of portion of the embankments	Fatality(s)	Release of tailings off site Large release of tailings on site Severe impact on groundwater or surface water off site
4	Major	Brief CHPP shutdown Regulatory penalty	Serious injury(s) requiring hospitalisation.	Limited release of tailings contained on site

Score	Conse-quence	Operational / Reputational	Health and Safety	Environmental
		Some community impact Rectification works to embankments	Near miss with potentially severe consequence	Limited impact on groundwater or surface water off site that can be rectified Major release of tailings dust off site Unsuccessful rehabilitation requiring significant rectification
3	Medium	Minor rectification of embankments due to erosion or regrading, Minor community impact	Minor medical treatment or first aid required. Near miss with potentially major consequence	Incident with a potential for release of tailings on site Limited impact on groundwater on site that can be rectified Release of tailings dust contained on site. Rectification of rehabilitation
2	Low	Increased monitoring No community impact	Near miss with potentially medium consequence	Incident with the potential to affect the environment in a limited way.
1	Insignificant	Insignificant additional impact on operations	Unidentified risk	Event with an insignificant impact barely outside the approved operational parameters

The combined risk score are colour coded, with red (scores 12 to 25) indicating an unacceptable risk requiring treatment, yellow (scores 4 to 10) indicating risks requiring monitoring and/or treatment and green (scores 1 to 3) requiring monitoring.

Table 3: Ranking matrix

	Likelihood					
Consequence		Almost Certain	Likely	Possible	Unlikely	Rare
	Severe	25	20	15	10	5
	Major	20	16	12	8	4
	Medium	15	12	9	6	3
	Low	10	8	6	4	2
	Insignificant	5	4	3	2	1

4.3 Risk identification and register

Golder prepared a risk register through a process of review of existing dam design, management and surveillance documentation, consultation with Peabody and the Assessment Outcome document issued by the regulator. Table 4 presents the register and provides a rationale for selecting each risk.

The qualitative risk assessment and combined risk rating is presented in APPENDIX A.

Additional analyses were prepared to respond to issues raised by the NSW Regulator with regard to geochemical, landform settlement and cap design risks. Risks posed by potential dam break were assessed using results from dam break assessment (Refer APPENDIX C).

Table 4: Risk register and risk identification

ID No.	Hazard	Risk	Rationale / risk identification / mitigation
1. General Safety			
1.1	Embankment slopes	Rockfall down steep embankment slopes and injuring ground personnel.	Review of dam surveillance reports and site observations. The downstream TD6 embankments within the proposed TD7 void are considered to be areas where rockfall incidents are possible to occur. ICMM
1.2	Fugitive tailings dust generation (during operation and post-closure)	Risk to human and animal health. Impact to air quality.	Review of dam surveillance reports and site observations. ICMM (2019) requirement for physical stability.
1.3	Unauthorised site access	Unrestricted access to TSF by members of the public or unauthorised staff resulting in injury due to various TSF hazards.	Review of dam surveillance reports and site observations. Workshop with Peabody. Dam Safety Regulation (2019), risk 3(f)
1.4	Spontaneous combustion	Coal or tailings deposits spontaneously combusting leading to local collapse and risk of injury or loss of life or emission of combustion gasses endangering health of human and wildlife. Injury/loss of life and/or impact to air quality.	Workshop with Peabody Dam Safety Regulation (2019), risk 3(g)
1.5	Supernatant water and soft tailings	Vehicles or ground personnel falling from the embankment into the supernatant water pond and/or soft surface tailings and possible injury/loss of life	Review of dam surveillance reports and site observations. Workshop with Peabody. This risk is likely to be present while tailings are uncapped.
1.6	Access roads	Vehicle rollover down embankment slopes	Review of dam surveillance reports and site observations. Workshop with Peabody.

ID No.	Hazard	Risk	Rationale / risk identification / mitigation
			There are access roads adjacent to TD6 to the east and south east of the storage area.
2. TSF Geotechnical Stability			
2.1	Embankment failure due to static or dynamic loading (e.g. earthquake)	Embankment materials becoming liquefied and losing strength, leading to embankment failure and loss of containment/dam break.	Review of design report and surveillance reports. Embankments have been widened significantly to reduce the likelihood of this failure occurring. Dam Safety Regulation (2019), risk 3(b) and (e)
2.2	Wind and water erosion	Erosion scour of the embankments and/or capping systems resulting in a loss of containment/dam break.	Review of design report and surveillance reports. Embankments have been widened significantly to reduce the likelihood of this failure occurring. Dam Safety Regulation (2019), risk 3(a)
2.3	Piping and tunnelling erosion	Piping and tunnelling erosion through embankment resulting in loss of containment and release of tailings water and/or tailings/dam break.	Review of surveillance report and site observations. Dam break assessment. Seepage at the toe of the TD6 embankment was previously observed. Peabody has managed this risk by ceasing deposition of water in TD6 and by installation of rock berms at the toe of the TD6 embankment. Dam Safety Regulation (2019), risk 3(c)
2.4	Embankment overtopping	Water flowing over the embankment crest due to crest settlement and/or very large storm event, leading to erosion scour of the embankment structure resulting in a loss of containment/dam break.	Review of surveillance report, capacity assessments and design report. Dam break assessment. TD6 is designed with freeboard to store runoff from a 1 in 10 000 year Average Recurrence Interval (ARI), 72 hour duration rainfall event. Dam Safety Regulation (2019), risk 3(a)
3. Groundwater and Surface Water – Geochemical/Water Quality			

ID No.	Hazard	Risk	Rationale / risk identification / mitigation
3.1	Contamination of surface and groundwater downstream of the TSF through acid rock drainage and metal leaching (ARD/ML)	Breach of operating/closure licence conditions Risk to human and wildlife health Impact to water supplies for local residents Reputational damage	Review of design report, rehabilitation plan, tailings management strategy and surveillance report. The regulator requested assessment of this risk. The geochemical tailings characterisation study (APPENDIX D) provides an assessment of the geochemical tailings properties. ICMM (2019) requirement for chemical stability
4. Tailings settlement			
4.1	Embankment differential settlement	Cracking of the TSF embankment or caps resulting in erosion or stability failure and loss of containment Grade reversal, ponding or excessive erosion	Review of design report, rehabilitation plan, tailings management strategy and surveillance report. The regulator requested assessment of this risk. ICMM (2019) requirement for physical stability and long-term care. Dam Safety Regulation (2019), risk 3(e)
5. Tailings and Capping Soil Toxicity			
5.1	Tailings exposed following closure of TD6	Fugitive dust loss/contaminated stormwater runoff Risk to human and wildlife health Unhabitable area for flora and fauna	Risk identified in workshop with Peabody. Review of rehabilitation plan and tailings management strategy. The geochemical tailings characterisation study (APPENDIX D) provides an assessment of the geochemical tailings properties. ICMM (2019) requirements for physical and chemical stability.
5.2	Root penetration through capping system	Penetration of cap vegetation roots into the tailings resulting in die-back of vegetation	NSW Regulator requested assessment of this risk. Review of rehabilitation plan/plant species selection.

ID No.	Hazard	Risk	Rationale / risk identification / mitigation
			The geochemical tailings characterisation study (APPENDIX D) provides an assessment of the tailings geochemical properties. ICMM (2019) requirements for physical and ecological stability.
5.3	Suitability and thickness of cover soils	Unsuccessful revegetation	NSW Regulator requested assessment of this risk. Review of rehabilitation plan. ICMM (2019) requirements for ecological stability.
6. Operational risks			
6.1	Damage to tailings delivery pipelines	Release of tailings outside of the TSF and breach of containment barriers leading to contamination of the surrounding environment	Review of surveillance reports and workshop with Peabody. Dam Safety Regulation (2019), risk 3(h)
6.2	Extended belt press filter outage	Consume storage capacity of TD6 prior to the expected filling date.	Review of surveillance reports and workshop with Peabody. Dam Safety Regulation (2019), risk 3(h) and (i)
6.3	Poor communication	Potential hazards not identified or not communicated Management plans not communicated	Review of surveillance reports and workshop with Peabody. Dam Safety Regulation (2019), risk 3(i)
6.4	Regulatory non-compliance	Risks not captured in the risk assessment Monetary fine from regulator and/or operation shutdown while cause of breach is rectified Reputational damage	Workshop with Peabody.
6.5	Excessive water stored in TSF	Embankment instability and increased seepage (internal embankment erosion)	Review of surveillance reports. Dam Safety Regulation (2019), risk 3(e) and (i)

4.4 Tailings geochemical risk

4.4.1 Risk description

Sulphide minerals contained in coal, coarse rejects or tailings may generate acidic and/or metal rich leachate when exposed to water and/or air. Acidified water is generated by the oxidation of sulphides as it migrates through the waste rock or tailings. This process is termed acid metalliferous drainage (AMD) or acid rock drainage and metalliferous leachates (ARD/ML). The generation of AMD is difficult to stop once it starts because it is a process that, if left unchecked, will continue (and may even accelerate) until one or more of the reactants (sulphide minerals, oxygen, water) is exhausted or no longer available for reaction. Whilst the acid generation process can be slowed by consumption of source term buffering agents (e.g. calcium containing carbonates), the process can continue to produce contaminated drainage for decades or even centuries after mining has ceased. AMD on a mining industry-wide basis is a widely recognised risk and potential source of ongoing residual risk and financial liabilities post-closure. At sites where this is a risk, operational and closure activities must be developed to prevent or mitigate AMD (ICMM 2019, INAP 2018). The primary strategy in AMD management is to minimise the exposure of reactive sulphides to air and water.

CDA (2016) defined the TSF failure mode of 'release of contaminated seepage' as a situation in which impoundment geochemistry is incompatible with the downstream environment and a release of contaminated seepage, such as AMD impacted seepage is released to groundwater or surface water. A failure would be defined as the seepage/groundwater geochemistry not meeting regulatory limits for groundwater and surface water due to seepage from the TSF.

4.4.2 Risk analysis

The TSF embankments are designed to allow seepage through the embankment material so that seepage of water from the tailings stored within TD6 to the outside environment is possible. The receiving environment for potential seepage includes the area immediately downgradient of TD6, which comprises TD5 to the north, backfilled portions of the mine pit to the east and west and a portion of the pit not yet backfilled and the location of a potential future TSF (TD7) to the northwest. The mine lease boundary and Wilpinjong Creek is located 1 km to the north and hydraulically downgradient of TD6. The off-site environment, including Wilpinjong Creek and aquifers off site could conceivably be impacted by AMD potentially originating from TD6.

Following the concerns raised by the regulator, Golder prepared a geochemical characterisation of ten tailings samples collected from the CHPP by Peabody (refer APPENDIX D). Tailings screening test (acid base accounting or ABA) results were used to characterise the samples with regard to the potential for acid generation. The results showed 3 samples were potentially acid forming (PAF), 5 samples were non-acid forming (NAF) and two samples were UC (Uncertain).

Based on the preliminary geochemical investigation the risk assessment considers the tailings to be potentially acid forming (PAF). Kinetic geochemical testing on two composite samples is recommended to assess the rate of acid generation to advance the geochemical characterisation of the tailings and the design of the capping system.

The current rehabilitation plan envisages capping of TD6 with a minimum of 2 m of inert cover material to significantly reduce the ingress of oxygen and water into the tailings, thus reducing the potential for AMD to occur and reducing the transport of AMD products off site.

4.4.3 Risk Evaluation

A risk rating of 12 (Unacceptable) was obtained from assessment of the risk of AMD impacting surface water and/or groundwater, on-site and off-site.

4.4.4 Risk mitigation measures

Existing risk mitigation measures comprise:

- Capping of TD6;
- Shaping of the rehabilitated TD6 to shed water and reduce ingress of water into tailings; and
- Minimising storage and inflow of water into TD6.

The following additional risk mitigation measures are recommended:

- Implementation of an ongoing geochemical testing program:
  - If in-pit tailings are not saturated, water quality testing in associated pooled/seepage water to monitor for acidity.
  - Monthly sampling at the CHPP tailings to develop a tailings 'static' screening test database.
  - Monthly sampling should involve testing for total sulfur, chromium reducible sulfur and acid neutralising capacity and should be carried out on six composite samples collected from the CHPP each month. After twelve months, the results should be summarised and interpreted in an annual geochemical report.
- Monitoring of surface water flow from the TSF (where present) for rate or volume, and quality (for example at seepage points downgradient of TD6), both through visual inspection and monitoring in line with Golder (2014) and WCPL (2014c). We note that Peabody has informed Golder that seepage downgradient of TD6 has mostly disappeared. Golder recommends seepage samples be collected on a monthly basis and be analysed for pH, EC, metals and major ions. After twelve months, the results should be summarised and interpreted in the annual geochemical report.
- Sampling and testing of groundwater downstream of the tailings dams for pH, EC, metals and major ions should continue in line with Golder (2014) and WCPL (2014c). The purpose of the monitoring is to assess the potential impact on receiving water systems. If the water balance for the pit remains net negative testing is not required. Any discharge, however, should be recorded and quantified.
- Blending NAF material with the tailings prior to discharge may reduce the risk of acid generation. This requires a reliable source of NAF material to be identified.
- The geochemical characterisation of the tailings should inform a rehabilitation (or closure) plan for TD6.

4.5 Tailings settlement

4.5.1 Risk description

This risk relates to item 4.1 in the risk register.

Tailings are deposited into TD6 as a a low solids density slurry which will then consolidate and gain in strength over time. After decommissioning of the process plant the surface tailings will be subjected to sun drying and evaporation resulting in a surface layer of higher strength than the underlying tailings. Capping of the surface can only commence when the shear strength of the surface tailings is sufficient to allow access by earthmoving equipment. The load applied by the planned 2 m thickness of capping material will result in further consolidation of the underlying tailings and settlement of the tailings surface. Settlement will be larger in areas with greater tailings thickness. The TD6 rock foundation and the TD6 embankments constructed of waste rock are not expected undergo further settlement. During operation and prior to capping the tailings surface will settle non-uniformly due to self-weight consolidation resulting in depressions forming in areas

where the tailings thickness is greatest and local ponding of stormwater. The cap design will take account of the expected long-term settlement of the tailings so as to maintain shedding of stormwater from the surface.
Risk Analysis

A high-level one-dimensional settlement analysis was undertaken for coal tailings deposited in TD6. Golder used one-dimensional consolidation equations for both primary and secondary settlement estimation. Three cross sections (i.e. A-A', B-B' and C-C') were considered to estimate the coal tailing settlement in TD6 as shown in Plate 3 . The assessments are presented in spreadsheets attached in APPENDIX B.

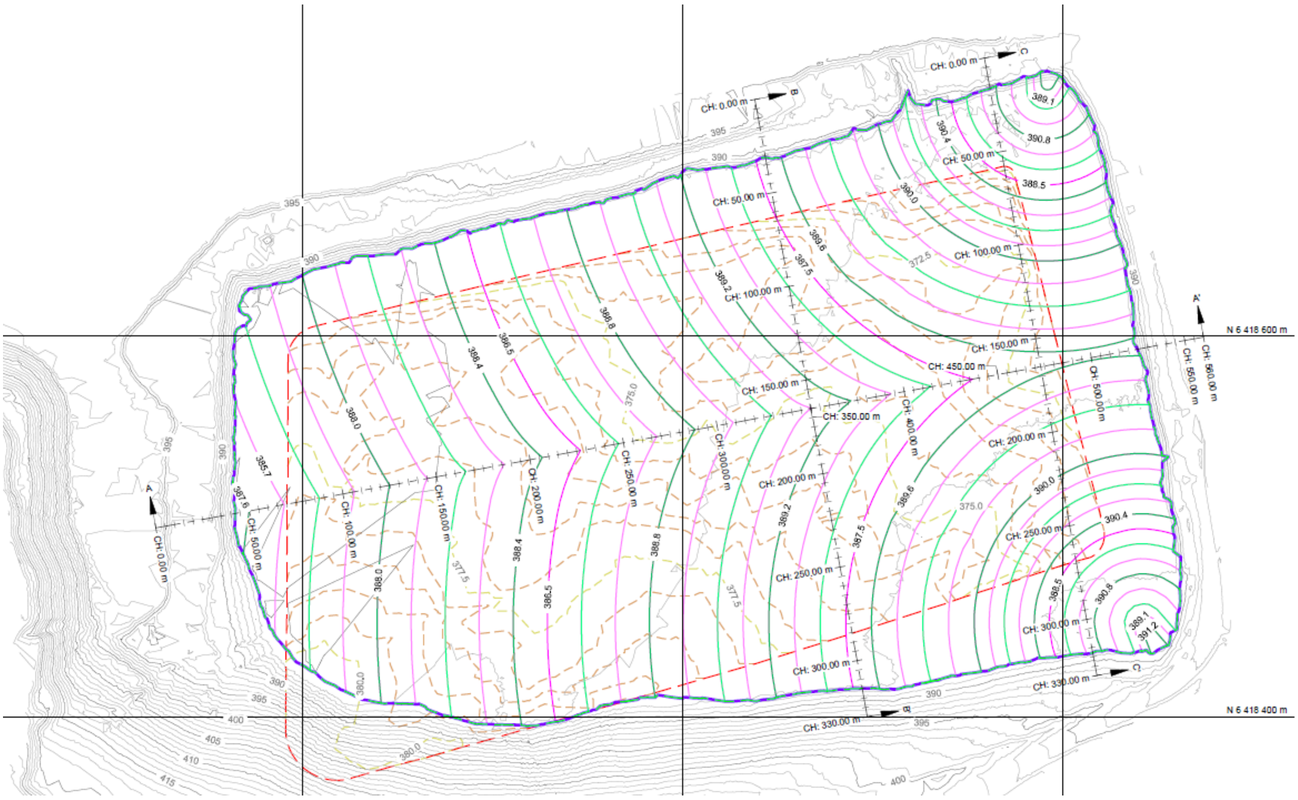

Plate 3: Cross sections (A-A', B-B' and C-C') through TD6 for settlement estimation

Golder estimated the tailings thickness in TD6 by comparing the proposed tailing beach contours (refer: 19129935-006-M-Rev0, dated 29 July 2020, Option 2) with the inferred base of TD6 as reported in the ATC Williams design report, 106021R18 Rev1, dated August 2013 to estimate the tailings thickness in the TSF. The base of the TSF foundation is assumed to be impermeable and non-compressible bedrock. Foundation settlement was therefore assumed to be negligible. Total tailing depth was divided into several layers of ≤5 m thickness for estimation of settlement.

For this model, Golder made the following assumptions:

- For estimation of primary consolidation, the tailings are assumed to have undergone initial settlement and drying. The assumption is based on how TD6 is operated, which involves intermittent filling with tailings over many years, followed by air-drying before covering.
- Settled tailings dry density was assumed to be 0.785 t/m^3 (refer: 178584-005-R-Rev1, dated July 2019).

- Vertical stress was estimated at layer mid-height and incremental stress was assumed to be equivalent to 2 m of inert cover soil (i.e. 40 kPa) above proposed final tailings level. Additional cover would increase the vertical stress and resulting settlement.
- Golder selected a primary compression index (C_c) of 0.278 based on research by Yu (2015). A similar value was obtained using a formula presented by Terzhaghi and Peck (1967).
- Golder estimated the tailings void ratio using relationships proposed by Gassner (1997) and Busch et al. (1975).

Secondary consolidation (creep) settlement was estimated using the relationship proposed by Fox (2003) and a secondary compression index relationship proposed by Bhanbhro et al. (2015) for fine tailings. The estimation is presented in APPENDIX B.

Pre capping and long term post capping tailings thickness (depth) profiles for sections A-A', B-B' and C-C' is presented in Plate 4. These show maximum estimated settlements of the capped landform ranged from 0.68 m to 0.77 m (Table 5).

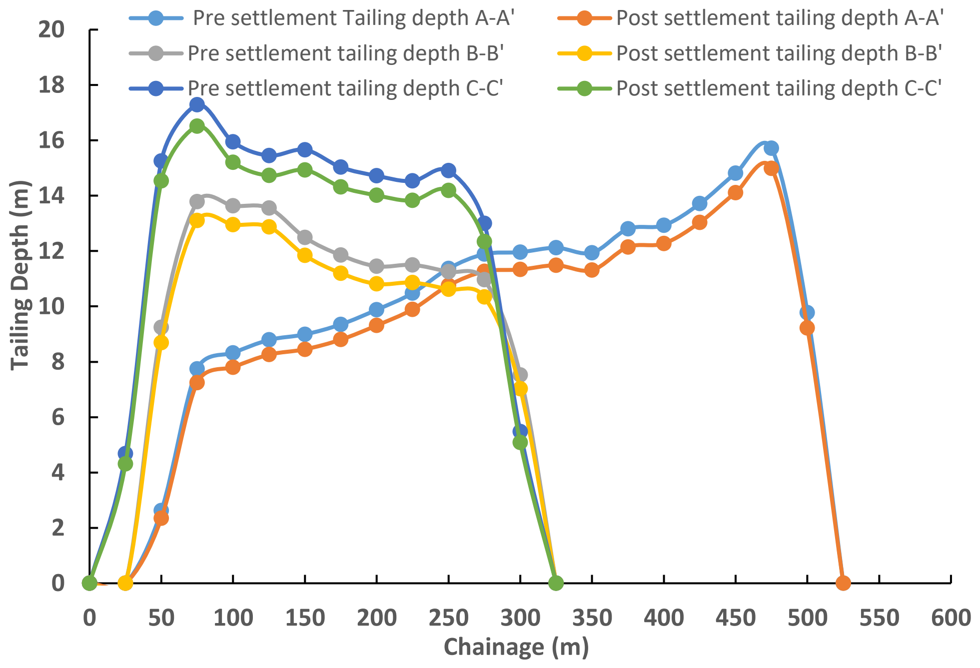

Plate 4: Depth of tailing before and after settlement for cross section A-A', B-B' and C-C'

Table 5: Maximum estimated tailing settlement

Cross sections	Maximum settlement (m)	Chainage at maximum settlement (m)
A-A'	0.72	475
B-B'	0.68	75, 100, 125
C-C'	0.77	75

The maximum differential settlement between the embankment crest and the capped landform is 0.77 m over a distance of 75 m (cross-section C-C) which is a gradient of approximately 1%.

4.5.2 Risk Evaluation

A risk rating of 9 (risk requiring monitoring and/or treatment) was obtained from the risk assessment.

4.5.3 Risk treatment measures

Based on this assessment, Golder recommends the following risk treatment measures:

1) To account for potential differential settlement and to maximise stormwater flow from the rehabilitated TD6 surface, Peabody should prepare:

    a. A TD6 Closure plan integrated with the site wide closure plan;

    b. A final landform design accounting for settlement due to final cover soil thickness and be inclusive of drainage design. This should be based on an iterative cap thickness/settlement analysis to estimate the minimum surface gradient and would preferentially result in a final cap shedding to the west, parallel to the fall of the tailings beach to minimise the volume of capping materials.

    c. As-built report of the constructed cap;

    d. Management, monitoring and maintenance plan for the rehabilitated surface, inclusive of measures to remediate areas of excessive settlement and ponding.

2) The settlement assessment is based on several assumptions as outlined in this report. Actual settlement may differ should tailings properties vary from the assumptions made. Should Peabody wish to refine the assumptions, consolidation tests on tailings samples from the site could be carried out.

Once the risk treatment measures 1 and 2 are applied Golder considers the likelihood score will reduce to 1, the consequence ranking will not change, and the resulting risk score is 4.

4.6 Capping design and performance

4.6.1 Risk description

This risk relates to risks 5.2 and 5.3 in the risk register.

As outlined in Section 3.5, rehabilitation of TSFs comprises placement of a minimum of 2 m inter cover material sourced on site, prior to grading to achieve the final landform, followed by placement of 0.1 m to 0.3 m of topsoil. This is followed by revegetation with a mix of tree, shrub and grass species.

The regulator raised concerns that the materials used for capping may not be a suitable growth medium and may exhibit phyto-toxic properties or are not placed at a suitable thickness to support the proposed plant species, resulting in unsuccessful re-vegetation.

4.6.2 Risk Analysis

Peabody informed Golder that an analysis of soil used in rehabilitation is carried out on an annual basis to assess whether soil is suitable as a growth medium for the species proposed and that soil is ameliorated, where required, to suit the proposed species. A report providing an assessment of rehabilitation soil proposed for use in 2020 is provided in APPENDIX E.

Peabody have indicated that If the cover soils and subsoils will be selected based on test results assessed by an experienced rehabilitation professional and approved by the regulator, the risk of unsuccessful capping vegetation is low.

Similarly the rehabilitation specialist would select plant species that have shallow root systems which remain in the cap soil or that are sustainable in the tailings. Experience gained from successful rehabilitation of existing TSFs such as TD1 and TD2 and other rehabilitated areas of the mine, should inform the vegetation selection. On site plot trials may be initiated post decommissioning and prior to capping to confirm the suitability of the selected species.

Golder considers that a capping design should be provided as part of a detailed rehabilitation plan for TD6 accounting for landform settlement, drainage and geochemical tailings properties.

4.6.3 Risk Evaluation

Assuming input from an experienced rehabilitation specialist in selecting plant species the risk assessment indicates a low risk of unsuccessful capping vegetation and a risk rating of 8 (Requires monitoring or treatment).

4.6.4 Risk treatment measures

With regards to this risk, we recommend that:

- Soil analyses be carried out for cover soil proposed for the rehabilitation of TD6, as is currently the case for all rehabilitation areas. This analysis should be carried out prior to use of soil for rehabilitation of TD6.
- Peabody should assess whether existing TSFs such as TD1 and TD2 have been successfully revegetated and should prepare a report outlining revegetation success and capping thickness.

The cap thickness should be audited during remediation of TD6 to ensure minimum cap soil thicknesses are achieved. Following implementation of the risk treatment measures, the likelihood score can be reduced to 1 (rare), resulting in an overall risk score of 4.

4.7 Operating Geotechnical and Dam break risks

4.7.1 Risk description

The low solids density tailings contained in TD6 has a very low dry density and consequently will also have a very low undrained shear strength. The tailings is contained by embankments founded on the Pit 2 floor and constructed of waste rock and with a soil cover over the upstream slope. The crest widths of the embankments are between 60 to 70 m wide The tailings surface ranges in elevation from about 390 m a short distance from the point of discharge to about 388 m adjacent to the supernatant pond. The minimum crest elevation varies from about 390 m on the eastern embankment to about 391 on the western embankment.

There are several possible failure modes for embankment dams, the most common ones being overtopping, piping, foundation and liquefaction failure. A short description of them is provided below:

- Overtopping Failure is typically the result of either an extreme storm event or a landslide within the impoundment. The flow of water over the embankment causes erosion of the downstream embankment slope material and leads towards a breach. Overtopping failure can also be caused during less extreme storm events after a loss of freeboard due to either a seismic event, spillway blockage or operating the dam at levels greater than the maximum design operating level.
- Piping Failure is typically triggered by seepage flows concentrated along a path of high hydraulic conductivity. These seepage paths can be caused by cracking, combustion, animal activity, high hydraulic gradients or relict structures in the foundation materials. The shear forces exerted by the escaping water could enlarge the seepage path until a portion of the embankment collapses, resulting in a breach through overtopping and erosion of the caved area. A piping failure event may occur at any time and not be a direct result of a storm event.

- Foundation Failure is typically the result of poor/low foundation permeability which leads to an increase in pore pressure. Failure potential is greater at locations where ponded water exists against an embankment face. Foundation failure can also occur due to instability of the underlying foundation due to low shear strength foundation materials

  The TD6 foundation is understood to comprise bedrock and foundation failure is therefore considered to be an unlikely dam break failure mode.

Liquefaction Failure is the substantial loss of strength and stiffness of saturated or partially saturated materials. Whilst the tailings in TD6 most likely will be susceptible to liquefaction during large earthquake events the free draining embankment waste rock will not be susceptible to liquefaction.

Diagrams showing for overtopping and piping failure development is provided in Plate 5.

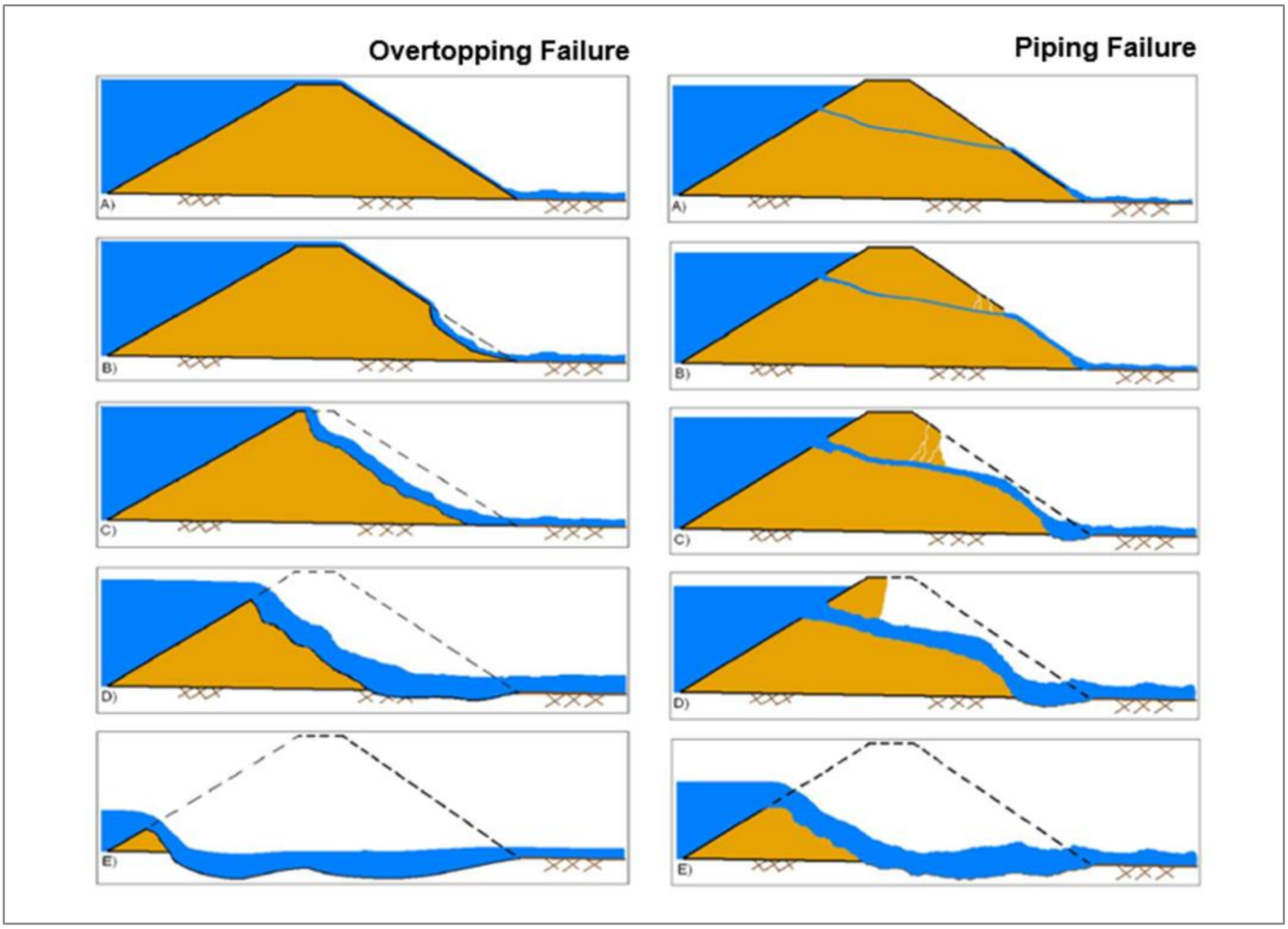

Plate 5: Overtopping and Piping Failure Configuration (US Army Corps of Engineers 2014)

4.7.2 Risk Analysis

The perimeter embankments are about 20 m high and more than 60 m wide at the crest and are founded on the Pit 2 floor. They are very robust structures and will have high factors of safety against geotechnical risks such as slope failure and piping or tunnel erosion and a very low likelihood of failure.

The intermittent deposition of slurry at low tonnages and evaporation or seepage of supernatant water means that the likelihood of overtopping the embankment crests is low.

Golder prepared a dam break assessment (Golder 2019), which is presented in APPENDIX C. The dam break assessment assumes that water or tailings and water is released from the TSF and only models the consequence of the failure. The assessment does not consider the likelihood of failure.

Several breach scenarios were considered in the assessment, as summarised in Table 6. It has conservatively been assumed that all scenarios consist of the initial pond water level being at spill level of the TSF, i.e. lowest embankment crest elevation. The adopted breach locations and associated scenarios listed in Table 6

Table 6: Summary of considered failure scenarios for TD6

Scenario	Breach Location	Failure Mechanism	Weather Conditions	Ponded Water
1	South-East Corner	Piping	Sunny Day	Spill Level
2	Eastern Embankment	Overtopping	Flood Day	Spill Level
3	North-West Corner	Piping	Sunny Day	Spill Level

.

The outcomes of the assessment showed the largest incremental increase in inundation due to a dam failure occurred in Scenario 1. Scenario 1 is therefore considered to be the critical scenario in terms of inundation extent and potential impact. Key outcomes are summarised below for each assessed scenario.

Scenario 1 (South-East Corner; Piping Failure):

- Largest inundation extent with outflow travelling eastward. Downstream infrastructure, including roads and mine haul roads are impacted, with the outflow reaching the downstream watercourse, Cumbo Creek.

Scenario 2 (East; Overtopping Failure):

- Relatively small inundation extent compared to background flood extent, and therefore smallest incremental increase in inundation of the assessed scenarios.
- Outflows travels north and south from the breach point, then travels east along an existing mine haul road before entering the downstream watercourse, Cumbo Creek. Negligible increase in inundation was observed within Cumbo Creek.

Scenario 3 (North-West Corner; Piping Failure):

- Following release, outflows travel north as shallow flows and enter the proposed location for TD7. The area is overtopped and spills continue to Pit 2 West Dam, where it is contained within the site.

4.7.3 Risk Evaluation

Regular dam surveillance inspections (Golder 2014, 2015, 2016, 2017, 2019, 2020) indicate that TD6 complied with the requirements of ANCOLD (2003). The physical configuration of the embankments and the foundation conditions makes the likelihood of geotechnical failure of the embankments rare. The risk assessment identified the consequence of a failure leading to dam break ranging from medium to severe resulting in risk ratings of 3 (Monitoring) or 5 (Monitoring and/or treatment).

The cap surface will most probably grade to the west, following the current beach slope and also discharging stormwater over the western embankment and onto the TD7 site and then into the Pit 2 west dam, as modelled in Scenario 3 above. Post closure stormwater will therefore be discharged onto the mine area where it can be collected and discharged off site, if necessary, in a controlled manner.

4.7.4 Risk Treatment Measures

Existing risk treatment measures include, amongst others:

- Operation of TD6 under an operations manual and a dam safety emergency plan (Golder 2015);
- Regular inspections of the TSF by Peabody staff;
- Annual dam safety surveillance inspection by a suitably qualified external consultant;
- Vibration monitoring when blasting occurred in the vicinity of TD6 (blasting in the vicinity of TD6 has now ceased);
- Regular aerial surveys; and
- Inspections of embankment toes for seepage.

We consider the existing risk treatment measures are suitable to control dam break risks for TD6. To further reduce the risk ranking, Peabody could construct a spillway to reduce the consequence of embankment overtopping failure.

4.8 Risk assessment summary

The risk assessment summary is presented in APPENDIX A together with the proposed risk treatment measures and additional commentary. Once treatment measures are applied, the remaining risk ratings are below 5, with the exception of:

- Risk 3.1 ‘Contamination of surface and groundwater downstream of the TSF through acid rock drainage and metal leaching (ARD/ML)’ with a remaining risk rating of 8 (Monitoring).; and

Golder notes that ranking for risk 3.1 is elevated due to uncertainty in the tailings geochemical classification as a result of heterogeneity in the samples collected to date and is expected to change once uncertainty around geochemical classification of tailings is reduced.

4.9 Monitoring and Review

This risk assessment, including risk register provided in APPENDIX A should be reviewed and updated every two years and should be considered in the preparation of updated operations and maintenance manuals as well as annual surveillance reports.

5.0 CLOSURE

Please do not hesitate to contact the undersigned should you have any queries regarding this document.

6.0 REFERENCES

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Signature Page

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https://golderassociates.sharepoint.com/sites/115081/project files/6 deliverables/010-r risk assessment/rev0/19129935-010-r-rev0.docx

APPENDIX A

Risk Register and Assessment

ID No.	Hazard	Risk	Original risk rating			Proposed control / mitigation measures	Residual risk rating			Comments on residual risk rating
			Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	
1. General Safety										
1.1	Embankment slopes	Rockfall down steep embankment slopes and injuring ground personnel.	2	4	8	Ground personnel to avoid toes of downstream embankment slopes. Signage and restriction of access to TSF and surrounds.	1	3	3	Isolation of ground personnel from the toe of embankment slopes reduces likelihood of injury.
1.2	Tailings dust generation (during operation and post-closure)	Risk to human and animal health. Impact to air quality.	4	2	8	Dust monitoring to be continued during operation. Cover soil and vegetation included as part of the closure plan.	2	2	4	Proposed controls will reduce potential for dust to become airborne
1.3	Unauthorised site access	Unrestricted access to TSF by members of the public or unauthorised staff resulting in injury due to various TSF hazards.	2	4	8	Control entry points to site during operation. Signage around the extents of TD6 during operation and following closure. Existing bunding around TD6.	1	4	4	Strict protocols reduces likelihood of unauthorised or inadvertent access to site
1.4	Spontaneous combustion	Coal or tailings deposits spontaneously combusting leading to local collapse and risk of injury or loss of life or emission of combustion gasses endangering health of human and wildlife. Injury/loss of life and/or impact to air quality.	2	4	8	Follow spontaneous combustion management plan. Check for signs of spontaneous combustion as part of the weekly inspection check. A capping system will be provided by Peabody and reviewed by Golder to create a low permeability capping system to reduce infiltration of oxygen.	1	3	3	Inspections will allow for combustion to be identified and managed to avoid an uncontrolled fire that may pose a significant risk to human and wildlife health
1.5	Supernatant water and soft tailings	Vehicles or ground personnel falling from the embankment into the supernatant water pond and/or soft surface tailings and possible injury/loss of life	2	5	10	No vehicles or ground personnel to access tailings surface. Bunds, safety barriers and signage. Limit access to TSF.	1	4	4	Isolation of vehicles and ground personnel from the tailings surface reduces likelihood of entrapment
1.6	Access roads	Vehicle rollover down embankment slopes	2	3	6	Safety barriers to be maintained at the edges of access roads surrounding the TSF. Signage indicating prohibited areas for vehicles to be maintained. Controlled park-up area with signage.	1	3	3	Creating separation of vehicles from the edges of access roads reduces likelihood of vehicle rollover. Consider not placing access trcks adjacent to batters.
2. TSF Geotechnical Stability										
2.1	Embankment failure due to static or dynamic loading (e.g. earthquake)	Embankment materials becoming liquefied and losing strength, leading to embankment failure and loss of containment/dam break.	1	4	4	Continue routine inspection of embankment.	1	4	4	Routine inspections and geotechnical investigations will allow early identification of potentially unstable embankment areas that may pose a risk of loss of containment
2.2	Wind and water erosion	Erosion scour of the embankments and/or capping systems resulting in a loss of containment/dam break.	2	3	6	Vegetation included in the closure plan for TD6. Proposed filling downstream of TD6 end of mine life.	1	3	3	Early identification of erosion scour will result in minor rectifications of embankments
2.3	Piping and tunnelling erosion	Piping and tunnelling erosion through embankment resulting in loss of containment and release of tailings water and/or tailings/dam break.	1	4	4	Continue routine inspection of embankment seepage to be carried out on a regular basis by appropriately trained and experienced personnel. Check on an annual basis whether dam break assessment required updating (to be included in the surveillance report).	1	4	4	Early identification of erosion scour will result in minor rectifications of embankments
2.4	Embankment overtopping	Water flowing over the embankment crest due to crest settlement and/or very large storm event, leading to erosion scour of the embankment structure resulting in a loss of containment/dam break.	2	3	6	Water and tailings level in TD6 continued to be surveyed on a regular basis. Design freeboard of 500 mm to be monitored as part of the weekly inspection.	1	3	3	Monitoring of freeboard allows capacity for storm events in the TSF, resulting in embankment overtopping to be very unlikely
3. Groundwater and Surface Water – Geochemical/Water Quality										
3.1	Contamination of surface and groundwater downstream of the TSF through acid rock drainage and metal leaching (ARD/ML)	Breach of operating/closure licence conditions Risk to human and wildlife health Impact to water supplies Reputational damage	3	4	12	Incorporation of geochemical data in to closure and capping plan Groundwater monitoring, Spoil bore in Pit 4 rehabilitation area Further geochemical tailings characterisation to advance to statistically relevant level of data. Monitornig of seepage (if present)	2	4	8	Isolating tailings from human and surrounding environment through capping works reduces potential for damage. Geochemical tailings characterisation used to classify the tailings
4. Tailings settlement										
4.1	Tailings differential settlement	Grade reversal, ponding or excessive erosion	3	3	9	Detailed closure plan including landform, capping and stormwater design. Iterative tailings settlement study on final design to estimate ranges of anticipated settlement. Surface monitoring of the rehabilitated surface to be undertaken.	2	2	4	Comparing surface monitoring to predicted settlement will allow a early response to potential instability and reduce the risk of loss of containment
5. Tailings and Soil Toxicity										
5.1	Tailings left exposed following closure of TD6	Fugitive dust loss/contaminated stormwater runoff Risk to human and wildlife health Unhabitable area for flora and fauna	2	4	8	Closure plan includes a cover system and vegetation plan. Closure plan to be reviewed prior to closure works commencing. Sufficient thickness of inert soils allowed for tailings cover. Survey to be undertaken of final tailings surface and top of capping layer to measure thickness of cover soils.	1	3	3	Isolation of tailings from the surrounding environment. Capping layers to provide habitat for local environment as per closure plan
5.2	Root penetration through capping system	Penetration of cap vegetation roots into the tailings resulting in die-back of vegetation	2	4	8	Capping thickness in accordance with the Closure Plan. Peabody should assess whether existing TSFs such as TD1 and TD2 have been successfully revegetated and should prepare a report outlining revegetation success and capping thickness.	1	3	3	Peabody should assess whether existing TSFs such as TD1 and TD2 have been successfully revegetated and should prepare a report outlining revegetation success and capping thickness.
5.3	Suitability of cover soils	Unsuccessful revegetation	2	4	8	Rehabilitation soil analyses be carried out for cover soil used in the future rehabilitation of TD6 as is currently the case for all rehabilitation areas. This analysis should be carried out prior to use of soil for rehabilitation of TD6. Use of existing and tested natural material Refer to closure plan	1	3	3	Assess cover soil to increase confidence in successful revegetation
6. Operational risks										
6.1	Damage to tailings delivery pipelines	Release of tailings outside of the TSF and breach of containment barriers leading to contamination of the surrounding environment	2	3	6	Routine inspection of tailings delivery pipelines to be carried out on a regular basis by appropriately trained and experienced personnel. Daily inspections of pipe conditions. Pipe buried. Assessment of pipe corridor for potential flow directions.	2	2	4	Inspections of pipeline will allow early identification of damage, reducing the likelihood and impact of contamination. Pipe corridor may be aligned based on minimal impact to surrounding environment and/or to be bunded.
6.2	Extended belt press filter outage	Consume capacity of TD6 prior to the expected filling date.	2	4	8	Provide additional storage in new TSF or expand TD6.	1	2	2	Additional storage reduces likelihood of site shutdown
6.3	Poor communication	Potential hazards not identified or not communicated Management plans not communicated	3	4	12	Regular meetings and clear assignment of tasks	1	3	3	Regular meetings creates personnel accountability and reduces likelihood of risks being mismanaged or not identified
6.4	Regulatory non-compliance	Risks not captured in the risk assessment Monetary fine from regulator and/or operation shutdown while cause of breach is rectified Reputational damage	3	4	12	Open communication lines with regulator regarding scope of risk assessment. Clear communication of requirements with all parties.	2	3	6	Clear and open communication allows all personnel to understand requirements and reduces likelihood of risks not being identified
6.5	Excessive water stored in TSF	Increased seepage (internal embankment erosion)	2	4	8	No water to be stored in TSF permanently Regular inspections Set criteria for what constitutes excessive water	1	3	3	Regular inspections allows for identification of excessive water before seepage occurs and reduces likelihood of internal embankment erosion. Potential minor rectification works only

APPENDIX B

Settlement Estimation Spreadsheets

19129935 Wilpinjong Settlement Estimation

EXISTING COAL TAILING SETTLEMENT ESTIMATION

Section A-A'

TABLE A1

Tailing Materials					Basis of adopted value	
Material	Coal Tailing					
waste type	Layer 1	Layer 2	Layer 3			
Dry Unit Weight (kN/m3)	7.85	7.85	7.85		from 1784584-005-R-Rev1, dated July 2019	
Void ratio, e_0	0.94881	0.87607	0.8523		estimated using e=-0.01320log(σ')²-0.0795(σ')+1.056	Gassner, 1997
C_c (primary)	0.278	0.278	0.278		From Hao Yu, 2015	
C_α (secondary)	0.0089	0.0089	0.0089		estimated using $C_\alpha = 0.032\ C_c$	from Bhanbhro et al. 2015 for fine tailings
average age in mid 2020(yr)	2	4	5		assumed from available site information	

2.1 SHORT-TERM "PRIMARY CONSOLIDATION"

$$S_p = \frac{C_c H}{1+e_0} \log\left(\frac{\sigma_0' + \Delta\sigma'}{\sigma_0'}\right)$$

C_c primary compression index

Assumptions

use Sigma-0 = current vertical stress at layer midpoint

use delta-sigma = vertical stress increase from top of coal tailing (2 m inert soil cap)

sume unit weight of inert cover soil as cap (kPa) 20

2.2 LONG-TERM "SECONDARY CONSOLIDATION"

Consolidation and Settlement Analysis, Equation 19.28, Civil Engineering Handbook Patrick J. Fox, CRC Press LLC, 2003

$$S_s = \frac{C_\alpha H_o}{1 + e_o} \log \frac{t_f}{t_p}$$

C_α- secondary compression index

Assumptions

use t-initial= average age in Oct 2020

use t-final= t-initial plus 50 years

t initial = starting time of the secondary settlement. Assumed to be equal to the age of the existing tailing dam for vertical expansion.

t final = ending time of the secondary settlement

Coal tailing assumed to be normally consolidated and drain from one side only as base contains bedrock.

2.1 Short-Term "Primary" Settlement of Liner

Point	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Chainage (m)	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525
Thickness of coal Tainings Filling (m)																						
Capping Layer (m)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total thickness of Coal Tailings	0	0	2.62	7.74	8.32	8.79	8.99	9.35	9.88	10.48	11.37	11.89	11.96	12.12	11.94	12.8	12.93	13.71	14.81	15.71	9.78	0
Thickness of layer 1 (top layer)	0.00	0.00	2.62	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00
Sigma-0 (kN/m2)	NA	NA	10.28	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.26	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.00
Thickness of Layer 2	0.00	0.00	0.00	2.74	3.32	3.79	3.99	4.35	4.88	5.48	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.78	0.00
Sigma-0 (kN/m2)	NA	NA	NA	50.00	52.28	54.13	54.91	56.32	58.40	60.76	58.88	58.88	58.88	58.88	58.88	58.88	58.88	58.88	58.88	58.88	58.01	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.10	0.12	0.13	0.14	0.15	0.16	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.16	0.00
Thickness of layer 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	1.89	1.96	2.12	1.94	2.80	2.93	3.71	4.81	5.71	0.00	0.00
Sigma-0 (kN/m2)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	83.88	85.92	86.19	86.82	86.11	89.49	90.00	93.06	97.38	100.91	NA	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.05	0.05	0.05	0.05	0.07	0.07	0.09	0.11	0.12	0.00	0.00
Total "Primary" settlement (m)	0.00	0.00	0.26	0.45	0.47	0.48	0.48	0.49	0.51	0.52	0.55	0.56	0.56	0.56	0.56	0.58	0.58	0.60	0.62	0.64	0.51	0.00

2.2 Long-Term "Secondary" Settlement of Liner

Point	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Chainage	0	25	50	75	100	125	150	175	200	225	250	275	300	325	350	375	400	425	450	475	500	525
Total Thickness	0.00	0.00	2.62	7.74	8.32	8.79	8.99	9.35	9.88	10.48	11.37	11.89	11.96	12.12	11.94	12.80	12.93	13.71	14.81	15.71	9.78	0.00
Thickness Layer 1 (Top)	0.00	0.00	2.62	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00
T-initial (yr)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
T-final (yr)	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
Calc settlement of layer (m)	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00
Thickness Layer 2	0.00	0.00	0.00	2.74	3.32	3.79	3.99	4.35	4.88	5.48	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.78	0.00
T-initial (yr)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
T-final (yr)	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00
Thickness Layer 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	1.89	1.96	2.12	1.94	2.80	2.93	3.71	4.81	5.71	0.00	0.00
T-initial (yr)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
T-final (yr)	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.00	0.00
Total "Secondary" settlement(m)	**0.00**	**0.00**	**0.02**	**0.05**	**0.05**	**0.05**	**0.05**	**0.06**	**0.06**	**0.06**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.07**	**0.08**	**0.08**	**0.09**	**0.06**	**0.00**

Settlement of bedrock is negligible.

Sum of calculated "Primary" and "Secondary" settlement (m)	0.00	0.00	0.27	0.49	0.52	0.53	0.54	0.55	0.57	0.58	0.61	0.63	0.63	0.63	0.63	0.65	0.66	0.68	0.70	0.72	0.56	0.00

19129935 Wilpinjong Settlement Estimation

EXISTING COAL TAILING SETTLEMENT ESTIMATION

Section B-B'

TABLE A1

Tailing Materials				Basis of adopted value	
Material	Coal Tailing				
waste type	Layer 1	Layer 2	Layer 3		
Dry Unit Weight (kN/m3)	7.85	7.85	7.85	from 1784584-005-R-Rev1, dated July 2019	
Void ratio, e_0	0.91909	0.86856	0.8477	estimated using e=-0.01320log(σ')²-0.0795(σ')+1.056	Gassner, 1997
C_c (primary)	0.278	0.278	0.278	From Hao Yu, 2015	
C_α (secondary)	0.0089	0.0089	0.00890	estimated using C_α = 0.032 C_c	from Bhanbhro et al. 2015 for fine tailings
average age in mid 2020(yr)	2	4	5	assumed from available site information	

2.1 SHORT-TERM "PRIMARY CONSOLIDATION"

$$S_p = \frac{C_c H}{1+e_0} \log\left(\frac{\sigma_0' + \Delta\sigma'}{\sigma_0'}\right)$$

C_c primary compression index

Assumptions

use Sigma-0 = current vertical stress at layer midpoint

use delta-sigma = vertical stress increase from top of coal tailing (2 m inert soil cap)

sume unit weight of inert cover soil as cap (kPa) 20

2.2 LONG-TERM "SECONDARY CONSOLIDATION"

Consolidation and Settlement Analysis, Equation 19.28, Civil Engineering Handbook Patrick J. Fox, CRC Press LLC, 2003

$$S_s = \frac{C_\alpha H_o}{1+e_o} \log\frac{t_f}{t_p}$$

C_α- secondary compression index

Assumptions

use t-initial= average age in Oct 2020

use t-final= t-initial plus 50 years

t initial = starting time of the secondary settlement. Assumed to be equal to the age of the existing tailing dam for vertical expansion.

t final = ending time of the secondary settlement

Coal tailing assumed to be normally consolidated and drain from one side only as base contains bedrock.

2.1 Short-Term "Primary" Settlement of Liner

Point	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chainage (m)	0	25	50	75	100	125	150	175	200	225	250	275	300	325
Thickness of coal Tainings Filling (m)														
Capping Layer (m)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total thickness of Coal Tailings	0	0	9.24	13.78	13.63	13.55	12.49	11.85	11.45	11.5	11.25	10.96	7.52	0
Thickness of layer 1 (top layer)	0.00	0.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	0.00
Sigma-0 (kN/m2)	NA	NA	19.63	19.63	19.63	19.63	19.63	15.70	15.70	15.70	15.70	15.70	19.63	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.35	0.35	0.35	0.35	0.35	0.32	0.32	0.32	0.32	0.32	0.35	0.00
Thickness of Layer 2	0.00	0.00	4.24	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	2.52	0.00
Sigma-0 (kN/m2)	NA	NA	55.89	58.88	58.88	58.88	58.88	47.10	47.10	47.10	47.10	47.10	49.14	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.15	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.10	0.00
Thickness of layer 3	0.00	0.00	0.00	3.78	3.63	3.55	2.49	3.85	3.45	3.50	3.25	2.96	0.00	0.00
Sigma-0 (kN/m2)	NA	NA	NA	93.34	92.75	92.43	88.27	77.91	76.34	76.54	75.56	74.42	NA	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.09	0.09	0.08	0.06	0.10	0.09	0.10	0.09	0.08	0.00	0.00
Total "Primary" settlement (m)	0.00	0.00	0.50	0.61	0.60	0.60	0.58	0.58	0.57	0.57	0.57	0.56	0.45	0.00

2.2 Long-Term "Secondary" Settlement of Liner

Point	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chainage	0	25	50	75	100	125	150	175	200	225	250	275	300	325
Total Thickness	0.00	0.00	9.24	13.78	13.63	13.55	12.49	11.85	11.45	11.50	11.25	10.96	7.52	0.00
Thickness Layer 1 (Top)	0.00	0.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	0.00
T-initial (yr)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
T-final (yr)	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
Calc settlement of layer (m)	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00
Thickness Layer 2	0.00	0.00	4.24	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	2.52	0.00
T-initial (yr)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
T-final (yr)	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Calc settlement of layer (m)	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.00
Thickness Layer 3	0.00	0.00	0.00	3.78	3.63	3.55	2.49	3.85	3.45	3.50	3.25	2.96	0.00	0.00
T-initial (yr)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
T-final (yr)	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.01	0.00	0.00
Total "Secondary" settlement(m)	**0.00**	**0.00**	**0.06**	**0.08**	**0.08**	**0.08**	**0.07**	**0.07**	**0.07**	**0.07**	**0.06**	**0.06**	**0.05**	**0.00**

Settlement of bedrock is negligible.

Sum of calculated "Primary" and "Secondary" settlement (m)	0.00	0.00	0.55	0.68	0.68	0.68	0.65	0.65	0.64	0.64	0.63	0.62	0.49	0.00

19129935 Wilpinjong Settlement Estimation

EXISTING COAL TAILING SETTLEMENT ESTIMATION

Section C-C'

TABLE A1

Tailing Materials					Basis of adopted value
Material	Coal Tailing				
waste type	Layer 1	Layer 2	Layer 3	Layer 4	
Dry Unit Weight (kN/m3)	7.85	7.85	7.85	7.85	from 1784584-005-R-Rev1, dated July 2019
Void ratio, e_0	0.91909	0.86856	0.8451	0.833316	estimated using e=-0.01320log(σ')²-0.0795(σ')+1.056 Gassner, 1997
C_c (primary)	0.278	0.278	0.278	0.278	From Hao Yu, 2015
C_α (secondary)	0.0089	0.0089	0.00890	0.00890	estimated using C_α = 0.032 C_c from Bhanbhro et al. 2015 for fine tailings
average age in mid 2020(yr)	2	4	5	6	assumed from available site information

2.1 SHORT-TERM "PRIMARY CONSOLIDATION"

$$S_p = \frac{C_c H}{1+e_0}\log\left(\frac{\sigma_0'+\Delta\sigma'}{\sigma_0'}\right)$$

C_c primary compression index

Assumptions

use Sigma-0 = current vertical stress at layer midpoint

use delta-sigma = vertical stress increase from top of coal tailing (2 m inert soil cap)

sume unit weight of inert cover soil as cap (kPa) 20

2.2 LONG-TERM "SECONDARY CONSOLIDATION"

Consolidation and Settlement Analysis, Equation 19.28, Civil Engineering Handbook Patrick J. Fox, CRC Press LLC, 200

$$S_s = \frac{C_\alpha H_o}{1+e_o}\log\frac{t_f}{t_p}$$

C_α- secondary compression index

Assumptions

use t-initial= average age in Oct 2020

use t-final= t-initial plus 50 years

t initial = starting time of the secondary settlement. Assumed to be equal to the age of the existing tailing dam for vertical expansion.

t final = ending time of the secondary settlement

Coal tailing assumed to be normally consolidated and drain from one side only as base contains bedrock.

2.1 Short-Term "Primary" Settlement of Liner

Point	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chainage (m)	0	25	50	75	100	125	150	175	200	225	250	275	300	325
Thickness of coal Tainings Filling (m)														
#REF!	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total thickness of Coal Tailings	0	4.68	15.25	17.28	15.94	15.45	15.66	15.03	14.72	14.53	14.9	13	5.48	
Thickness of layer 1 (top layer)	0.00	4.68	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.48	0.00
Sigma-0 (kN/m2)	NA	18.37	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	19.63	21.51	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.34	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.36	0.00
Thickness of Layer 2	0.00	0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	0.00
Sigma-0 (kN/m2)	NA	NA	58.88	58.88	58.88	58.88	58.88	58.88	58.88	58.88	58.88	58.88	NA	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.00	0.00
Thickness of layer 3	0.00	0.00	5.25	5.00	5.00	5.45	5.66	5.03	4.72	4.53	4.90	3.00	0.00	0.00
Sigma-0 (kN/m2)	NA	NA	99.11	98.13	98.13	99.89	100.72	98.24	97.03	96.28	97.73	90.28	NA	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.12	0.11	0.11	0.12	0.12	0.11	0.11	0.10	0.11	0.07	0.00	0.00
Thickness Layer 4 (bottom layer)	0.00	0.00	0.00	2.28	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sigma-0 (kN/m2)	NA	NA	NA	126.70	121.44	NA	NA	NA	NA	NA	NA	NA	NA	NA
Delta-sigma (kN/m2)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total "Primary" settlement (m)	0.00	0.34	0.63	0.68	0.65	0.64	0.64	0.63	0.62	0.62	0.63	0.59	0.36	0.00

2.2 Long-Term "Secondary" Settlement of Liner

Point	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Chainage	0	25	50	75	100	125	150	175	200	225	250	275	300	325
Total Thickness	0.00	4.68	15.25	17.28	15.94	15.45	15.66	15.03	14.72	14.53	14.90	13.00	5.48	0.00
Thickness Layer 1 (Top)	0.00	4.68	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.48	0.00
T-initial (yr)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
T-final (yr)	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00	52.00
Calc settlement of layer (m)	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.00
Thickness Layer 2	0.00	0.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	0.00	0.00
T-initial (yr)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
T-final (yr)	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Calc settlement of layer (m)	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00
Thickness Layer 3	0.00	0.00	5.25	5.00	5.00	5.45	5.66	5.03	4.72	4.53	4.90	3.00	0.00	0.00
T-initial (yr)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
T-final (yr)	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00	55.00
Calc settlement of layer (m)	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.00	0.00
Thickness of Layer 4 (bottom)	0.00	0.00	0.00	2.28	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T-initial (yr)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
T-final (yr)	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00	56.00
Calc settlement of layer (m)	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total "Secondary" settlement(m)	**0.00**	**0.03**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.08**	**0.08**	**0.08**	**0.08**	**0.07**	**0.04**	**0.00**

Settlement of bedrock is negligible.

Sum of calculated "Primary" and "Secondary" settlement (m)	0.00	0.37	0.72	0.77	0.74	0.72	0.73	0.71	0.71	0.70	0.71	0.66	0.40	0.00

APPENDIX C

Dam Break Assessment

REPORT

TD6 TSF Dam Break Assessment

Wilpinjong Mine

Submitted to:

Peabody Energy
1434 Ulan-Wollar Road
Wilpinjong, NSW 2850

Submitted by:

Golder Associates Pty Ltd
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19128879-001-R-RevA

11 May 2020

Distribution List

Peabody Energy - 1 x electronic copy

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

Peabody Energy Pty Ltd (Peabody) has engaged Golder Associates Pty Ltd (Golder) to undertake a dam break assessment (DBA) for Tailings Dam 6 (TD6) Tailings Storage Facility (NCPP TSF) at its Wilpinjong Coal Mine (Wilpinjong).

Dam breach inundation studies are performed to inform dam consequence classification and/or as input to emergency plans that would be enacted in the hypothetical occurrence of a dam breach. A dam breach inundation study does not constitute, nor imply, a Dam Safety Review and specifically excludes any consideration of the likelihood of failure and/or probable failure modes. Rather, it assumes that a breach is initiated irrespective of likelihood, and assumes hypothetical failure modes based on historic dam failures and assumed [worse case/severe] site conditions.

This report presents the methodology, inputs and outcomes of the dam breach modelling.

2.0 SITE DESCRIPTION

Wilpinjong is owned and operated by Wilpinjong Coal Pty Ltd (WCPL), which is a wholly owned subsidiary of Peabody. The mine is located in the western coalfields of New South Wales (NSW) and 48 km north-east of Mudgee. It produces thermal coal for domestic and export markets, with 14 million tonnes (Mt) of coal produced in 2019 (Peabody, 2020).

Six TSFs, named TD1 to TD6, have been constructed at Wilpinjong to date. All have been constructed within a large mined out void. TD1, TD2, TD3, TD4 and TD5 have been decommissioned and rehabilitated. TD6 is active and received tailing.

An overview of the site layout within the study area is presented in Figure 1.

PATH: V:\Peabody\Wilpinjong Coal Mine\99_PROJECTS\19128879 - TD6 TSF DBA\11_GIS\01_FIGURES\19128879-001-R-F001 Site Layout.mxd PRINTED ON: 2020-05-08 AT: 1:34:58 PM

LEGEND

- Railways
- Roads
- Watercourses

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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REFERENCE(S)

1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Base Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

CONSULTANT
GOLDER

DD-MM-YYYY	08-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

TITLE
SITE LAYOUT

PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	001

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25mm

3.0 TSF CHARACTERISTICS

TD6 was originally designed by ATC Williams Pty Ltd (ATC) (2013) with a design capacity of 1.48 Mm^3 and was commissioned in October 2013.

TD6 was constructed within Pit 2 to the south of TD5. The north embankment is buttressed against the TD5 embankment and constructed using the centreline raise method. Embankments constructed within the pit void form the south and west embankments. The east embankment is over natural rock at depth, with the embankment footprint extending into the adjacent Pit 4. At the time of construction, the embankment crest varied in height between 10 and 20 m above the pit floor, with the nominal crest width varying between 60 and 70 m (Golder, 2019).

TD6 has a single tailings discharge point adjacent to the south-east embankment corner. Supernatant water forms a pond against the western embankment.

A summary of the TSF characteristics is presented in Table 1.

Table 1: Summary of TSF Characteristics (Golder, 2019) (ATC, 2013)

Item	Value
Total Volume of Tailings Deposit (Mm^3)	1.48
Crest Elevation (m RL)	390 (northern and eastern embankments) 391 (western embankment) 391 to 419 (southern embankment)
Crest Width (m)	60 to 70
Upstream Embankment Slope (H:V)	2.25:1
Downstream Embankment Slope (H:V)	2:1

4.0 DAM FAILURE OVERVIEW

4.1 Failure Mechanisms

There are several possible failure modes for embankment dams, the most common ones being overtopping, piping, foundation and liquefaction failure. A short description of them is provided below:

- Overtopping Failure is typically the result of either an extreme storm event or a landslide within the impoundment. The flow of water over the embankment causes erosion of the downstream embankment slope material and leads towards a breach. Overtopping failure can also be caused during less extreme storm events after a loss of freeboard due to either a seismic event, spillway blockage or operating the dam at levels greater than the maximum design operating level.

  A recent example of this type of failure mechanism is the Zijin (China) failure occurring in 2010 resulting in 22 deaths.

- Piping Failure is typically triggered by seepage flows concentrated along a path of high hydraulic conductivity. These seepage paths can be caused by cracking, combustion, animal activity, high hydraulic gradients or relict structures in the foundation materials. The shear forces exerted by the escaping water could enlarge the seepage path until a portion of the embankment collapses, resulting in a breach through overtopping and erosion of the caved area. A piping failure event may occur at any time and not be a direct result of a storm event.

  A recent example of this type of failure mechanism is the Baia Mare and Baia Borsa (Romania) failure occurring in 2000. This structure had an upstream and downstream raise construction with approximately 0.1 Mm^3 released resulting in 0 deaths.

- Foundation Failure is typically the result of poor/low foundation permeability which leads to an increase in pore pressure. Failure potential is greater at locations where ponded water exists against an embankment face. Foundation failure can also occur due to instability of the underlying foundation due to incorrect characterisation during the design phase of a structure. Therefore, it is possible that foundation failure may occur at any location along an embankment.

  A recent example of this type of failure mechanism is the Mount Polley (Canada) failure occurring in 2014. This structure had a centreline raise construction with approximately 23.6 Mm^3 released resulting in 0 deaths.

- Liquefaction Failure is the substantial loss of strength and stiffness of saturated or partially saturated tailings. The material, which is normally a solid, starts behaving like a liquid. It occurs in response to an applied stress, a sudden change in stress condition or an earthquake. Historic tailings failure events indicate that upstream raised dams are most susceptible to tailings liquefaction and operations such as mine blasting or motion of heavy equipment can also instigate such a failure.

  A recent example of this type of failure mechanism is the Feijão Mine (Brazil) failure occurring in 2019. This structure had an upstream raise construction with approximately 12 Mm^3 released resulting in 248 deaths.

Typical diagrams for overtopping and piping failure is provided in Figure 2.

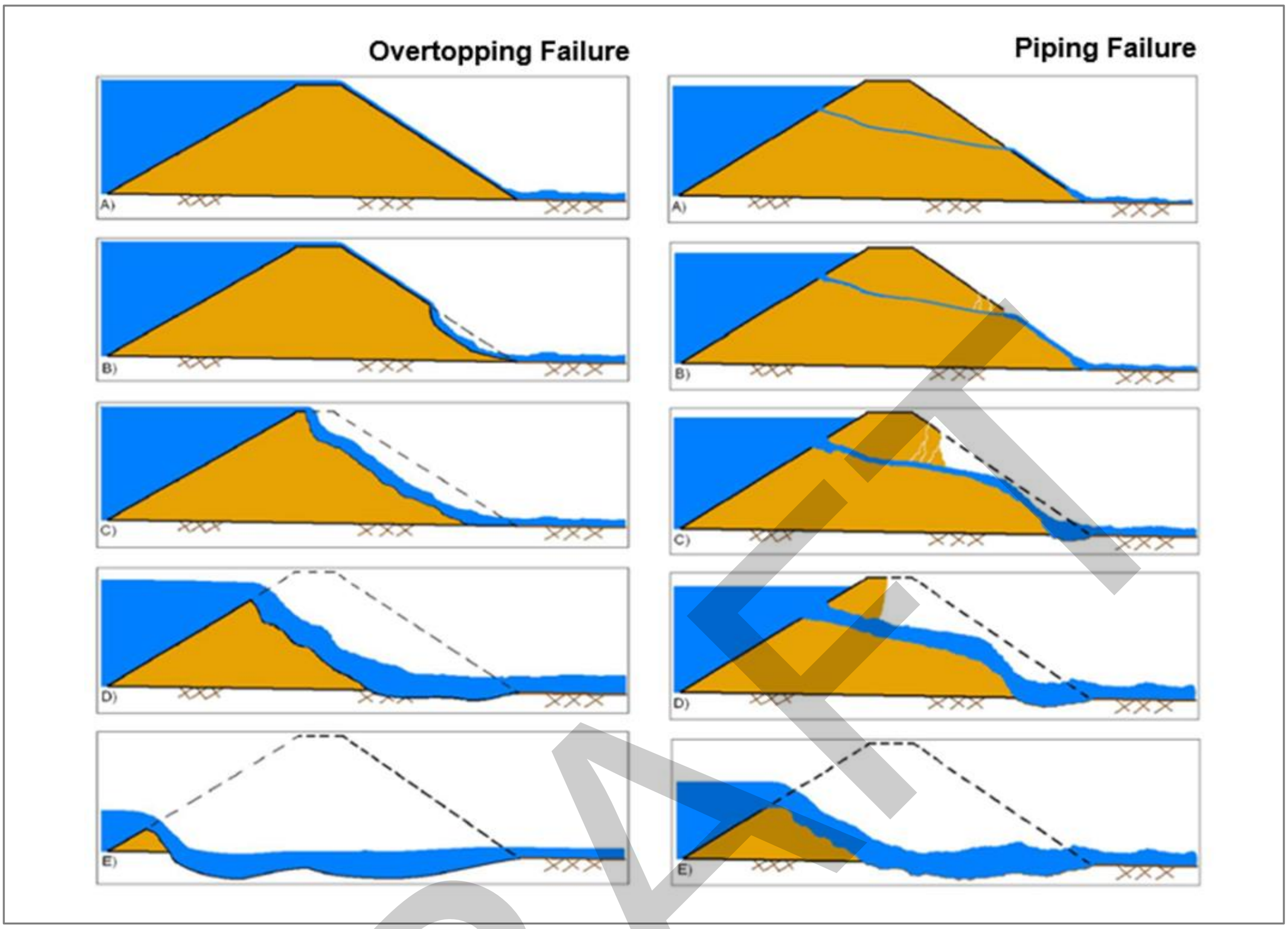

Figure 2: Overtopping and Piping Failure Configuration (US Army Corps of Engineers, 2014)

4.2 Sunny Day vs Flood Day

The consequence category for a dam is assigned by assessing the consequence of dam failure under two events, including:

- Sunny Day Failure: Failure occurring without any natural rainfall or flooding, giving rise to the 'Sunny Day' Consequence Category. The consequence of failure is taken as the impact of the entire inundation extent.
- Flood Induced Failure: Failure that occurs in association with a natural flood event, giving rise to the Flood Consequence Category. The consequence of failure is taken as the impact of the incremental increase in flood extent from the natural flood extent.

4.3 Newtonian vs non-Newtonian

A tailings dam breach analysis is generally more complex than a water dam failure analysis. Depending upon the solids concentrations of the released tailings and water, the slurry can possess Newtonian (water flood) characteristics, or non-Newtonian (mud flood or mud flow) characteristics. In general, the travel time and inundation area for water floods will be larger than mud floods. Non-Newtonian assessments have a larger data requirement due to the need to characterise the tailings flow properties.

4.4 Breach Location

The breach location is the location or section of embankment where the failure originates from. When undertaking a dam break assessment, the breach location chosen has a direct influence on the potential estimated impact. For the current assessment, the following items were considered when selecting appropriate breach locations:

- Maximising of potential outflow volume, i.e. typically equal to the location with the largest outer embankment height.
- Resulting in large failure reach length, i.e. proximity to natural watercourses which would carry the outflow further.
- Population density and degree of environmental significance in expected downstream inundation extent.
- Capturing the ultimate inundation footprint from a dam failure scenario.

5.0 FAILURE SCENARIOS

Several failure scenarios have been considered in this assessment, as summarised in Table 2. It has conservatively been assumed that all scenarios consist of the initial water level within the TSF being at spill level of the TSF, i.e. lowest embankment crest elevation.

Table 2: Summary of considered failure scenarios

Scenario	Breach Location	Failure Mechanism	Weather Conditions	Ponded Water
1	South-East Corner	Piping	Sunny Day	Spill Level
2	Eastern Embankment	Overtopping	Flood Day	Spill Level
3	North-West Corner	Piping	Sunny Day	Spill Level

The adopted breach locations and associated scenarios listed in Table 2 are presented in Figure 3.

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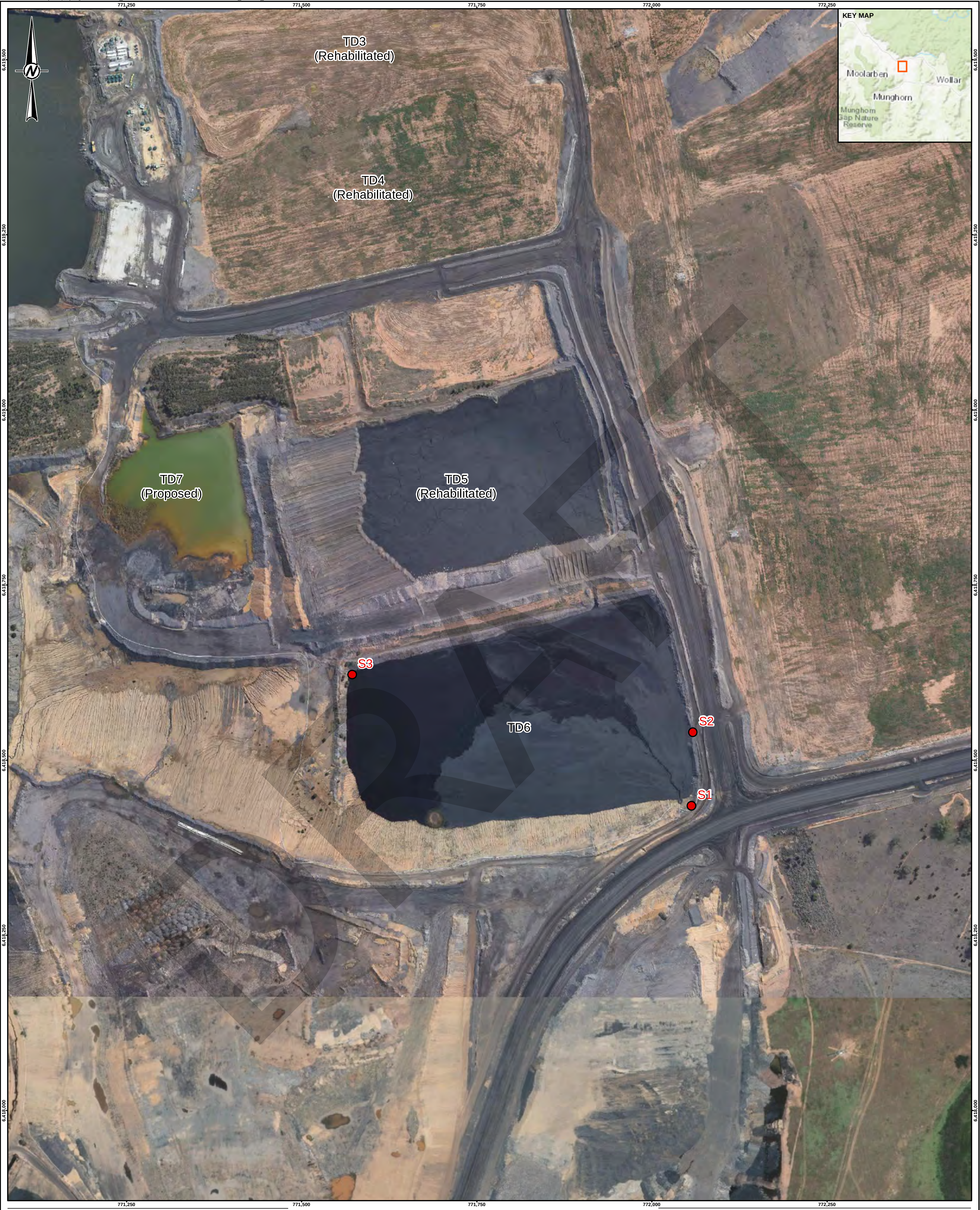

LEGEND

● Indicative Breach Locations

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Projection: Transverse Mercator
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2. Base Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

CLIENT PEABODY ENERGY		PROJECT TD6 TSF DAM BREAK ASSESSMENT WILPINJONG MINE	
CONSULTANT GOLDER	DD-MM-YYYY	06-05-2020	TITLE **ADOPTED BREACH LOCATIONS AND FAILURE SCENARIOS**
	DESIGNED	MP	
	PREPARED	MP	
	REVIEWED	NM	
	APPROVED	NM	

PROJECT NO.	CONTROL	REV.	FIGURE
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6.0 BACKGROUND FLOOD

The flood day failure is assessed based on the incremental impact from the natural flood (referred to herein as the background flood) with and without dam failure.

The probable maximum precipitation (PMP) event has been chosen as the background flood event. The PMP is the theoretical maximum precipitation for a given duration.

6.1 Background Catchment Areas

The surrounding catchment areas were delineated based on LiDAR obtained from the NSW Government Spatial Services[1].

An overview of the surrounding catchments is presented in Figure 4, with areas summarised in Table 3.

Table 3: Summary of surrounding catchments

Catchment	Area (km^2)	Average Slope (%)
A	121.3	1.3
B	71.4	2.5
TOTAL	**192.7**	**-**

[1] NSW Government Spatial Services, Gulgong Digital Elevation Model; Survey Date: October 2015; Resolution: 2 m

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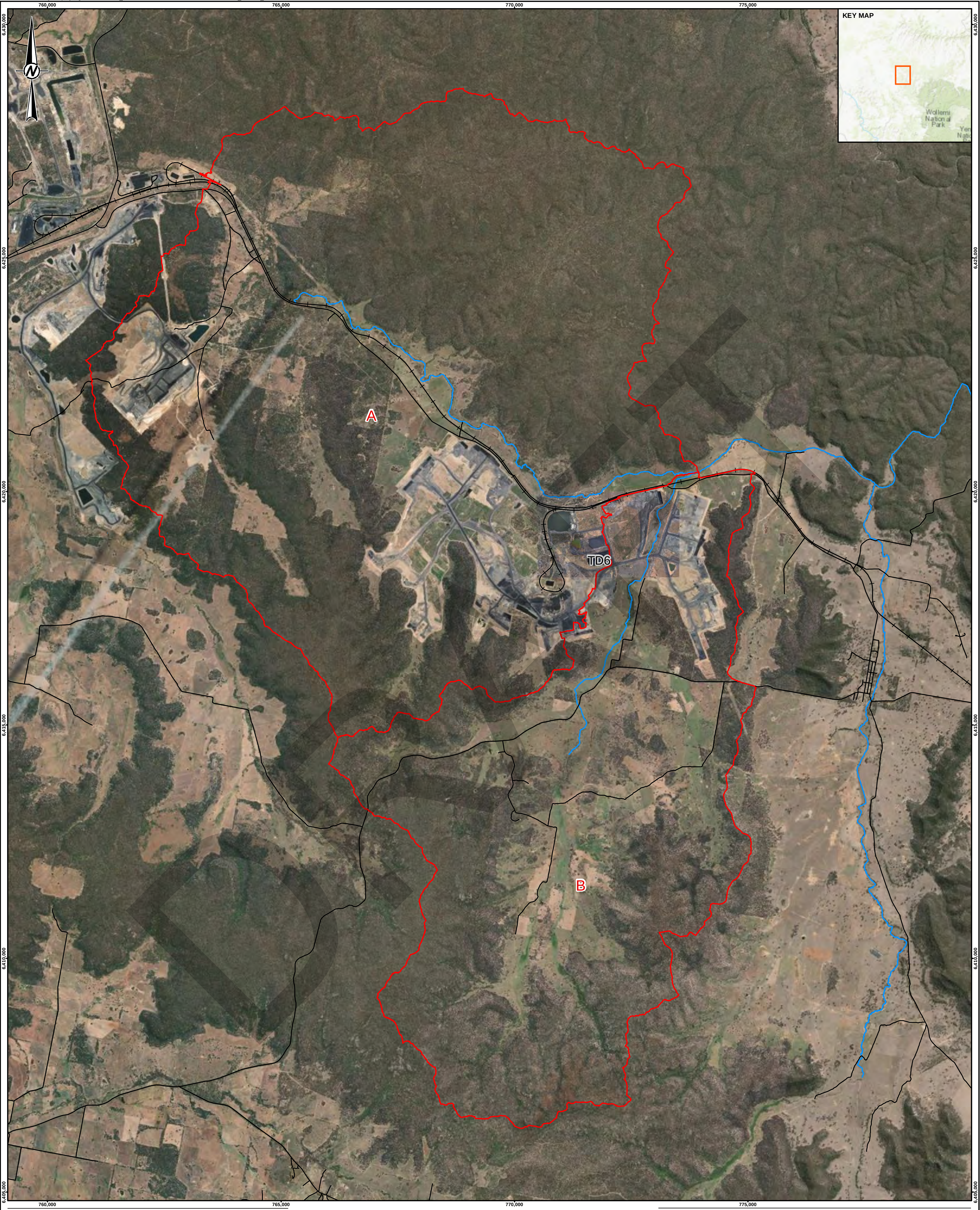

LEGEND

- Catchment Boundaries
- Railways
- Roads
- Watercourses

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Projection: Transverse Mercator
Datum: GDA 1994

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TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

CONSULTANT
GOLDER

DD-MM-YYYY	06-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

TITLE
OVERVIEW OF SURROUNDING CATCHMENT AREAS

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6.2 Design Rainfall

The intensity-frequency-duration (IFD) data up to the 1 in 2 000 AEP was sourced from the Australia Bureau of Meteorology (BoM) online IFD database (2016) for the site location (32.34˚S, 149.89˚E).

The probable maximum precipitation (PMP) is the theoretical maximum precipitation for a given duration, and was estimated using the following methods:

- Generalised Short-Duration Method - GSDM (durations up to 3 hours) (BoM, 2003)
- Larger of the following methods:
  - Generalised Tropical Storm Method - GTSM (durations up to 96 hours) (BoM, 2004)
  - Generalised Southeast Australia Method - GSAM (durations up to 96 hours) (BoM, 2006)

Extreme rainfall events are estimated following the procedures developed by Siriwardena and Weinman (1998) as outlined in the Australian Rainfall and Runoff (ARR) 2019 guidelines (Ball, et al., 2019), to interpolate between the 1 in 2 000 AEP and the PMP rainfall depths.

The IFD and PMP rainfall depths are presented in Table 4.

Table 4: IFD and PMP Rainfall depths (mm)

Duration (hrs)	Annual Exceedance Probability (1 in X)							PMP
	100	1 000	2 000	5 000	10 000	100 000	200 000	
1	51.7	80.5	91.1	107	119	165	179	240
2	61.6	95.7	108	127	142	207	231	370
3	68.9	107	120	140	157	232	261	450
6	86.2	132	149	175	197	294	331	564
9	101	154	174	204	230	336	376	605
12	113	174	196	229	257	371	412	646
18	134	207	234	274	308	440	486	728
24	152	235	266	312	351	500	551	810
36	179	292	334	397	448	641	704	990
48	198	326	373	443	502	724	798	1,150
72	223	359	411	490	556	826	922	1,440
96	237	373	426	507	576	867	975	1,610

6.3 Background Flood Estimation

A hydrology model was developed using XPRAFTS (V2018.1) in order to estimate the background flood for the PMP event. The resulting peak flows downstream of each catchment, and corresponding critical durations, are summarised in Table 5 for the PMP event. The critical duration relates to the storm event duration resulting in the largest peak flow for a given catchment area.

Table 5: Summary of modelled catchment peak flow

Catchment	Peak Flow (m^3/s)	Critical Duration (hours)
A	4,047	3
B	3,251	3

As shown in Table 5, the critical duration for all assessed catchments is 3 hours for the PMP event. The 3-hour storm event has therefore been adopted for the flood day scenario.

7.0 DAM BREACH CHARACTERISATION

7.1 Outflow Volume

The tailings outflow volume has been estimated assuming a conical failure outflow volume. Studies by Blight and Fourie (2003) indicate that failure slopes typically vary between 3 to 7%, and can be up to 17 to 33% around the perimeter of the cone. Additionally, observations from a selection of historical tailings dam breaches by Rourke and Luppnow (2015) indicate that post-failure tailings slopes are typically within the range of 5 to 18%.

Based on these findings, a failure slope of 5% has been adopted for the tailings failure slope in this study. The volume of tailings outflow in the event of failure at each location for the TSF has been estimated taking into account the following:

- Embankment spatial alignment
- Estimated base elevation determined from natural ground level along the outside embankment toe.
- Base of failure cone conservatively taken at embankment crest centreline projected to the estimated base cone elevation.

It should be noted that in addition to the tailings outflow, the all decant water above the lowest intersection point of the decant pond and tailings failure cone surface will be mobilised. An indicative diagram of the potential outflow is presented in Figure 5.

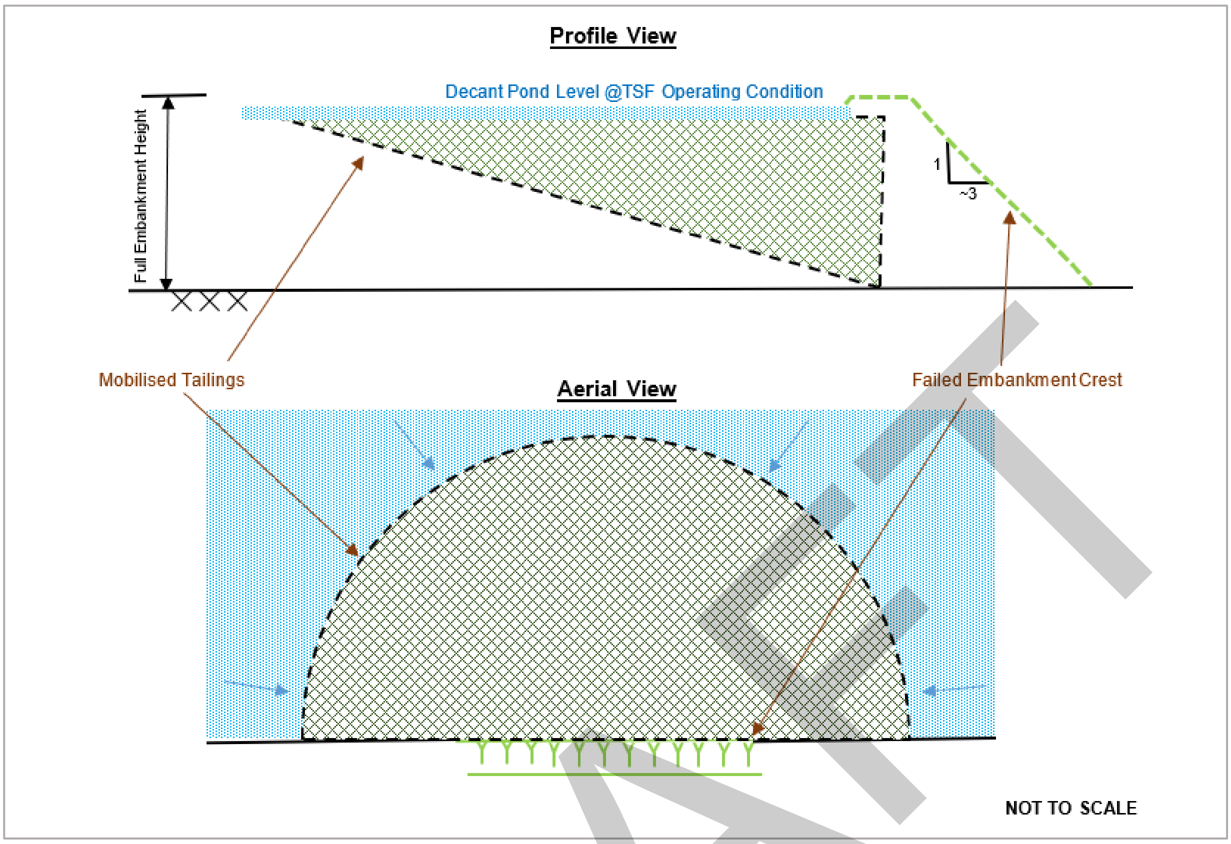


Figure 5: Indicative diagram of the tailings and water outflow during the failure event

Estimated extents of the tailings failure cones for each of the assessed scenarios are provided in APPENDIX A. An impounded tailings elevation of 389.3 mRL will be adopted based on the expected maximum height of beach in the TSF (ATC, 2013). Based on the embankment elevations at the adopted breach locations, it is expected that of the three locations only the breach from location S1 will release both tailings and ponded water. The tailings level is below the outer embankment toe elevation for breach locations S2 and S3, therefore breaches from S2 and S3 will only release ponded water above ground level for the purposes of this assessment. Key parameters used, and resultant volumes are presented in Table 6.

Table 6: Dam breach release volumes for all scenarios

Parameter	Scenario		
	1	2	3
Impounded Tailings Level (m RL)	389.3	389.3	389.3
Ponded Water Level[(a)] (m RL)	390.0	390.0	390.0
Total Impounded Tailings Volume (Mm^3)	1.48	1.48	1.48
Total Ponded Water Volume (Mm^3)	0.1	0.1	0.1
Total Impounded Volume (Mm^3)	1.49	1.49	1.49
Embankment Crest Elevation[(b)] (m RL)	392.6	390.0	390.0[(c)]
Final Breach Elevation[(d)] (m RL)	387.9	389.6	389.7
Breach Height (m)	4.7	0.4	0.3

Above-Ground Impounded Tailings Volume (Mm^3)	0.2	0	0
Above-Ground Ponded Water Volume (Mm^3)	0.1	0.1	0.1
Above-Ground Impounded Volume (Mm^3)	0.3	0.1	0.1
Assumed Failure Slope (%)	5	5	5
Failure Cone Volume (Mm^3)	0.5 x 10^{-3}	0	0
Released Ponded Water Outflow Volume (Mm^3)	0.1	0.1	0.1
Total Outflow Volume (Mm^3)	0.1	0.1	0.1
Total Outflow (% of Impounded)	6.3	3.2	2.5
Total Outflow (% of Impounded Above-Ground)	33	100	100

Note: (a) Adopted ponded water level at spill level immediately prior to breach event.
(b) Obtained from TSF design report (ATC, 2013).
(c) Highest crest elevation at S3 identified as ~395 mRL. This is believed to comprise of ~5 m of recently deposited waste rock, which has been assumed to not hold any strength during a breach event for the purposes of this assessment. The true embankment crest elevation has therefore been estimated as 390 mRL.
(d) Estimated as outer embankment toe elevation based on available topographic data provided by Peabody (03/2020).

The estimated total release volume presented in Table 6 has been validated against published research and studies on available historic tailings dam failures and release volumes. Historical release volumes presented in studies undertaken by Rico et. al. (2008) and Larrauri and Lall (2018) are plotted against impounded tailings volume in Figure 6 for the adopted failure scenarios.

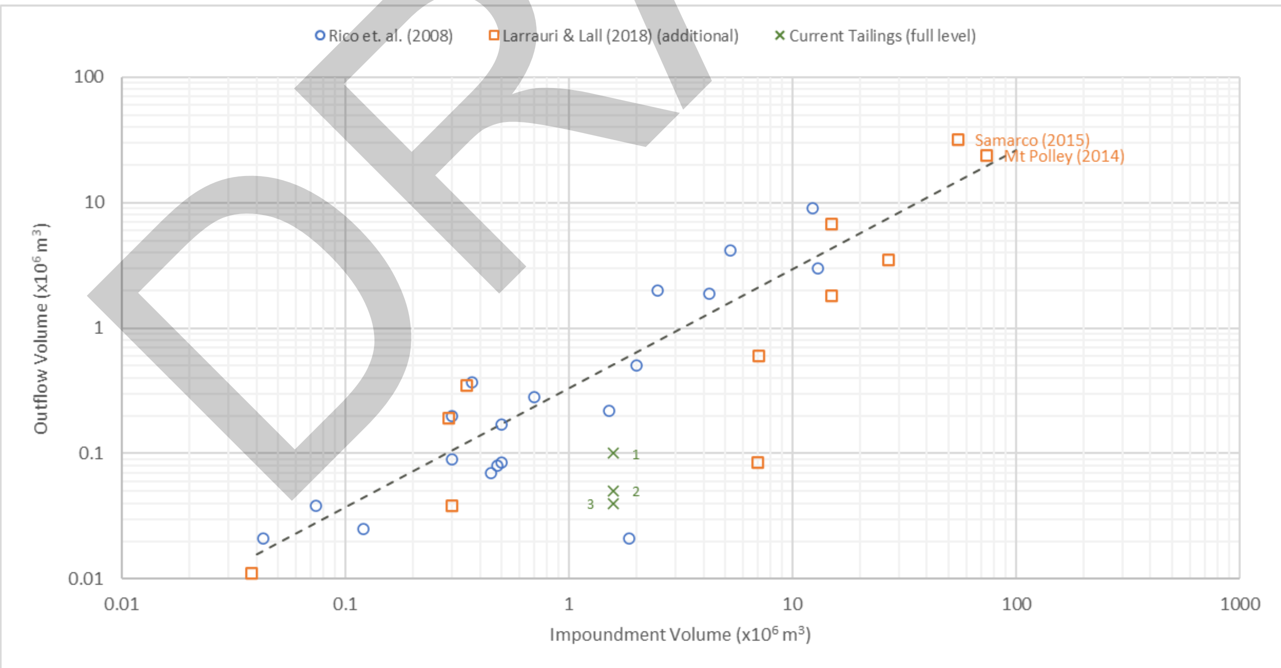


Figure 6: Comparison of historical dam failure release volumes and estimated release volumes for OTD

As shown in Figure 6, the estimated tailings release volumes for all scenarios fall below the regression fit of historical failure events. It is believed that this is due to the relatively large tailings footprint and volume in comparison to the breach height. The estimated tailings outflow volumes, however, are considered to be reasonable estimates for the purposes of this assessment.

7.2 Breach Parameters

An initial assessment identified that average breach widths are likely to be less than 5 m due to the failure height of the embankment. Studies by Knight and Froehlich (2016) recommends using emprical equations derived by MacDonald & Lanagridge-Monopolis (1984) for breach widths less than 5 m due to the sample data used in developing the equations. Breach parameters have therefore been estimated using the relationships provided MacDonald & Lanagridge-Monopolis (1984). Adopted breach parameters are presented in Table 7.

Table 7: Adopted breach parameters

Scenario	Average Breach Width (m)	Breach Side Slopes (H:1V)	Formation Time (min)	Erosion Rate (m/h)
1	1.64	0.2	11	26
2	2.15	1.0	5	5
3	1.85	0.2	4	5

As discussed by the Canadian Dam Association (CDA) (2019), a review of historical dam failures by Walder and O'Connor (1997) show that erosion rates are typically slower than 100 m/h. The estimated breach formation times presented in Table 7 relate to erosion rates ranging between 5 and 26 m/h. The estimated breach formation times are therefore believed to suitable for the purposes of this assessment given the breach heights ranging between 0.3 and 4.7 m.

7.3 Outflow Hydrographs

Outflow hydrographs were derived following standard breach routing equations derived by Fread (1988) by utilising the breach parameters presented in Table 7. Estimation of the hydrographs take into account the unique stage-storage relationship of the outflow failure cone as shown in Figure 5. Derived breach hydrographs are provided in APPENDIX B. The resulting peak flows for each of the assessed scenarios are summarised in Table 8.

Table 8: Summary of peak breach flow rates (m^3/s)

Scenario	Peak Breach Flow Rate (m^3/s)
S1	964
S2	1.1
S3	76

8.0 TAILINGS RHEOLOGY

The tailings rheology characteristics are required for modelling of non-Newtonian flow behaviour. Key tailings characteristics has been estimated based on available data and our professional experience in this field.

A summary of the rheological parameters is presented in Table 9.

Table 9: Summary of rheological properties

Property	Value
Total Volume of Tailings Deposit (Mm^3)	1.48[a]
Average Dry Density (t/m^3)	0.8[b]
Tailings Solids Density (t/m^3)	1.81[a]
Degree of Saturation	1.00[c]
Porosity	0.56
Void Ratio	1.26
Total Tailings Solids Mass (Mt)	1.18
Volume of Tailings Solids (Mm^3)	0.65
Volume of Interstitial Water (Mm^3)	0.83
Solids Concentration by Mass (%)	58.9
Solids Concentration by Volume (%)	44.2
Bulk Density (t/m^3)	1.36

Note: (a) Obtained from TD6 Design Report (ATC, 2013).
(b) Assumed based on our professional experience.
(b) Fully saturated tailings conservatively assumed for the purposes of this analysis.

The expected solids concentrations of the breach outflow volume has been estimated based on the proportion of tailings and water (see Table 6) and tailings solids concentration (see Table 9). Resulting outflow solids concentrations are presented in Table 10.

Table 10: Outflow solids concentration

Scenario	Tailings Outflow (Mm^3)	Water Outflow (Mm^3)	Combined Solids Concentration by Mass (%)	Combined Solids Concentration by Volume (%)
1	0.5×10^{-3}	0.1	0.4	0.2
2	0	0.1	0	0
3	0	0.1	0	0

For outflows with solids concentrations by mass of less than 40%, the outflow typically exhibits Newtonian (water flow) characteristics (CDA, 2019), as shown in Figure 7. Therefore, based on the findings in Table 10, this assessment will be completed using a Newtonian hydraulic modelling approach for all adopted failure scenarios.

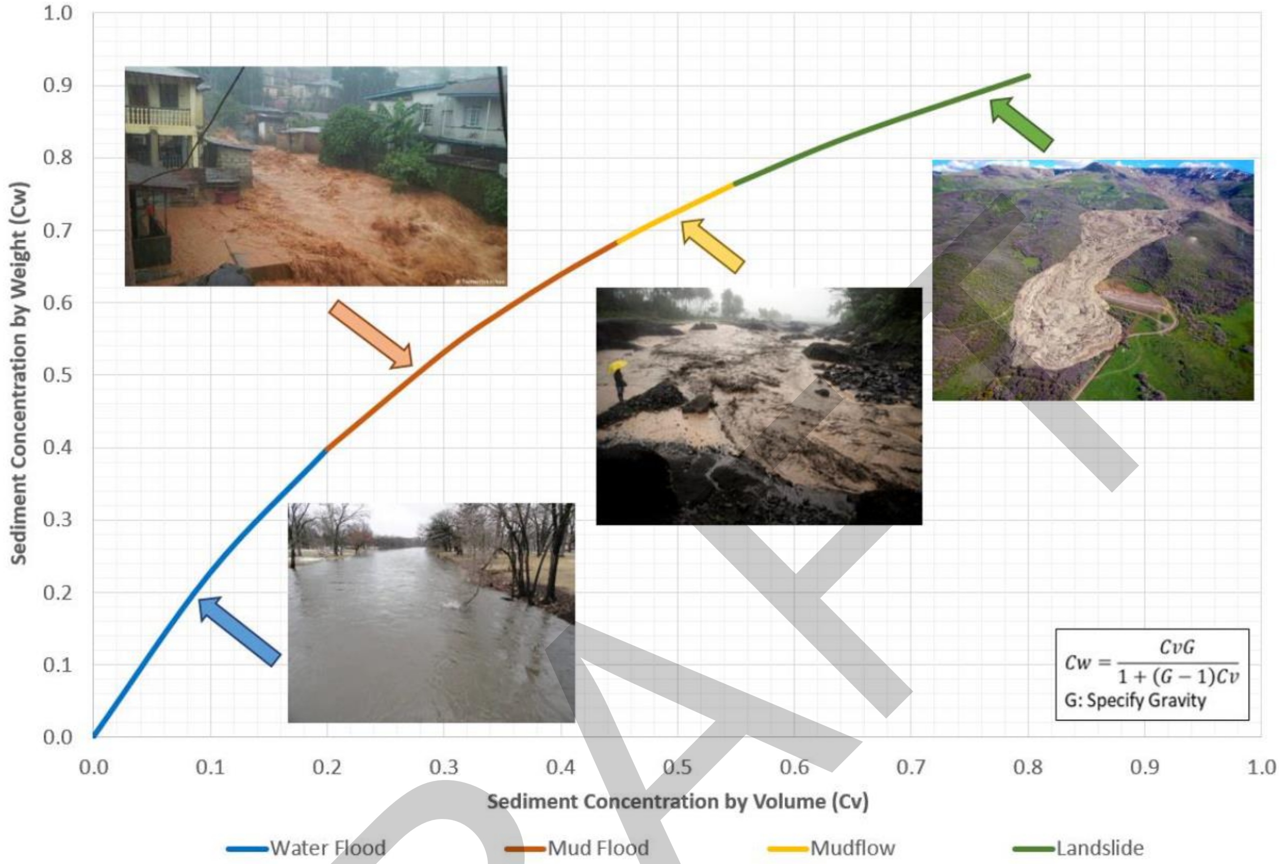


Figure 7: Flow types as a function of solids concentration (CDA, 2019)

9.0 HYDRAULIC MODELLING

9.1 Overview

Due to the relatively low solids concentration and the resulting assumption of Newtonian fluid behaviour, the TUFLOW modelling software was used to develop a hydrodynamic, dynamically linked two-dimensional (2D) / one-dimensional (1D) hydraulic model of the assessment study area. TUFLOW, developed by BMT WBM, has the capacity to represent complex changes in topography, hydraulic structures, floodplain storage and floodplain/channel interaction.

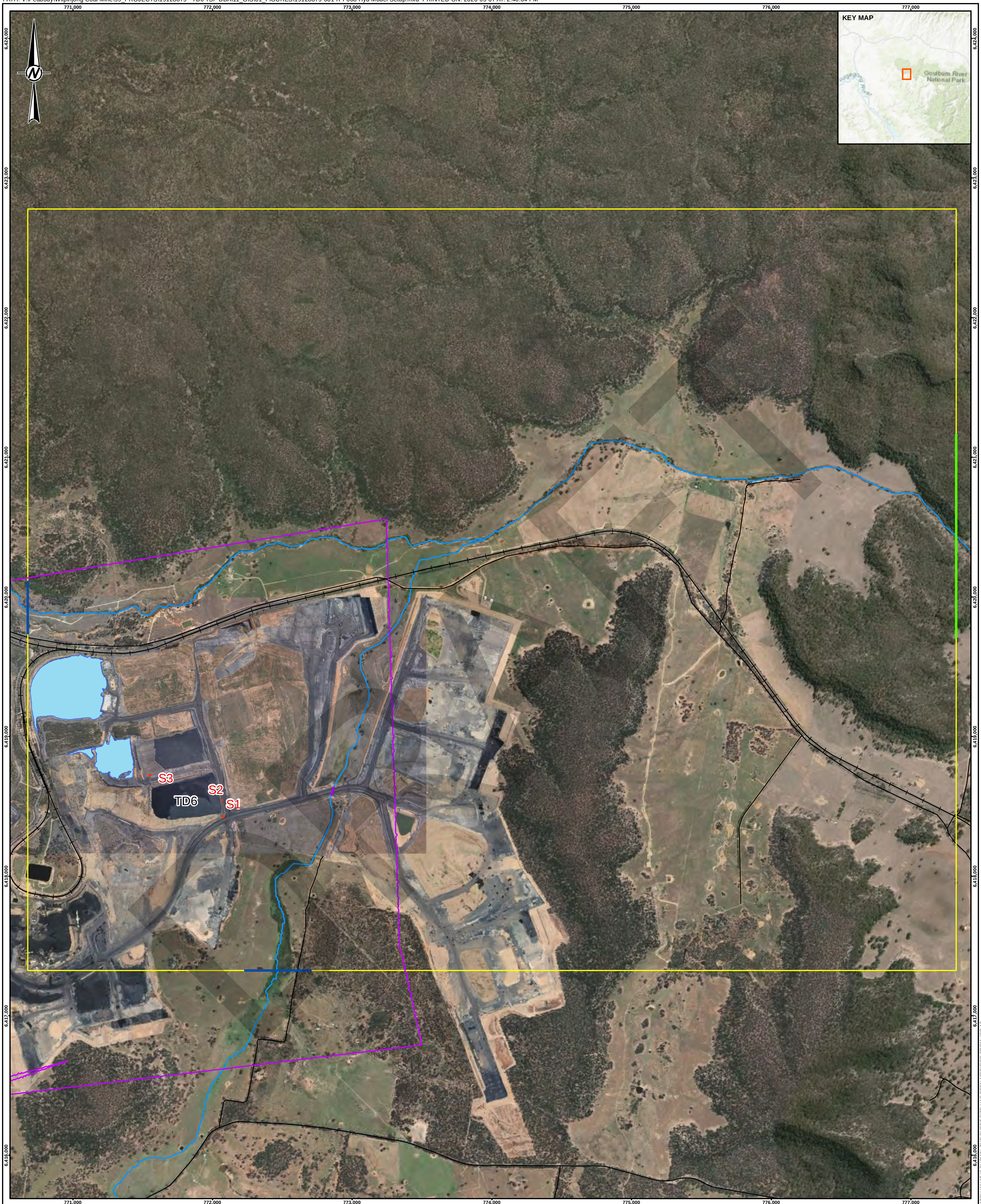
9.2 Inputs and Assumptions

The following modelling assumptions and approach was used for the hydraulic modelling:

- Topography was built using LiDAR data set provided by Peabody, dated March 2020 within the mining lease and publicly available data from the NSW Government Spatial Services[1] for area outside the LiDAR extent.
- An initial water levels of 372 and 379 m were conservatively assumed for Pit 2 West Dam and the proposed location for future TD7, respectively. This corresponds to the approximate spill levels of the respective storages.
- Cell sizes of 5 and 20 m were adopted for sunny day and flood day scenarios, respectively.

An overview of the hydraulic model setup is provided in Figure 8.

PATH: V:\Peabody\Wilpinjong Coal Mine\99_PROJECTS\19128879 - TD6 TSF DBA\11_GIS\01_FIGURES\19128879-001-R-F008 Hyd Model Setup.mxd PRINTED ON: 2020-05-07 AT: 2:40:04 PM



LEGEND

- LiDAR Extent
- Model Domain
- Initial Ponded Water
- Inflow Boundary (Breach Locations)
- Inflow Boundary (Background Catchments)
- Culvert Location
- Railways
- Roads
- Watercourses

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

0 500 1,000
1:25,000 @ A3 METRES

REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Base Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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PEABODY ENERGY

PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

CONSULTANT
GOLDER

DD-MM-YYYY	07-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

TITLE
OVERVIEW OF HYDRAULIC MODEL SETUP

PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	008

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25mm
0

9.3 Results

Detailed flood maps have been generated from the hydraulic results and are provided in APPENDIX C.

Flood maps are provided for each of the assessed scenarios and include the following:

- Maximum Inundation Depth
- Maximum Velocity
- Maximum Depth-Velocity Product (DV)
- Flood Severity (see Section 9.3.1)

9.3.1 Flood Severity

The inundated area has been categorised by flood severity to assess the potential hazard. The flood severity indicates the likely damage caused by the flood. Guidance on categorisation of the flood severity provided in the Australian Rainfall and Runoff (ARR) guidelines (Ball, et al., 2019) has been used for this assessment.

Flood severity is described by six hazard classifications, based on the maximum flood depth, velocity and depth-velocity product (DV) at a given location. It is noted that the time of the maximum DV may not coincide with the time at which the maximum inundated depth or velocity occurs.

The adopted hazard classifications are presented in Figure 9 and summarised in Table 11.

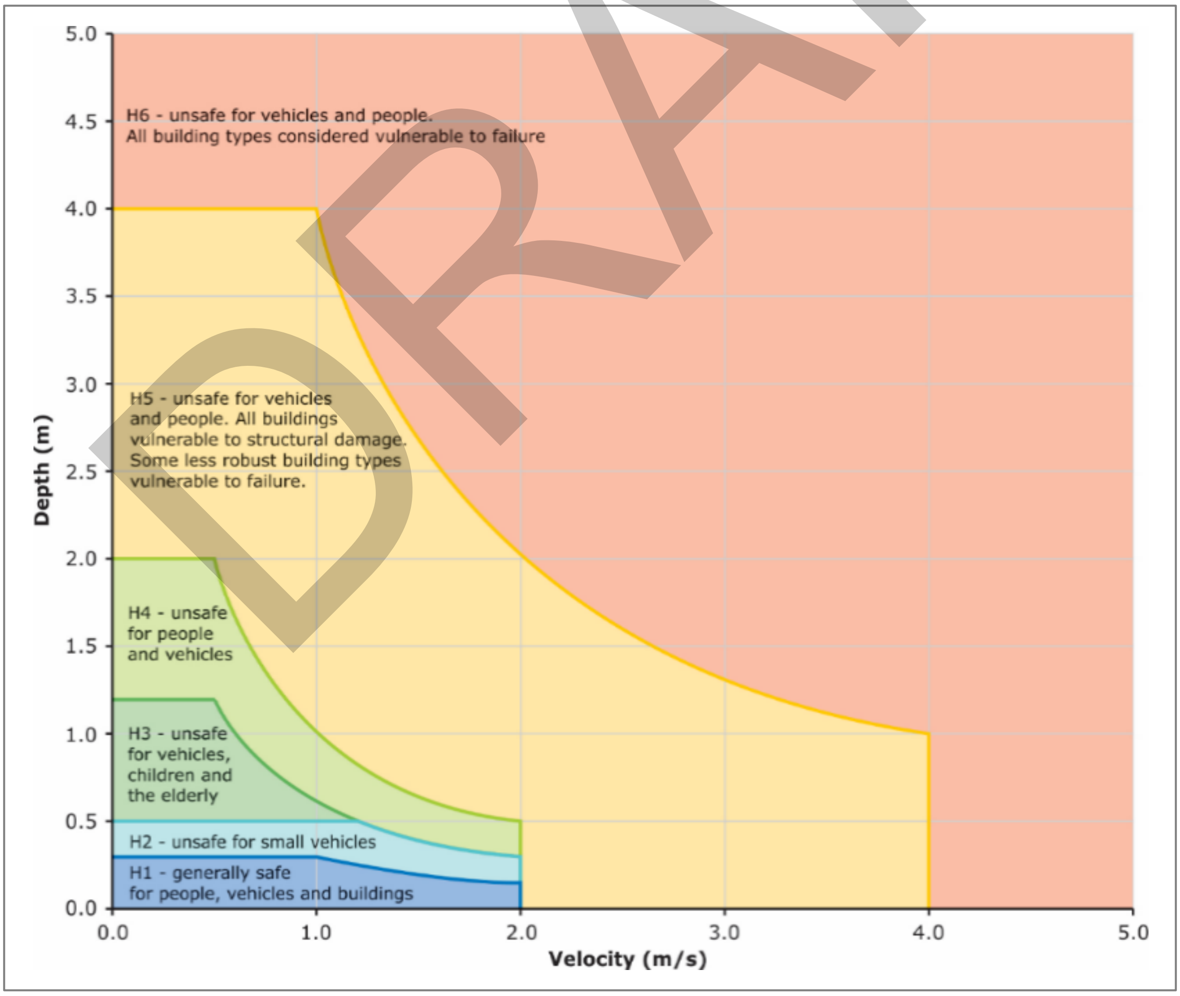

Figure 9: Combined flood hazard curves (Smith, Davey, & Cox, 2014)

Table 11: Vulnerability thresholds classification limits of flood hazard curves (Smith, Davey, & Cox, 2014)

Hazard Vulnerability Classification	Description of Hazard Classification	Depth-Velocity Product (DV) (m^2/s)	Limiting Still Water Depth (m)	Limiting Velocity (m/s)
H1	Generally safe for vehicles, people and buildings.	≤ 0.3	0.3	2.0
H2	Unsafe for small vehicles.	≤ 0.6	0.5	2.0
H3	Unsafe for vehicles, children and the elderly.	≤ 0.6	1.2	2.0
H4	Unsafe for vehicles and people.	≤ 1.0	2.0	2.0
H5	Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.	≤ 4.0	4.0	4.0
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.	> 4.0	-	-

10.0 SENSITIVITY ANALYSIS

There are several uncertainties in conducting dam failure assessments, including the estimation of the tailings outflow volume. This assessment incorporates relevant industry guidelines, site specific data and engineering judgment to inform inputs to the modelling of the assessed failure scenarios.

A sensitivity analysis was completed to assess model sensitivity to varying the dam breach parameters for the critical scenario. Scenario 1 was identified as the critical scenario in terms of largest incremental flooding increase.

As part of the current assessment, it was identified that the methodology provided by MacDonald & Lanagridge-Monopolis (1984) are suitable for estimating the breach parameters (see Section 7.2). A summary of dam breach parameters is presented in Table 12 for several published methodologies based on the critical scenario.

Table 12: Breach parameters for critical scenario based on various methodologies

Methodology	Average Breach Width (m)	Breach Side Slopes (H:1V)	Formation Time (min)
MacDonald & Lanagridge-Monopolis (1984) (adopted)	1.64	0.2	11
Froehlich (2016)	6.04	0.6	34
Queensland Department of Natural Resources, Mines and Energy (DNRME) (2018)	0.78	0.1	19
Von Thun & Gillette (1990)	11.40	0.2	2

As shown in Table 12, the average breach width ranges between 0.78 m and 11.4 m (average of 5 m) and breach formation time ranges between 2 and 34 minutes (average of 16.5 minutes). The average width estimated using MacDonald & Lanagridge-Monopolis (1984) aligns with all assessed methods.

Additionally, the breach parameters shown in Table 12 highlights that the methodology by MacDonald & Lanagridge-Monopolis (1984) is generally more conservative than that of DNRME (2018) and Froehlich (2016) due to the smaller formation time. Of the assessed methods, the Von Thun & Gillette (1990) method was identified to be the most conservative, however, is based on a smaller data set than that used by the other methods and therefore may not be suitable for the current assessment.

Due to no significant difference in peak flow being observed, no hydraulic modelling of the different breach parameters was completed.

11.0 IMPORTANT INFORMATION

Your attention is drawn to the document titled – "Important Information Relating to this Report", which is included in APPENDIX D of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understand and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

12.0 CONCLUSION

The outcomes of the assessment showed the largest incremental increase in inundation due to a dam failure occurred in Scenario 1. Scenario 1 is therefore considered to be the critical scenario in terms of inundation extent and potential impact. Key outcomes are summarised below for each assessed scenario.

Scenario 1 (South-East Corner; Piping Failure):

- Largest inundation extent of the assessed scenarios, with outflow travelling eastward. Downstream infrastructure, including roads mine haul roads are impacted, with the outflow reaching the downstream watercourse, Cumbo Creek.

Scenario 2 (East; Overtopping Failure):

- Relatively small inundation extent compared to background flood extent, and therefore smallest incremental increase in inundation of the assessed scenarios.
- Outflows travels north and south from the breach point, then travels east along an existing mine haul road before entering the downstream watercourse, Cumbo Creek. Negligible increase in inundation was observed within Cumbo Creek.

Scenario 3 (North-West Corner; Piping Failure):

- Following release, outflows travel north as shallow flows and enter the proposed location for TD7. The area is overtopped and spills continue to Pit 2 West Dam, where it is contained within the site.

As highlighted in this report, there are several uncertainties in conducting dam failure assessments. Relevant industry guidelines, site specific data and engineering judgment has formed the basis of the assessment inputs. It should also be noted that the current assessment was completed based on the available topography at the time. In the event of a change to the downstream topography or key receptors, a reassessment may be required.

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APPENDIX A

Failure Surface Drawings

PATH: V:\Peabody\Wilpinjong Coal Mine\99_PROJECTS\19128879 - TD6 TSF DBA\11_GIS\01_FIGURES\19128879-001-R-FA001 Failure Cone.mxd PRINTED ON: 2020-05-06 AT: 10:27:56 PM

LEGEND

- TD6 Outline
- Failure Cone Extent
- Indicative Breach Locations

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

CONSULTANT
GOLDER

DD-MM-YYYY	06-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

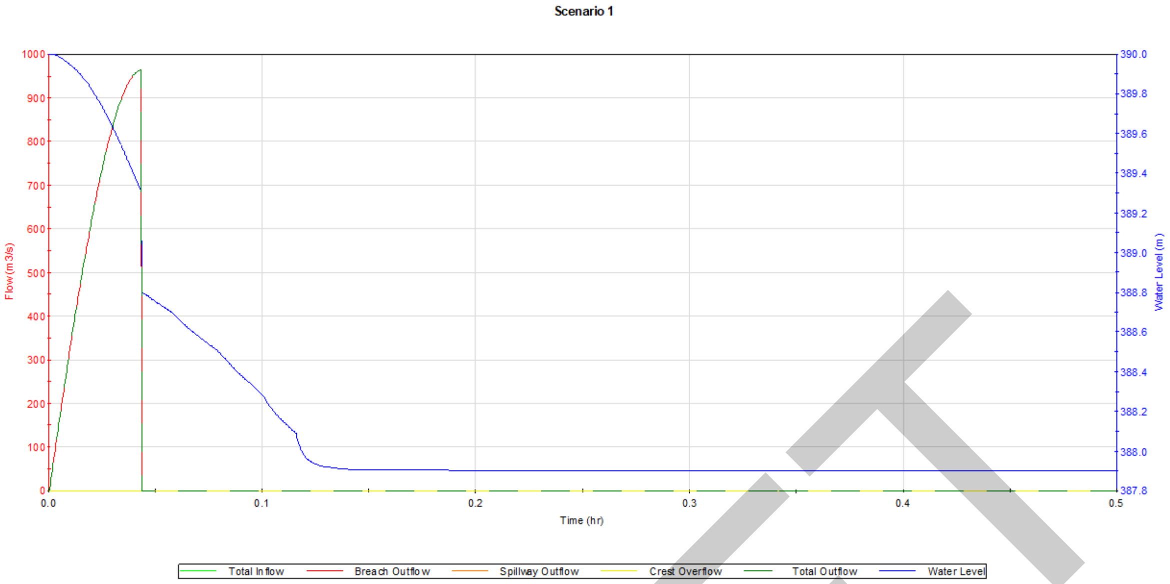
TITLE
ESTIMATED FAILURE CONE EXTENTS (SCENARIO 1 ONLY)

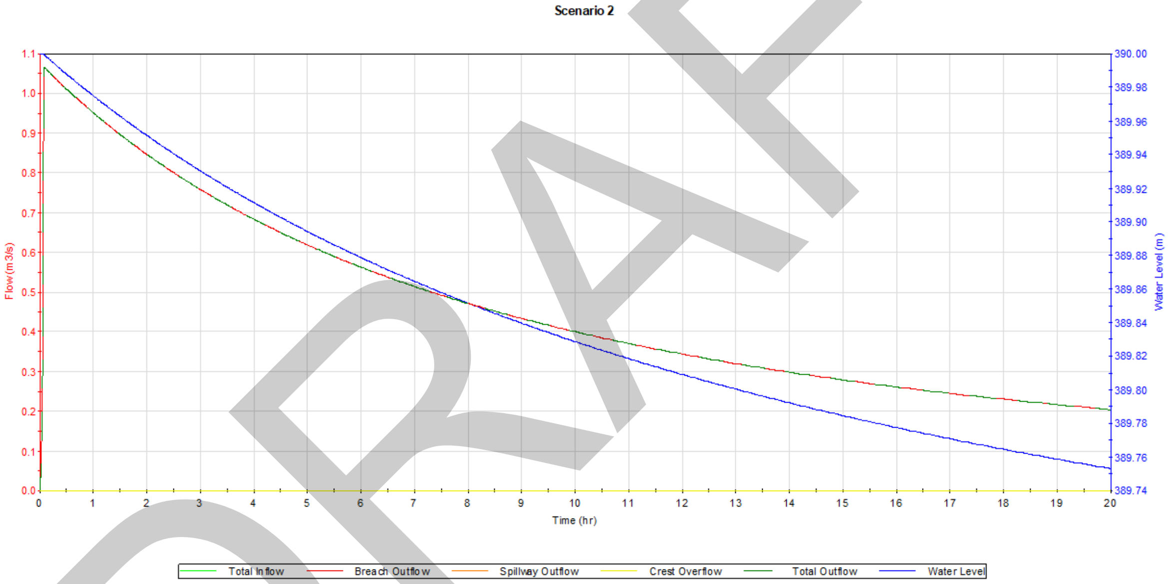
PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	A001

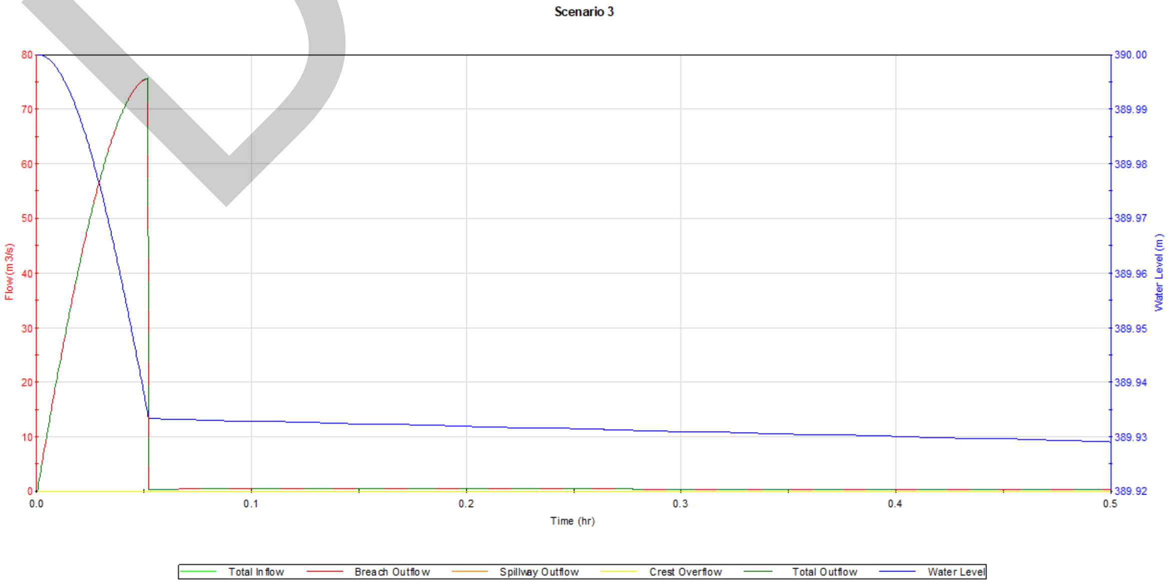
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25mm

APPENDIX B

Breach Hydrographs

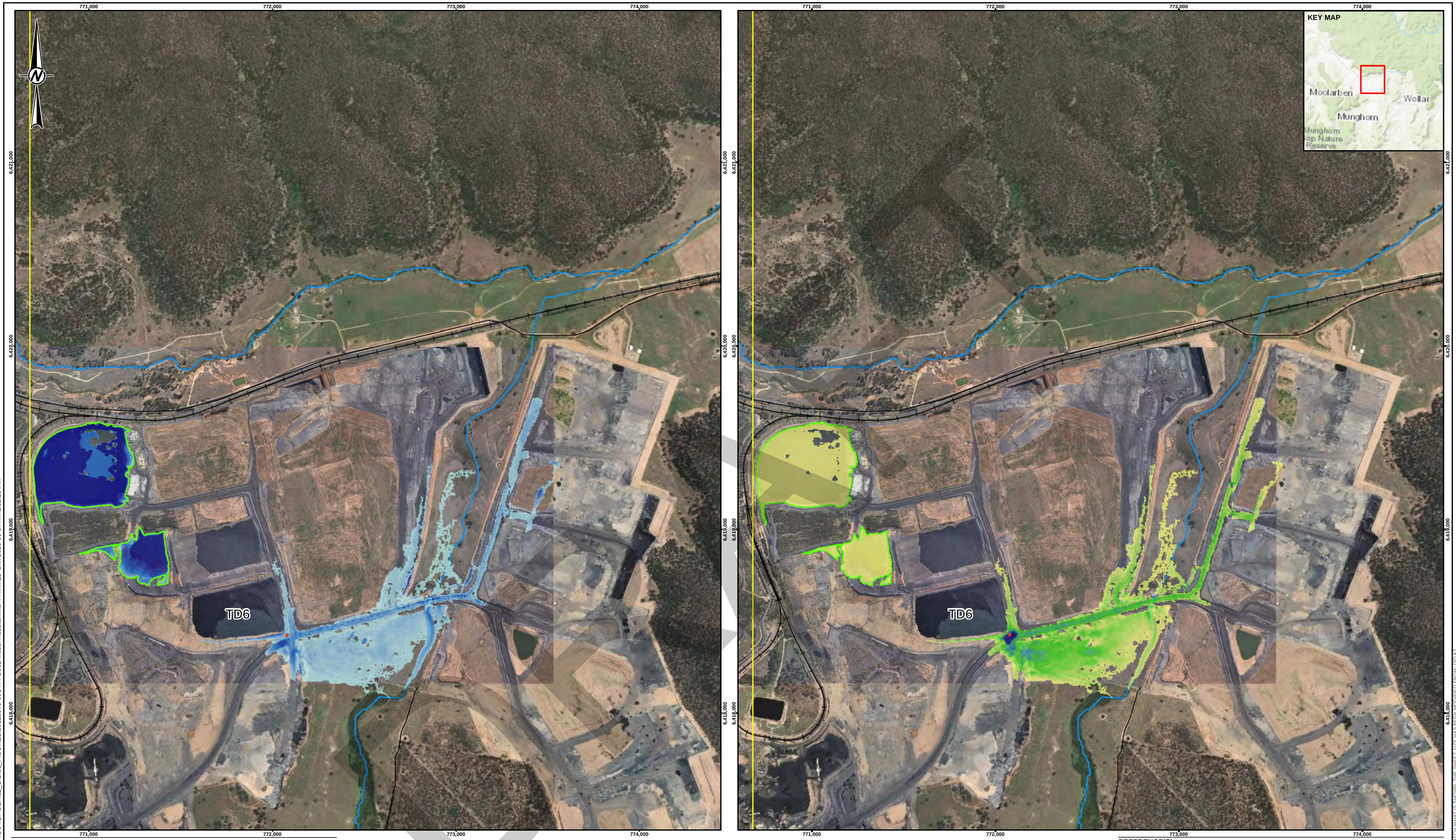

Scenario 1
Flow (m3/s)
Water Level (m)
Time (hr)
Total Inflow
Breach Outflow
Spillway Outflow
Crest Overflow
Total Outflow
Water Level


Scenario 2
Flow (m3/s)
Water Level (m)
Time (hr)
Total Inflow
Breach Outflow
Spillway Outflow
Crest Overflow
Total Outflow
Water Level


Scenario 3
Flow (m3/s)
Water Level (m)
Time (hr)
Total Inflow
Breach Outflow
Spillway Outflow
Crest Overflow
Total Outflow
Water Level

APPENDIX C

Flood Inundation Maps



LEGEND

Model Domain	**Depth (m)**	1.75 - 2.00	3.75 - 4.00	**Velocity (m/s)**	3.5 - 4.0	7.5 - 8.0
Initial Ponded Water	< 0.25	2.00 - 2.25	4.00 - 4.25	< 0.5	4.0 - 4.5	8.0 - 8.5
Breach Location	0.25 - 0.50	2.25 - 2.50	4.25 - 4.50	0.5 - 1.0	4.5 - 5.0	8.5 - 9.0
Railways	0.50 - 0.75	2.50 - 2.75	4.50 - 4.75	1.0 - 1.5	5.0 - 5.5	9.0 - 9.5
Roads	0.75 - 1.00	2.75 - 3.00	4.75 - 5.00	1.5 - 2.0	5.5 - 6.0	9.5 - 10.0
Watercourses	1.00 - 1.25	3.00 - 3.25	> 5.00	2.0 - 2.5	6.0 - 6.5	> 10.0
	1.25 - 1.50	3.25 - 3.50		2.5 - 3.0	6.5 - 7.0	
	1.50 - 1.75	3.50 - 3.75		3.0 - 3.5	7.0 - 7.5	

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Key Map Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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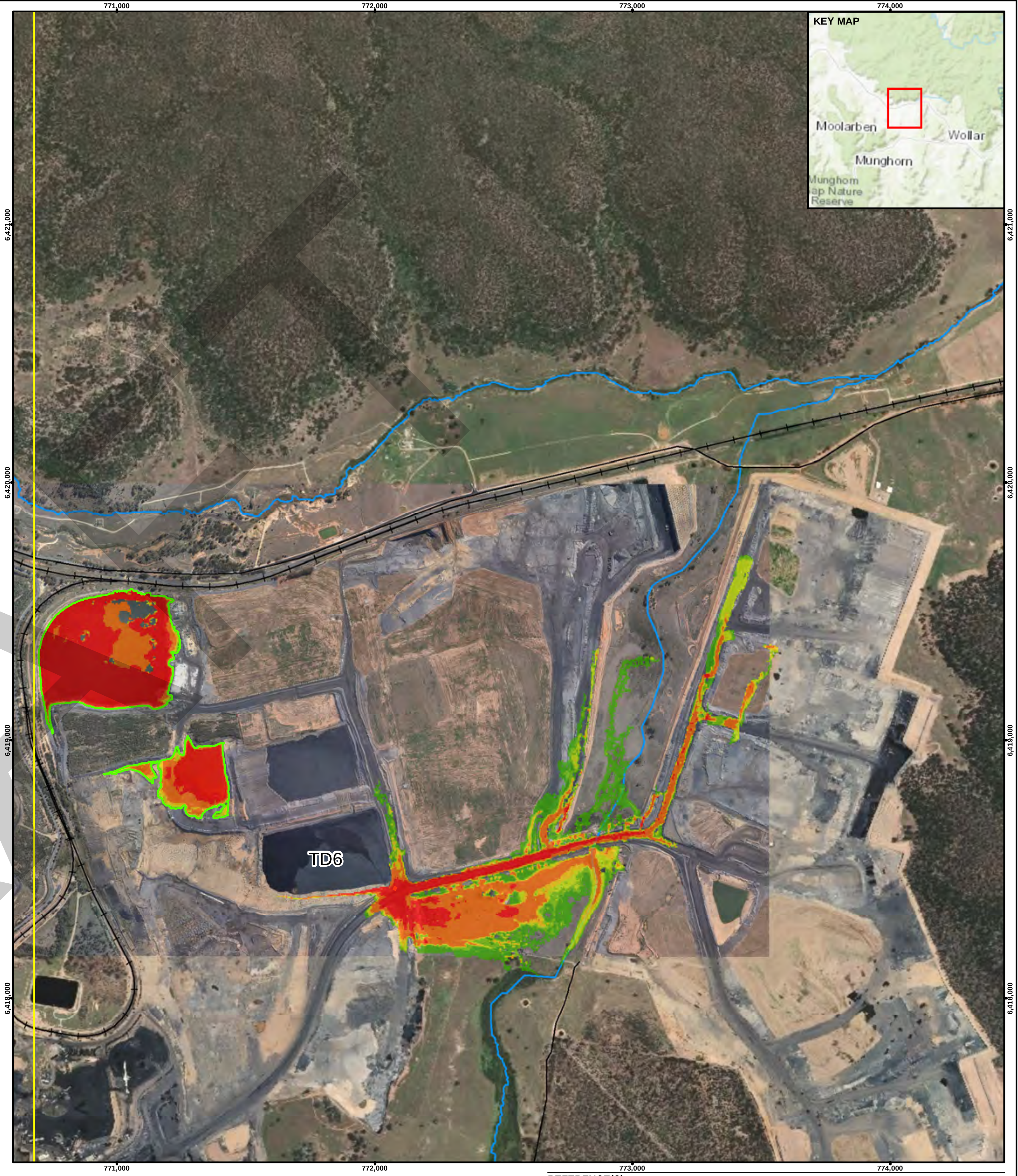
PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

CONSULTANT
GOLDER

DD-MM-YYYY	07-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

TITLE
SCENARIO 1 HYDRAULIC RESULTS:
FLOOD INUNDATION DEPTH (LEFT)
FLOOD VELOCITY (RIGHT)

PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	C001



LEGEND

Model Domain	**DV (m2/s)**	3.5 - 4.0	7.5 - 8.0	**Flood Severity**
Initial Ponded Water	< 0.5	4.0 - 4.5	8.0 - 8.5	H1
Breach Location	0.5 - 1.0	4.5 - 5.0	8.5 - 9.0	H2
Railways	1.0 - 1.5	5.0 - 5.5	9.0 - 9.5	H3
Roads	1.5 - 2.0	5.5 - 6.0	9.5 - 10.0	H4
Watercourses	2.0 - 2.5	6.0 - 6.5	> 10.0	H5
	2.5 - 3.0	6.5 - 7.0		H6
	3.0 - 3.5	7.0 - 7.5		

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

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1:20,000 @ A3 METRES

REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Key Map Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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GOLDER

DD-MM-YYYY	07-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

TITLE
SCENARIO 1 HYDRAULIC RESULTS:
DEPTH-VELOCITY PRODUCT (DV) (LEFT)
FLOOD SEVERITY (RIGHT)

PROJECT NO.	CONTROL	REV.	FIGURE
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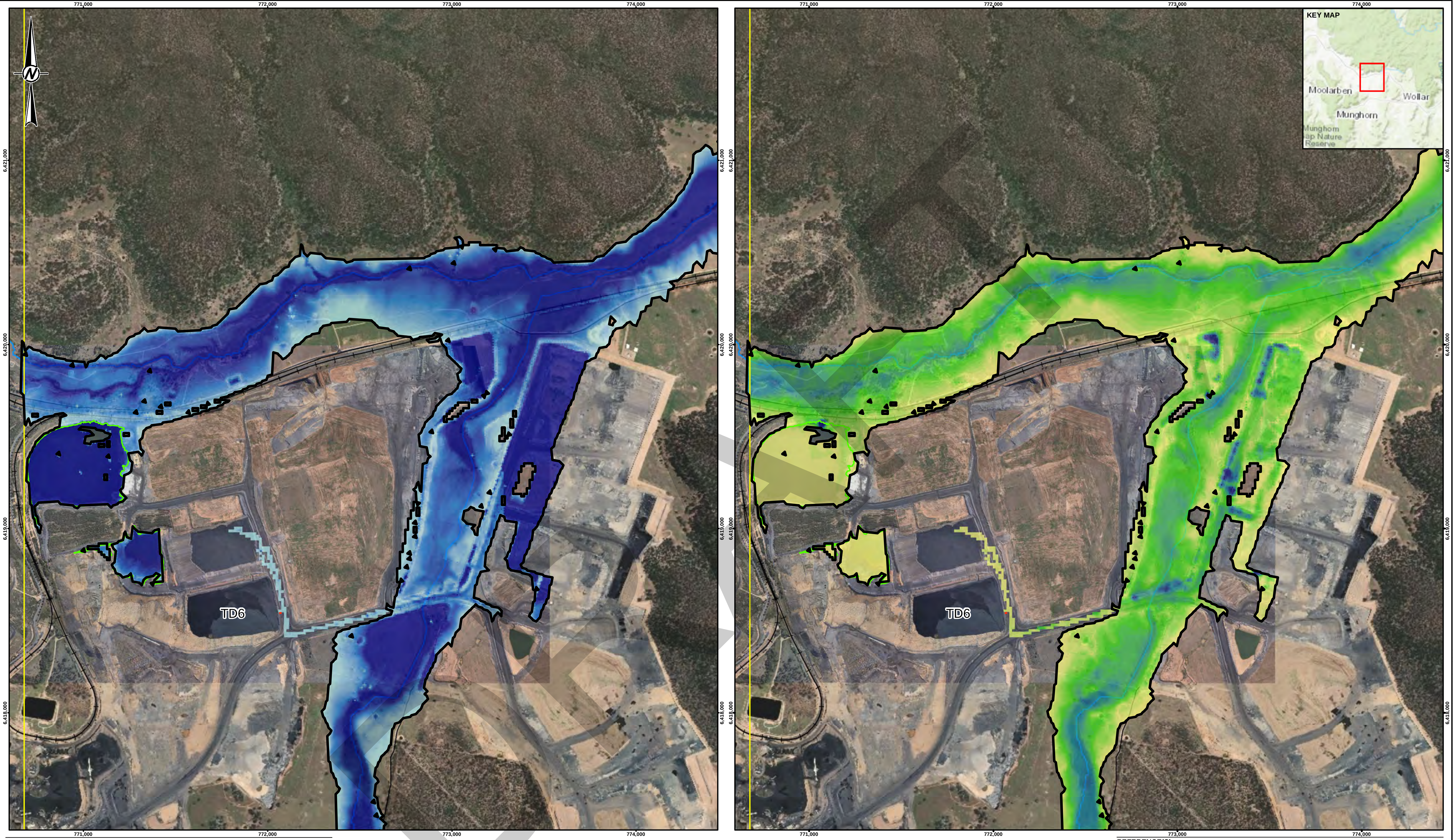

LEGEND

Model Domain	**Depth (m)**			
Initial Ponded Water	< 0.25	1.75 - 2.00	3.75 - 4.00	
Background Flood Extent	0.25 - 0.50	2.00 - 2.25	4.00 - 4.25	
Breach Location	0.50 - 0.75	2.25 - 2.50	4.25 - 4.50	
Railways	0.75 - 1.00	2.50 - 2.75	4.50 - 4.75	
Roads	1.00 - 1.25	2.75 - 3.00	4.75 - 5.00	
Watercourses	1.25 - 1.50	3.00 - 3.25	> 5.00	
	1.50 - 1.75	3.25 - 3.50		
		3.50 - 3.75		

Velocity (m/s)		
< 0.5	3.5 - 4.0	7.5 - 8.0
0.5 - 1.0	4.0 - 4.5	8.0 - 8.5
1.0 - 1.5	4.5 - 5.0	8.5 - 9.0
1.5 - 2.0	5.0 - 5.5	9.0 - 9.5
2.0 - 2.5	5.5 - 6.0	9.5 - 10.0
2.5 - 3.0	6.0 - 6.5	> 10.0
3.0 - 3.5	6.5 - 7.0	
	7.0 - 7.5	

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

0 250 500 750
1:20,000 @ A3 METRES

REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Key Map Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

CLIENT
PEABODY ENERGY

PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

CONSULTANT
GOLDER

DD-MM-YYYY	07-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

TITLE
SCENARIO 2 HYDRAULIC RESULTS:
FLOOD INUNDATION DEPTH (LEFT)
FLOOD VELOCITY (RIGHT)

PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	C003

PATH: V:\Peabody\Wilpinjong Coal Mine\99_PROJECTS\19128879 - TD6 TSF DBA\11_GIS\01_FIGURES\19128879-001-R-FC003 Model Results.mxd PRINTED ON: 2020-05-07 AT: 2:02:10 PM

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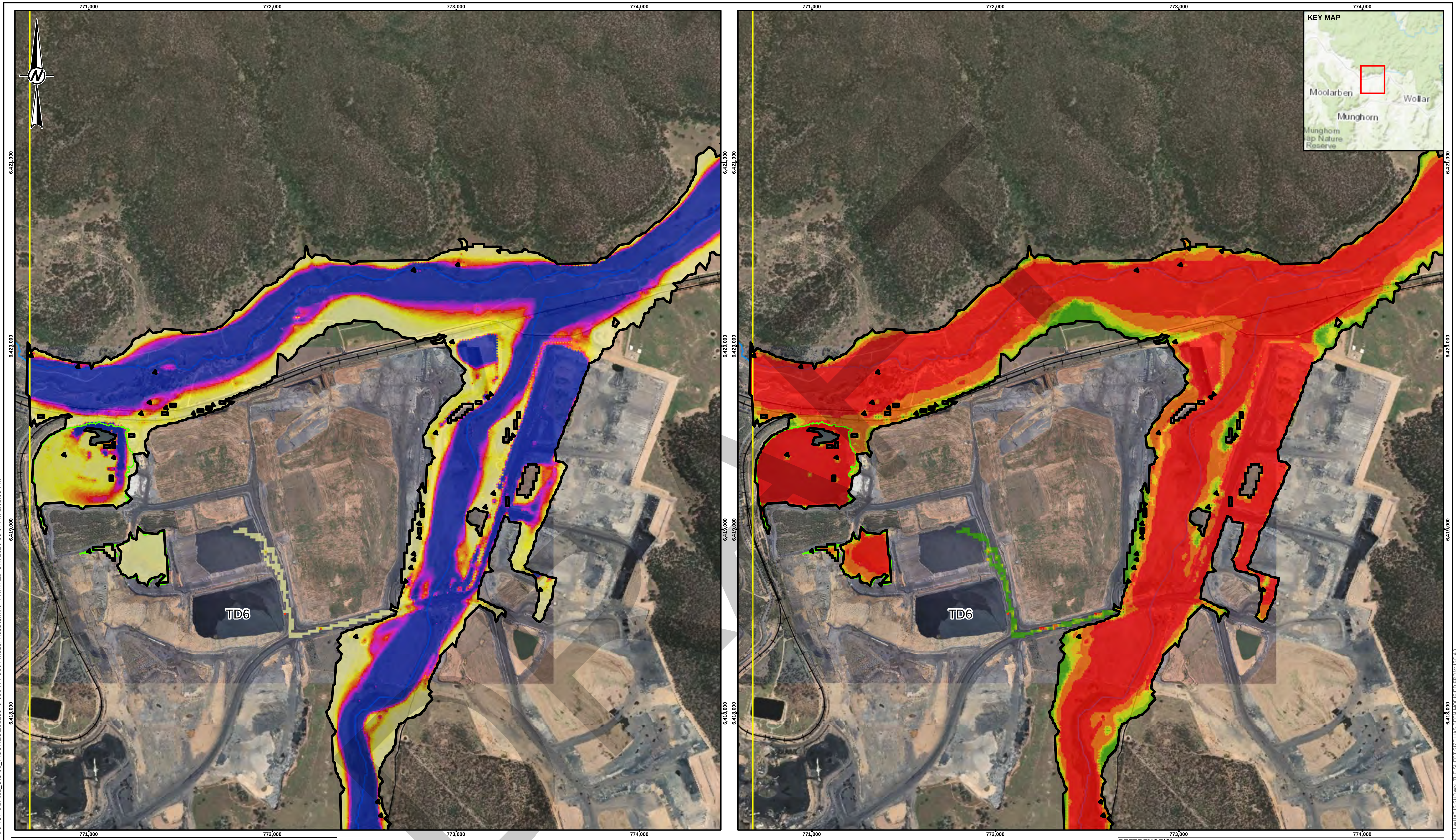

LEGEND

	DV (m2/s)			Flood Severity
Model Domain	< 0.5	3.5 - 4.0	7.5 - 8.0	H1
Initial Ponded Water	0.5 - 1.0	4.0 - 4.5	8.0 - 8.5	H2
Background Flood Extent	1.0 - 1.5	4.5 - 5.0	8.5 - 9.0	H3
Breach Location	1.5 - 2.0	5.0 - 5.5	9.0 - 9.5	H4
Railways	2.0 - 2.5	5.5 - 6.0	9.5 - 10.0	H5
Roads	2.5 - 3.0	6.0 - 6.5	> 10.0	H6
Watercourses	3.0 - 3.5	6.5 - 7.0		
		7.0 - 7.5		

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

0 250 500 750
1:20,000 @ A3 METRES

REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Key Map Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
3. Key Map Image Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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GOLDER

DD-MM-YYYY	07-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

TITLE
SCENARIO 2 HYDRAULIC RESULTS:
DEPTH-VELOCITY PRODUCT (DV) (LEFT)
FLOOD SEVERITY (RIGHT)

PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	C004

PATH: V:\Peabody\Wilpinjong Coal Mine\99_PROJECTS\19128879 - TD6 TSF DBA\11_GIS\01_FIGURES\19128879-001-R-FC004 Model Results.mxd PRINTED ON: 2020-05-07 AT: 2:01:53 PM

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25mm
0

LEGEND

- Model Domain
- Initial Ponded Water
- Breach Location
- Railways
- Roads
- Watercourses

Depth (m)			Velocity (m/s)		
< 0.25	1.75 - 2.00	3.75 - 4.00	< 0.5	3.5 - 4.0	7.5 - 8.0
0.25 - 0.50	2.00 - 2.25	4.00 - 4.25	0.5 - 1.0	4.0 - 4.5	8.0 - 8.5
0.50 - 0.75	2.25 - 2.50	4.25 - 4.50	1.0 - 1.5	4.5 - 5.0	8.5 - 9.0
0.75 - 1.00	2.50 - 2.75	4.50 - 4.75	1.5 - 2.0	5.0 - 5.5	9.0 - 9.5
1.00 - 1.25	2.75 - 3.00	4.75 - 5.00	2.0 - 2.5	5.5 - 6.0	9.5 - 10.0
1.25 - 1.50	3.00 - 3.25	> 5.00	2.5 - 3.0	6.0 - 6.5	> 10.0
1.50 - 1.75	3.25 - 3.50		3.0 - 3.5	6.5 - 7.0	
	3.50 - 3.75			7.0 - 7.5	

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

0 250 500 750
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REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Key Map Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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CLIENT
PEABODY ENERGY

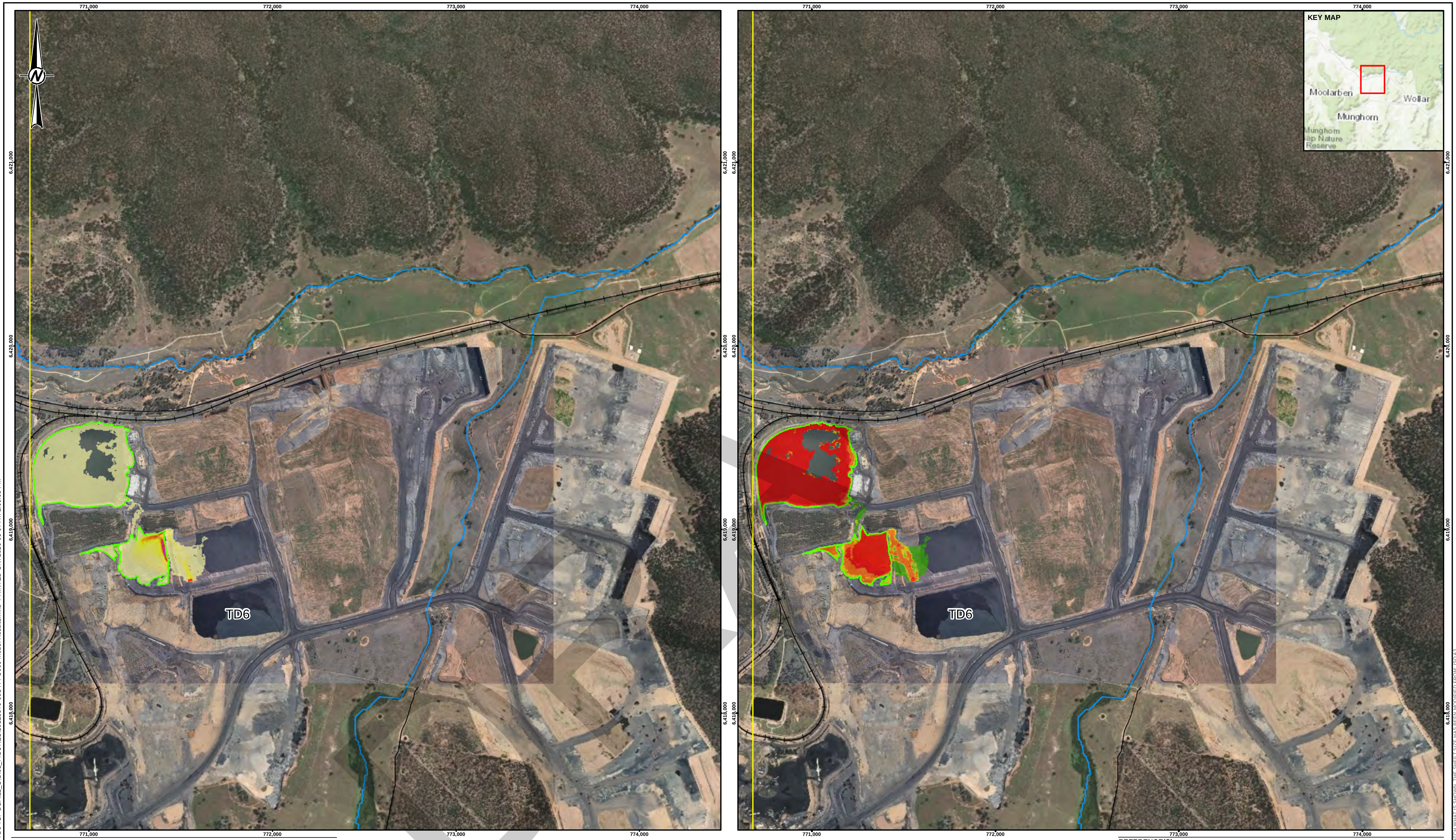
PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

CONSULTANT
GOLDER

DD-MM-YYYY	07-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

TITLE
SCENARIO 3 HYDRAULIC RESULTS:
FLOOD INUNDATION DEPTH (LEFT)
FLOOD VELOCITY (RIGHT)

PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	C005



LEGEND

- Model Domain
- Initial Ponded Water
- Breach Location
- Railways
- Roads
- Watercourses

DV (m2/s)

- < 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 2.5
- 2.5 - 3.0
- 3.0 - 3.5
- 3.5 - 4.0
- 4.0 - 4.5
- 4.5 - 5.0
- 5.0 - 5.5
- 5.5 - 6.0
- 6.0 - 6.5
- 6.5 - 7.0
- 7.0 - 7.5
- 7.5 - 8.0
- 8.0 - 8.5
- 8.5 - 9.0
- 9.0 - 9.5
- 9.5 - 10.0
- > 10.0

Flood Severity

- H1
- H2
- H3
- H4
- H5
- H6

Coordinate System: GDA 1994 MGA Zone 55
Projection: Transverse Mercator
Datum: GDA 1994

0 250 500 750
1:20,000 @ A3 METRES

REFERENCE(S)
1. Aerial Image over mine site provided by Client ("WILP-0287_DSC_PIT_PLAN.pdf")
2. Key Map Image Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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GOLDER

DD-MM-YYYY	07-05-2020
DESIGNED	MP
PREPARED	MP
REVIEWED	NM
APPROVED	NM

PROJECT
TD6 TSF DAM BREAK ASSESSMENT
WILPINJONG MINE

TITLE
SCENARIO 3 HYDRAULIC RESULTS:
DEPTH-VELOCITY PRODUCT (DV) (LEFT)
FLOOD SEVERITY (RIGHT)

PROJECT NO.	CONTROL	REV.	FIGURE
19128879	001	0	C006

PATH: V:\Peabody\Wilpinjong Coal Mine\99_PROJECTS\19128879 - TD6 TSF DBA\11_GIS\01_FIGURES\19128879-001-R-FC006 Model Results.mxd PRINTED ON: 2020-05-07 AT: 2:06:08 PM

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APPENDIX D

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Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

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APPENDIX D

Geochemical tailings characterisation

REPORT

Preliminary Geochemical Characterisation of Tailings for Tailings Storage Facility TD6 - Stage 2

Peabody Australia

Submitted to:

Clark Potter

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Wilpinjong NSW 2850

Submitted by:

Golder Associates Pty Ltd

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19129935-012-R-Rev0

20 November 2020

Distribution List

1 electronic copy - Peabody Energy Australia Pty Ltd

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TABLES

APPENDICES

1.0 INTRODUCTION

Peabody Energy Australia Pty Ltd (Peabody) has engaged Golder Associates Pty Ltd (Golder) to conduct a preliminary geochemical characterisation for tailings storage facility (TSF) TD6 at the Wilpinjong Coal Mine. TD6 was commissioned in 2014 and is an in-pit TSF with embankments constructed from waste rock. Representatives of the NSW Resources Regulator have recently inspected the Wilpinjong Coal Mine TSF as part of the Regulator’s Target Assessment Program. Following this inspection, the NSW Resources Regulator issued Peabody an Assessment Outcome letter (the letter) identifying items of concern and advising Peabody is required to complete a risk assessment. In an email dated 12 May 2020, Clark Potter of Peabody requested Golder conduct the required Risk Assessment with the objective of addressing the items of concern presented in the letter. In this regard Peabody require a preliminary geochemical characterisation of tailings for TSF TD6.

Previous geochemical assessments have been conducted on overburden, coal washery wastes (EGi 2005), and tailings from TSFs TD3, TD4 and TD5 (Golder 2015, 2018) at the Wilpinjong Coal Mine. Section 3.3.1 of the Mine Operations Plan (MOP) (WCPL 2014a) defines the coarse rejects as having low risk of acid generation and being non-saline, while tailings are recognised as having a low risk of acid generation.

1.1 Objectives

- Assess the geochemical characteristics of the tailings
- Classify the tailings according to risk of AMD

1.2 Scope of work

Original scope

- Review previous geochemical assessments, including the assessments carried out by Golder in 2015 and 2017 (references 1530126-001-R-RevA, dated 18 August 2015 and 1784584-003-R-RevA, dated 30 July 2018).
- Liaise with laboratory and interpret analysis results; and
- Preliminary geochemical characterisation and risk assessment.

Updated/extended scope

Stage 1 analytical results (reference 19129935-009-R-RevA, dated 09 September 2020) indicate elevated carbon content in the tailings. While carbon in coal tailings is expected, the elevated carbon content in the Wilpinjong tailings (36.9% - 65.2%) induced anomalous response in the net acid generation test (NAG), which is one of two tests used to determine risk classification. The purpose of the updated/extended scope is to analyse the carbon content of the tailings to determine its impact on geochemical stability. To address the uncertainty and provide more confidence in the classification method, four new tests were performed which generally aim to determine the extent that organic carbon contributes to acidity.

2.0 METHODS

This section presents the methods used to select and analyse samples for the geochemical assessment.

2.1 Sample selection

In total, eight samples were selected (from previously characterised samples in Stage 1) due to the uncertainty regarding the impact of organic matter and to assess the readily available ANC and the kinetics of sulphide oxidation and acid generation. Seven samples were classified as uncertain (UC) and one sample was classified as PAF in Phase 1. The samples were collected from the conveyor belt between the Coal Handling and Preparation Plant (CHPP) and represent materials from:

- Pits 1, 2, 3 and 6
- Coal handling and preparation plant
- Belt press filter plant
- Reject bin

The samples were reserved at ALS Limited's (ALS) Brisbane premises.

2.2 Analytical methods

Static tests represent short-term laboratory procedures that are used to assess the geochemical characteristics of solid samples and are typically the first of three stages of investigation to assess the geochemical characteristics of the material.

The geochemical assessment has been undertaken in line with industry best practice. Relevant guidelines include:

- Preventing Acid and Metalliferous Drainage, Leading Practice Sustainable Development Program in the Mining Industry, Department of Foreign Affairs and Trade (DFAT), 2016.
- AMIRA method, Acid Rock Drainage Test Handbook. Project P387A Prediction and Control of Acid Metalliferous Drainage, 2002.
- Mine Environment Neutral Drainage Program (MEND). Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials, Report 1.20.1, 2009

In accordance with the above guidelines, the following static analytical tests were performed in Stage 1:

- $pH_{(1:5)}$ and electrical conductivity $(EC)_{(1:5)}$ measurement
- Sulphide sulphur assay (Chromium Reducible Sulphur (CRS))
- Maximum potential acidity (MPA) calculated as 30.6 kg H_2SO_4/t per 1% sulphur
- Net Acid Producing Potential (NAPP) calculated as MPA – ANC = NAPP
- Total Organic Carbon (TOC) and Total Carbon (TC)
- Single addition Net Acid Generation (NAG) testing
- Sequential NAG testing
- Acid Neutralising Capacity (ANC) determination
- Exchangeable cations
- Trace Metal / Whole Rock Analysis on Solids
- Deionised (DI) water leach
- Multi-element analysis of leachate extracts including metals – full suite by ICP-MS, major cations and anions

In Stage 2, the following static analytical tests were performed:

- Total Organic Carbon (TOC) and sulphate from the sequential NAG solutions
- Kinetic NAG
- Acid Buffering Characteristic Curve (ABCC) Test

These methods are described further in Appendix A.

2.3 Quality assurance and quality control

The quality assurance and quality control (QA/QC) program for the analysis of TSF TD6 tailings includes data entry checks, review and senior review as well as the examination of the QC reports issued by the external subcontracted laboratories.

Four method blanks (TOC) had blank results from 8 to 9 mg/L, exceeding permitted value (1 mg/L). However, these blank results are significantly lower than the TOC results from stage 1 to stage 3, of which the majority of S was released. Thus, they do not affect the assessment of the OM impact.

ALS reported that one matrix spike recovery could not be determined as background levels was greater than or equal to four times the spike level. This was reported for one sulphate analysis.

Review of the laboratory results indicates that the data is considered sufficiently reliable to achieve the objectives of this assessment.

Laboratory certificates are available in Appendix B.

3.0 RESULTS

3.1 TOC and sulphate from sequential NAG solutions

Sequential NAG tests were performed on the samples and the resulting liquor solutions were analysed for TOC and sulphate to assess the impact of organic carbon (OC) on NAG results (Table 1). Detailed results are presented in Appendix B. The concentration of sulphate measured in each of the sequential NAG test solutions shows that the oxidation of sulphide in most samples completed after stage 3. Acid generation after stage 3 was attributed to organic acids.

Table 1: TOC and sulphate from sequential NAG solutions

Sequential NAG	A PIT 3 N/S	B1 PIT 6 N/S	B1/A/E PIT 1 N/S	B23 SP8 D/S	B23 SP8 N/S	COAL B1/E1 D/S	COAL M4 RIA STOCKPILE N/S
SO_4 (mg/L) - stage 1	93	125	129	126	92	59	120
SO_4 (mg/L) - stage 2	46	64	56	20	20	104	67
SO_4 (mg/L) - stage 3	22	20	18	7	6	48	11
SO_4 (mg/L) - stage 4	4	2	4	1	2	12	2
SO_4 (mg/L) - stage 5	<1	<1	<1	<1	<1	2	<1
TOC (mg/kg) - stage 1	102	98	107	512	747	40	126
TOC (mg/kg) - stage 2	271	153	205	774	624	120	206
TOC (mg/kg) - stage 3	274	76	197	282	177	282	102
TOC (mg/kg) - stage 4	35	20	41	53	39	76	18
TOC (mg/kg) - stage 5	12	13	14	18	15	37	10
% of total S oxidised - stage 1	56.4	61.3	65.2	77.8	62.6	27.7	62.5
% of total S oxidised - stage 2	27.9	31.4	28.3	12.3	13.6	48.8	34.9
% of total S oxidised - stage 3	13.3	9.8	9.1	4.3	4.1	22.5	5.7

Sequential NAG	A PIT 3 N/S	B1 PIT 6 N/S	B1/A/E PIT 1 N/S	B23 SP8 D/S	B23 SP8 N/S	COAL B1/E1 D/S	COAL M4 RIA STOCKPILE N/S
% of total S oxidised - stage 4	2.4	1.0	2.0	0.6	1.4	5.6	1.0
% of total S oxidised - stage 5	0.6	0.5	0.5	0.6	0.7	0.9	0.5
Total %S oxidised	100.6	103.9	105.1	95.7	82.3	105.6	104.7

3.2 Kinetic NAG

Kinetic NAG results for eight samples are presented in Appendix C. Kinetic NAG tests record pH and temperature while the test runs (over the 6 hours).

All tested samples reached pH 4 between less than 10 to 260 minutes, with 6/8 samples reaching pH 4 after less than 60 minutes and 3/8 samples reached pH 4 less than 30 minutes. The samples then reached a final average pH of 3.1 after 360 minutes. Results of the Kinetic NAG tests are similar to the results of the NAG tests.

3.3 Acid Buffering Characteristic Curve (ABCC) Test

The results from the ABCC testing are shown in Appendix D. The majority of samples reached a pH of 4 between 2.5 to 8.3 kg H_2SO_4/t. In all cases, the samples either started acidic, or quickly became acidic during titration, indicating that samples had inefficient or ineffective ANC reactivity or there was little acid neutralisation capacity in the tested material.

4.0 DISCUSSION

Sequential NAG test observations and discussion:

- Sulphide oxidation was generally completed within the first three extractions (evidenced by presence of sulphate).
- Additional extractions continued to generate acid – which occurred via oxidation of organic matter (evidenced by lack of sulphate).
- After stage 3, sulphur or sulphide (as pyrite) was ruled out as the source of acid by comparing total NAG pH acid generated at pH 7.0 against NAPP (Table 2) ,and TOC and sulphate results (Appendix E) – the difference (between the first and last column on right) indicates that there is a very large difference in the acid generated by sulphur bearing minerals and the acid measured in the NAG pH test.
- Organic acids could be formed during the peroxide oxidation (NAG test), causing interference with NAG test results; but Golder does not expect that these acids will form under expected environmental conditions in situ (and therefore are not considered a risk contributing to AMD).

Table 2: Net acid generated (from NAG test) results compared to NAPP (based on TS)

Sample	NAG pH (7.0) (kgH2SO4/t)	NAPP (kg H2SO4/t)	Difference (kg H2SO4/t)
Coal M4 RIAStockpile	91.2	-3.3	94.5
A PIT 3 N/S	124	0.2	123.8
B1 PIT 6 N/S	58.7	-10.8	69.5
B1/A/E PIT 1 N/S	104	-0.4	104.4
B23 SP8 D/S	222	3.9	218.1
B23 SP8 N/S	185	-3.4	188.4
COAL B1/E1 D/S	128	2.3	125.7

Kinetic NAG test observations and discussion:

- Progression to acidic state was steady with short lag time (generally indicative that there is relatively little acid neutralisation capacity or ANC reactivity was too slow to make a difference).
- Temperature was steady on all but one sample – acid generation from organic matter is not exothermic, while sulphide oxidation is exothermic, steady temperatures indicate acid generation from organic matter rather than sulphide oxidation.
- For more information on kinetic NAG testing, see Stewart et al (2006).

Acid base characteristic curve (ABCC) observations and discussion:

- Acid neutralisation capacity was limited in all samples (ineffective, inefficient).
- Carbon present in the tailings is mainly organic. The inorganic carbon it is not associated with calcium or magnesium containing carbonates (which are known sources of acid neutralisation capacity with high reactivity).

Classification:

Based on the aggregated results of the NAG pH test results (NAG pH significantly impacted by organic carbon), an alternate classification system was required that did not use NAG pH as part of the criteria.

An alternate classification scheme was adopted which uses the ANC:MPA ratio (MEND 2009, Table 3). Note that conversions between north American methods and Australian methods were required for this assessment:

- NP:AP ratio is assumed to be equivalent to ANC:MPA

Table 3: Classification criteria using ANC:MPA (MEND 2009)

Classification	ANC:MPA
Non-acid forming (NAF)*	> 2
Potentially acid forming (PAF)*	< 1
Uncertain (UC)	1-2

*Note: names are changed to Australian method to avoid confusion.

Classification of the tailings samples (and bulk classification) is shown in Table 4. Golder observes that tailings samples from the same location (e.g. Pit 3) have produced significantly different ANC:MPA ratios; this is due to sample heterogeneity. Golder notes that a robust and mature characterisation program will provide statistically relevant confidence and quantification of the heterogeneity (see section 5.2).

Table 4: Sample classification (MPA = S% *30.6kg H_2SO_4/t per 1%)

Sample	Sample description	CRS (%S)	ANC (kg H_2SO_4/t)	MPA (kg H_2SO_4/t) [1]	NAPP (kg H_2SO_4/t) [2]	ANC:MPA ratio	Classification (Stage 2) [3]
A PIT 3 D/S	A Coal, Pit 3, day shift	0.764	17.7	23.4	5.7	0.8	PAF
A PIT 3 N/S	A Coal, Pit 3, night shift	0.229	16.6	7.0	-9.6	2.4	NAF
B1 PIT 6 N/S	B1 Coal, Pit 6, night shift	0.342	31.6	10.5	-21.1	3.0	NAF
B1/A/E PIT 1 N/S	B1/A/E Coal, Pit 6, night shift	0.346	20.6	10.6	-10.0	1.9	UC
B23 SP8 D/S	B23 Coal, day shift	0.192	12.6	5.9	-6.7	2.1	NAF
B23 SP8 N/S	B23 Coal, night shift	0.126	18.4	3.9	-14.5	4.8	NAF
COAL B1/E1 D/S	B1/E1 Coal, day shift	0.358	19.4	11.0	-8.4	1.8	UC
COAL M4 RIA STOCKPILE N/S	M4 Coal, night shift	0.31	22.9	9.5	-13.4	2.4	NAF
E PIT 2 D/S	E Coal, Pit 2, day shift	0.871	15.8	26.7	10.9	0.6	PAF
G PIT 1 D/S	G Coal, Pit 1, day shift	0.937	17.2	28.7	11.5	0.6	PAF
Average		0.448	19.3	13.7	-5.6	1.4	UC
95th Percentile (S%)		0.907	19.3*	27.8	0.1	0.7	PAF

*Note that for the conservative estimate, the 95th percentile S% is compared against the average ANC of the tailings.

[1] Calculated using CRS

[2] Calculated using CRS

[3] MEND 2009 classification

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The results of the stage 2 tailings risk assessment by classification are:

- 3/10 samples are PAF (samples from Pits 1, 2 and 3)
- 5/10 samples are NAF (samples from Pit 3, 6, B23 Coal and M4 Coal)
- 2/10 samples are still uncertain (UC) (samples from Pit 1 and B1/E1 Coal).

The classification method employed (Section 4.0), has significantly reduced the number of samples with an "uncertain" classification when compared to Stage 1.

The results of the risk assessment for the tailings, assuming the samples are representative of the material, and assuming the number of samples is representative of the quantity of each material source, the *average* classification is UC (Uncertain).

Golder finds the average response to be of limited value, considering it is not the average tailings that generate the bulk of geochemical risk or impact, indeed, it is more important to consider the more conservative estimates of material in order to gauge risk. On this basis, Golder suggests using the 95th percentile of sulphide sulphur to generate a more conservative estimate of the tailings risk (Table 4), which is common practice. The 95th percentile tailings risk classification is PAF (potentially acid forming).

Golder concludes that the geochemical data available is limited and should be advanced to statistically relevant confidence levels so that the tailings characterisation can be confirmed with more confidence and, if required, management measures be developed.

Golder notes that there are handling and/or storage methodologies that are proven to delay or avoid sulphide oxidation and AMD production:

- Reducing oxygen ingress by covers (reduced gas penetration and flux)
- Reducing oxygen availability (diffusion – i.e. aqueous cover)
- Reducing transport of reaction products (limiting water infiltration)
- Improving availability of neutralisation potential (blending with high ANC material)

More information about handling of reactive material can be found in the GARD Guide (INAP 2009).

5.2 Recommendations

In accordance with standard geochemical testing and to reduce uncertainty, Golder recommends advanced geochemical characterisation on a sub-set of samples according to AMIRA (2002) which comprises kinetic test work (leach columns or humidity cell testing.

Kinetic testing should be carried out for 20 weeks to establish lag times to acidic conditions and or acid neutralisation; quantify and verify sulphide oxidation rates. Golder recommends consideration of a formalised geochemistry program which has the overarching aims to provide actionable intelligence about material reactivity, explore management options and inform closure and long-term geochemical stability.

In addition, Golder recommends additional monitoring:

- Due to the variability of tailings properties within the samples collected and analysed, Golder recommends ongoing tailings sampling and analysis on a monthly basis on tailings from the CHPP and reporting of results in an annual report. This should form part of a formalised geochemical testing program:

- If in-pit tailings are not saturated, water quality testing in associated pooled/seepage water to monitor for acidity.
- Consider monthly sampling at the CHPP to start developing a tailings 'static' database.

- Water movement (e.g. surface water) associated with the TSF should be monitored for rate or volume, and quality (for example at a seepage points downgradient of TD6), both through visual inspection and monitoring in line with Golder (2014) and WCPL (2014c). Golder however notes that Peabody has informed Golder that seepage downgradient of TD6 has mostly disappeared.
- Groundwater downstream of the tailings dams should continue to be monitored for salinity and AMD impact from the tailings in line with Golder (2014) and WCPL (2014c). The purpose of the monitoring is to assess whether (or quantify) the impact to receiving systems. If the water balance for the pit remains net negative, this is irrelevant. But if there is discharge, this impact should be observed and quantified.
- Blending NAF and PAF material is a reliable method of reducing acidification risk, but requires understanding of the material properties and conservative estimates to affect the desired outcome; Golder recommends advancing material characterisation to statistically relevant confidence levels prior to engaging in a blending study.

6.0 LIMITATIONS

Your attention is drawn to the document - "Limitations", which is included in Appendix F of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be, and to present you with recommendations on how to minimise the risks associated with the services provided for this project. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

7.0 REFERENCES

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8.0 ABBREVIATIONS

% - percentage

µS/cm – Microsiemens per centimetre

ABCC – Acid Buffering Characteristic Curve

AC – Acid Consuming

AMD – Acid Metalliferous Drainage

ANC – Acid Neutralising Capacity

ANZECC – Australian and New Zealand guidelines for Fresh and Marine Water Quality

CEC – Cation Exchange Capacity

CRS – Chromium Reducible Sulphur

DI - Deionised

EC – Electrical Conductivity

ESP – Exchangeable Sodium Percentage

GARD – Global Acid Rock Drainage

Golder – Golder Associates Pty Ltd

ICP-MS - Inductively Coupled Plasma Mass Spectrometry

Kg H_2SO_4/t – kilograms of sulphuric acid per tonne

LOM – Life Of Mine

LOR – Limit of Reporting

mg/L – milligrams per litre

meq/100g – milliequivalents per one hundred grams

MOP – Mine Operations Plan

MPA – Maximum Potential Acidity

N/A – Not Available

NAF – Non Acid Forming

NAG – Net Acid Generation

NAPP – Net Acid Producing Potential

PAF – Potentially Acid Forming

PAF-LC – Potentially Acid Forming – Low Capacity

ppm – parts per million

QA - Quality Assurance

QC - Quality Control

ROM – Run-Of-Mine

SPLP – Synthetic Precipitation Leaching Procedure

TOC – Total Organic Carbon

TSF – Tailings Storage Facility

UC – Uncertain

WCPL – Wilpinjong Coal Pty Limited

WHO – World Health Organisation

Signature Page

Golder Associates Pty Ltd

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https://golderassociates.sharepoint.com/sites/115081/project files/6 deliverables/012-r geochemical assessment - stage 2/rev0/19129935-012-r-rev0.docx

APPENDIX A

Laboratory Methods

NAG (Net Acid Generation)

Further NAG analysis was performed using the sequential NAG method (AMIRA, 2002). The sequential NAG follows the same procedure as the single NAG but in multiple stages (consisting of a series of single NAG tests). The sequential NAG repeats steps until “no further reaction is observed AND the filtered NAG solution has a pH greater than 4.5”. Sequential NAG is used to address incomplete oxidation of sulphide sulphur, impact of organic matter as well as the conflict between NAG and NAPP results. Sequential NAG analysis was conducted at ALS Environmental.

Kinetic NAG (Net Acid Generation)

Further NAG analysis was completed using the kinetic NAG method. The kinetic NAG follows the same procedure as the single NAG except that the temperature, pH and sometimes EC of the liquor are recorded. Variations in these parameters during the test provide an indication of the kinetics of sulphide oxidation and acid generation during the test. Kinetic NAG analysis was conducted at ALS Environmental.

Acid Buffering Characteristic Curve

The Acid Buffering Characteristic Curve (ABCC) test involves slow titration of a sample with acid while continuously monitoring pH. This data provides an indication of the portion of ANC within a sample that is readily available for acid neutralisation. This test is useful in assessing whether a sulfidic sample with NAPP <0 and NAG pH ≥ 4.5 has enough readily available carbonate to render it non-acid producing (AMIRA, 2002). Acid Buffering Characteristic Curve analysis was conducted at ALS Environmental.

APPENDIX B

Laboratory Certificates

CERTIFICATE OF ANALYSIS

Work Order	: **EB2028135**	Page	: 1 of 9
Amendment	: **1**		
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Brisbane
Contact	: Hong Vu	Contact	: Carsten Emrich
Address	: P O BOX 1734 MILTON QLD, AUSTRALIA 4064	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: ----	Date Samples Received	: 27-Oct-2020 14:54
Order number	: ----	Date Analysis Commenced	: 28-Oct-2020
C-O-C number	: ----	Issue Date	: 06-Nov-2020 10:52
Sampler	: ----		
Site	: ----		
Quote number	: EN/002/20		
No. of samples received	: 36		
No. of samples analysed	: 35		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

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

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- ALS is not NATA accredited for the performance of EN35: Miscellaneous Leaching procedure.
- Amendment (06/11/20): This report has been amended to alter the client entity from Wilpinjong to Golder. All analysis results are as per the previous report.
- EP005 (Total Organic Carbon): The method blank is positive due to the leaching fluid used.
- EA046 ABCC: NATA Acreditation does not cover the performance of this service.

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)			Client sample ID	A PIT 3 N/S Stage 1	B1 PIT 6 N/S Stage 1	B1/A/E PIT 1 N/S Stage 1	B23 SP8 D/S Stage 1	B23 SP8 N/S Stage 1
			Client sampling date / time	11-Jul-2020 00:00	13-Jul-2020 00:00	14-Jul-2020 00:00	18-Jul-2020 00:00	17-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	EB2028135-001	EB2028135-002	EB2028135-003	EB2028135-004	EB2028135-005
				Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	93	125	129	126	92
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	102	98	107	512	747

Analytical Results

Sub-Matrix: **LEACHATE**
(Matrix: **WATER**)

			Client sample ID	COAL B1/E1 D/S Stage 1	COAL M4 RIA STOCKPILE N/S Stage 1	A PIT 3 N/S Stage 2	B1 PIT 6 N/S Stage 2	B1/A/E PIT 1 N/S Stage 2
			Client sampling date / time	16-Jul-2020 00:00	12-Jul-2020 00:00	11-Jul-2020 00:00	13-Jul-2020 00:00	14-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	EB2028135-006	EB2028135-007	EB2028135-009	EB2028135-010	EB2028135-011
				Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**59**	**120**	**46**	**64**	**56**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**40**	**126**	**271**	**153**	**205**

Analytical Results

Sub-Matrix: **LEACHATE**
(Matrix: **WATER**)

Client sample ID				B23 SP8 D/S Stage 2	B23 SP8 N/S Stage 2	COAL B1/E1 D/S Stage 2	COAL M4 RIA STOCKPILE N/S Stage 2	A PIT 3 N/S Stage 3
Client sampling date / time				18-Jul-2020 00:00	17-Jul-2020 00:00	16-Jul-2020 00:00	12-Jul-2020 00:00	11-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	EB2028135-012	EB2028135-013	EB2028135-014	EB2028135-015	EB2028135-016
				Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**20**	**20**	**104**	**67**	**22**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**774**	**624**	**120**	**206**	**274**

Analytical Results

Sub-Matrix: **LEACHATE**
(Matrix: **WATER**)

Client sample ID				B1 PIT 6 N/S Stage 3	B1/A/E PIT 1 N/S Stage 3	B23 SP8 D/S Stage 3	B23 SP8 N/S Stage 3	COAL B1/E1 D/S Stage 3
Client sampling date / time				13-Jul-2020 00:00	14-Jul-2020 00:00	18-Jul-2020 00:00	17-Jul-2020 00:00	16-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	EB2028135-017	EB2028135-018	EB2028135-019	EB2028135-020	EB2028135-021
				Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**20**	**18**	**7**	**6**	**48**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**76**	**197**	**282**	**177**	**282**

Analytical Results

Sub-Matrix: **LEACHATE**
(Matrix: **WATER**)

			Client sample ID	COAL M4 RIA STOCKPILE N/S Stage 3	A PIT 3 N/S Stage 4	B1 PIT 6 N/S Stage 4	B1/A/E PIT 1 N/S Stage 4	B23 SP8 D/S Stage 4
			Client sampling date / time	12-Jul-2020 00:00	11-Jul-2020 00:00	13-Jul-2020 00:00	14-Jul-2020 00:00	18-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	EB2028135-022	EB2028135-023	EB2028135-024	EB2028135-025	EB2028135-026
				Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**11**	**4**	**2**	**4**	**1**
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**102**	**35**	**20**	**41**	**53**

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)			Client sample ID	B23 SP8 N/S Stage 4	COAL B1/E1 D/S Stage 4	COAL M4 RIA STOCKPILE N/S Stage 4	A PIT 3 N/S Stage 5	B1 PIT 6 N/S Stage 5
			Client sampling date / time	17-Jul-2020 00:00	16-Jul-2020 00:00	12-Jul-2020 00:00	11-Jul-2020 00:00	13-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	EB2028135-027	EB2028135-028	EB2028135-029	EB2028135-030	EB2028135-031
				Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**2**	**12**	**2**	<1	<1
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**39**	**76**	**18**	**12**	**13**

Analytical Results

Sub-Matrix: LEACHATE (Matrix: WATER)			Client sample ID	B1/A/E PIT 1 N/S Stage 5	B23 SP8 D/S Stage 5	B23 SP8 N/S Stage 5	COAL B1/E1 D/S Stage 5	COAL M4 RIA STOCKPILE N/S Stage 5
			Client sampling date / time	14-Jul-2020 00:00	18-Jul-2020 00:00	17-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	EB2028135-032	EB2028135-033	EB2028135-034	EB2028135-035	EB2028135-036
				Result	Result	Result	Result	Result
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	<1	2	<1
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	14	18	15	37	10

Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2028135**		Page	: 1 of 4
Amendment	: **1**			
Client	: **GOLDER ASSOCIATES**		Laboratory	: Environmental Division Brisbane
Contact	: Hong Vu		Contact	: Carsten Emrich
Address	: P O BOX 1734 MILTON QLD, AUSTRALIA 4064		Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----		Telephone	: +61 7 3552 8616
Project	: ----		Date Samples Received	: 27-Oct-2020
Order number	: ----		Date Analysis Commenced	: 28-Oct-2020
C-O-C number	: ----		Issue Date	: 06-Nov-2020
Sampler	: ----			
Site	: ----			
Quote number	: EN/002/20			
No. of samples received	: 36			
No. of samples analysed	: 35			

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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

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

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3335923)									
EB2028309-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	19	19	0.00	0% - 50%
EB2028139-002	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	1010	984	2.24	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3339918)									
EB2028135-009	A PIT 3 N/S Stage 2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	46	47	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3345264)									
EB2028135-016	A PIT 3 N/S Stage 3	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	22	22	0.00	0% - 20%
EB2028135-025	B1/A/E PIT 1 N/S Stage 4	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	4	0.00	No Limit
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3345265)									
EB2028135-036	COAL M4 RIA STOCKPILE N/S Stage 5	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.00	No Limit
EP005: Total Organic Carbon (TOC) (QC Lot: 3337145)									
EB2028135-001	A PIT 3 N/S Stage 1	EP005: Total Organic Carbon	----	1	mg/L	102	102	0.00	0% - 20%
EP005: Total Organic Carbon (TOC) (QC Lot: 3339992)									
EB2028135-009	A PIT 3 N/S Stage 2	EP005: Total Organic Carbon	----	1	mg/L	271	276	1.90	0% - 20%
EP005: Total Organic Carbon (TOC) (QC Lot: 3342783)									
EB2028135-016	A PIT 3 N/S Stage 3	EP005: Total Organic Carbon	----	1	mg/L	274	276	0.763	0% - 20%
EP005: Total Organic Carbon (TOC) (QC Lot: 3344820)									
EB2028135-023	A PIT 3 N/S Stage 4	EP005: Total Organic Carbon	----	1	mg/L	35	33	5.87	No Limit
EB2028135-032	B1/A/E PIT 1 N/S Stage 5	EP005: Total Organic Carbon	----	1	mg/L	14	14	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3335923)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	102	85.0	118
				<1	100 mg/L	94.4	85.0	118
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3339918)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	101	85.0	118
				<1	100 mg/L	94.7	85.0	118
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3345264)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	105	85.0	118
				<1	100 mg/L	101	85.0	118
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3345265)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	105	85.0	118
				<1	100 mg/L	96.8	85.0	118
EP005: Total Organic Carbon (TOC) (QCLot: 3337145)								
EP005: Total Organic Carbon	----	1	mg/L	# 8	10 mg/L	101	79.0	113
				# 8	100 mg/L	104	79.0	113
EP005: Total Organic Carbon (TOC) (QCLot: 3339992)								
EP005: Total Organic Carbon	----	1	mg/L	# 8	10 mg/L	98.1	79.0	113
				# 8	100 mg/L	108	79.0	113
EP005: Total Organic Carbon (TOC) (QCLot: 3342783)								
EP005: Total Organic Carbon	----	1	mg/L	# 9	10 mg/L	90.2	79.0	113
				# 9	100 mg/L	99.1	79.0	113
EP005: Total Organic Carbon (TOC) (QCLot: 3344820)								
EP005: Total Organic Carbon	----	1	mg/L	# 9	10 mg/L	96.3	79.0	113
				# 9	100 mg/L	100	79.0	113

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3335923)							
EB2028284-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	# Not Determined	70.0	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3339918)							
EB2028135-010	B1 PIT 6 N/S Stage 2	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	200 mg/L	106	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3345264)							
EB2028135-017	B1 PIT 6 N/S Stage 3	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	20 mg/L	105	70.0	130
EP005: Total Organic Carbon (TOC) (QCLot: 3337145)							
EB2028135-002	B1 PIT 6 N/S Stage 1	EP005: Total Organic Carbon	----	100 mg/L	100	70.0	130
EP005: Total Organic Carbon (TOC) (QCLot: 3339992)							
EB2028135-010	B1 PIT 6 N/S Stage 2	EP005: Total Organic Carbon	----	100 mg/L	104	70.0	130
EP005: Total Organic Carbon (TOC) (QCLot: 3342783)							
EB2028135-017	B1 PIT 6 N/S Stage 3	EP005: Total Organic Carbon	----	100 mg/L	95.7	70.0	130
EP005: Total Organic Carbon (TOC) (QCLot: 3344820)							
EB2028135-024	B1 PIT 6 N/S Stage 4	EP005: Total Organic Carbon	----	100 mg/L	94.1	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2028135**	Page	: 1 of 5
Amendment	: **1**		
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Brisbane
Contact	: Hong Vu	Telephone	: +61 7 3552 8616
Project	: ----	Date Samples Received	: 27-Oct-2020
Site	: ----	Issue Date	: 06-Nov-2020
Sampler	: ----	No. of samples received	: 36
Order number	: ----	No. of samples analysed	: 35

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Method Blank value outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Method Blank (MB) Values							
EP005: Total Organic Carbon (TOC)	QC-3337145-001	----	**Total Organic Carbon**	----	8 mg/L	1 mg/L	**Blank result exceeds permitted value**
EP005: Total Organic Carbon (TOC)	QC-3339992-001	----	**Total Organic Carbon**	----	8 mg/L	1 mg/L	**Blank result exceeds permitted value**
EP005: Total Organic Carbon (TOC)	QC-3342783-001	----	**Total Organic Carbon**	----	9 mg/L	1 mg/L	**Blank result exceeds permitted value**
EP005: Total Organic Carbon (TOC)	QC-3344820-001	----	**Total Organic Carbon**	----	9 mg/L	1 mg/L	**Blank result exceeds permitted value**
Matrix Spike (MS) Recoveries							
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA	EB2028284--001	Anonymous	**Sulfate as SO4 - Turbidimetric**	14808-79-8	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G)								
A PIT 3 N/S - Stage 3, B1/A/E PIT 1 N/S - Stage 3, B23 SP8 N/S - Stage 3, COAL M4 RIA STOCKPILE N/S - Stage 3, B1 PIT 6 N/S - Stage 4, B23 SP8 D/S - Stage 4, COAL B1/E1 D/S - Stage 4,	B1 PIT 6 N/S - Stage 3, B23 SP8 D/S - Stage 3, COAL B1/E1 D/S - Stage 3, A PIT 3 N/S - Stage 4, B1/A/E PIT 1 N/S - Stage 4, B23 SP8 N/S - Stage 4, COAL M4 RIA STOCKPILE N/S - Stage 4	**03-Nov-2020**	**----**	----	----	**04-Nov-2020**	01-Dec-2020	✓
Clear Plastic Bottle - Natural (ED041G)								
A PIT 3 N/S - Stage 5, B1/A/E PIT 1 N/S - Stage 5, B23 SP8 N/S - Stage 5, COAL M4 RIA STOCKPILE N/S - Stage 5	B1 PIT 6 N/S - Stage 5, B23 SP8 D/S - Stage 5, COAL B1/E1 D/S - Stage 5,	**04-Nov-2020**	**----**	----	----	**04-Nov-2020**	02-Dec-2020	✓
Clear Plastic Bottle - Natural (ED041G)								
A PIT 3 N/S - Stage 1, B1/A/E PIT 1 N/S - Stage 1, B23 SP8 N/S - Stage 1, COAL M4 RIA STOCKPILE N/S - Stage 1	B1 PIT 6 N/S - Stage 1, B23 SP8 D/S - Stage 1, COAL B1/E1 D/S - Stage 1,	**29-Oct-2020**	**----**	----	----	**29-Oct-2020**	26-Nov-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA - Continued								
Clear Plastic Bottle - Natural (ED041G)								
A PIT 3 N/S - Stage 2, B1/A/E PIT 1 N/S - Stage 2, B23 SP8 N/S - Stage 2, COAL M4 RIA STOCKPILE N/S - Stage 2	B1 PIT 6 N/S - Stage 2, B23 SP8 D/S - Stage 2, COAL B1/E1 D/S - Stage 2,	**30-Oct-2020**	**----**	----	----	**02-Nov-2020**	27-Nov-2020	✓
EP005: Total Organic Carbon (TOC)								
Amber TOC Vial - Sulfuric Acid (EP005)								
A PIT 3 N/S - Stage 3, B1/A/E PIT 1 N/S - Stage 3, B23 SP8 N/S - Stage 3, COAL M4 RIA STOCKPILE N/S - Stage 3	B1 PIT 6 N/S - Stage 3, B23 SP8 D/S - Stage 3, COAL B1/E1 D/S - Stage 3,	**03-Nov-2020**	**----**	----	----	**03-Nov-2020**	01-Dec-2020	✓
Amber TOC Vial - Sulfuric Acid (EP005)								
A PIT 3 N/S - Stage 4, B1/A/E PIT 1 N/S - Stage 4, B23 SP8 N/S - Stage 4, COAL M4 RIA STOCKPILE N/S - Stage 4	B1 PIT 6 N/S - Stage 4, B23 SP8 D/S - Stage 4, COAL B1/E1 D/S - Stage 4,	**03-Nov-2020**	**----**	----	----	**04-Nov-2020**	01-Dec-2020	✓
Amber TOC Vial - Sulfuric Acid (EP005)								
A PIT 3 N/S - Stage 5, B1/A/E PIT 1 N/S - Stage 5, B23 SP8 N/S - Stage 5, COAL M4 RIA STOCKPILE N/S - Stage 5	B1 PIT 6 N/S - Stage 5, B23 SP8 D/S - Stage 5, COAL B1/E1 D/S - Stage 5,	**04-Nov-2020**	**----**	----	----	**04-Nov-2020**	02-Dec-2020	✓
Amber TOC Vial - Sulfuric Acid (EP005)								
A PIT 3 N/S - Stage 1, B1/A/E PIT 1 N/S - Stage 1, B23 SP8 N/S - Stage 1, COAL M4 RIA STOCKPILE N/S - Stage 1	B1 PIT 6 N/S - Stage 1, B23 SP8 D/S - Stage 1, COAL B1/E1 D/S - Stage 1,	**29-Oct-2020**	**----**	----	----	**30-Oct-2020**	26-Nov-2020	✓
Amber TOC Vial - Sulfuric Acid (EP005)								
A PIT 3 N/S - Stage 2, B1/A/E PIT 1 N/S - Stage 2, B23 SP8 N/S - Stage 2, COAL M4 RIA STOCKPILE N/S - Stage 2	B1 PIT 6 N/S - Stage 2, B23 SP8 D/S - Stage 2, COAL B1/E1 D/S - Stage 2,	**30-Oct-2020**	**----**	----	----	**02-Nov-2020**	27-Nov-2020	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	6	46	**13.04**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	5	35	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	8	46	**17.39**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	8	35	**22.86**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	4	46	**8.70**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	4	35	**11.43**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	3	46	**6.52**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP005	4	35	**11.43**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	SOIL	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Total Organic Carbon	EP005	SOIL	In house: Referenced to APHA 5310 B, The automated TOC analyzer determines Total and Inorganic Carbon by IR cell. TOC is calculated as the difference. This method is compliant with NEPM Schedule B(3)

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
Leach Preparation	* EN35	SOIL	In house: Preparation of Soil / Liquid leaches as per client instructions.

	Samples	Sampled_Date_Time	Lab_Report_Number	Sequnetial NAG and analysis of NAG solution (SO4 and TOC)	Kinetic NAG and Acid Buffering Characteristics Curve
1	A PIT 3 N/S	11/07/2020	ES2025510	x	x
2	B1 PIT 6 N/S	13/07/2020	ES2025510	x	x
3	B1/A/E PIT 1 N/S	14/07/2020	ES2025510	x	x
4	B23 SP8 D/S	18/07/2020	ES2025510	x	x
5	B23 SP8 N/S	17/07/2020	ES2025510	x	x
6	COAL B1/E1 D/S	16/07/2020	ES2025510	x	x
7	COAL M4 RIA STOCKPILE N/S	12/07/2020	ES2025510	x	x
8	G PIT 1 D/S	17/07/2020	ES2025510		x

Environmental Division
Brisbane
Work Order Reference
EB2028135

Telephone : + 61-7-3243 7222

CHAIN OF CUSTODY DOCUMENTATION

PROJECT ID: Peabody Wilpinjong

EMAIL REPORT& Invoice TO: CPotter@peabodyenergy.com

SITE: ACIRL Lithgow   P.O. NO.:   EMAIL SRN TO: lithgow.enviro@alsglobal.com

RESULTS REQUIRED (Date): Standard   QUOTE NO.:

ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract suite prices)

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DIPOSAL:

ORMATION (note: S = Soil, W=Water)   CONTAINER INFORMATION

ALS ID	SAMPLE ID 1	MATRIX	DATE	Time	Type / Code	Total bottles
1	E pit 2 D/S		10/07/2020			
2	A Pit 3 N/S		11/07/2020			
3	A Pit 3 D/S		11/07/2020			
4	Coal m4 RIA Stockpile N/S		12/07/2020			
5	B1 Pit 6 N/S		13/07/2020			
6	B1/A/ E Pit 1 N/S		14/07/2020			
7	Coal B1/ E1 D/S		16/07/2020			
8	G Pit 1 D/S		17/07/2020			
9	B23 SP8 U/S		17/07/2020			
10	B23 SP8 D/S		18/07/2020			

- **Acid-Base Account (ABA)** and **Net Acid Producing Potential (NAPP)** – used to develop estimates of the potential for acid generation based on the balance between acid producing and acid buffering minerals. The suite of tests includes:
  - pH and electrical conductivity (EC) determination (1:5)
  - Total sulfur assay + total carbon
  - Acid neutralising capacity (ANC) determination
  - Net acid producing potential (NAPP) calculation
  - Single addition net acid generation (NAG) testing
  - Chromium reducible sulfur (CRS) + Sulphate-sulfur (acid generating and non-acid generating)
- **Trace Metal / Whole Rock Analysis on Solids** – used to determine the total amount of metals in the solid phase of the tailings samples, suite includes:
  - 31 metals, Total Organic Carbon (TOC), Exchangeable Cations
- **Short-Term Leach Testing (Australian Standard Leachate Procedure, ASLP)** – used to develop initial estimates of metal leaching from the tailings. Suite includes:
  - Leach (DI water) and multi element scans (full scan ICPMS) of leachate - Major cations (Mg, Ca, K, Na) and anions (Cl, alkalinity, F, SO_4), Nutrients (ammonia, total nitrogen, nitrate, nitrite, total phosphorus) and metal(loids).
- Additional **Testing** – used to address the conflicting between NAPP and NAG:
  - Sequential NAG

RELINQUISHED BY:			RECEIVED BY	METHOD OF SHIPMENT
Name: S. Thompson	Date: 23/7/2020		Name: 24/7/20	Con' Note No:
	Time: 14:00		Of: 2:20	
Name:	Date:		Name:	Transport Co:
Of:	Time:		Of:	

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserveed Plastic; AG = Amber Glass Unpreserved; V = VOA Vial HCl Preserved; VS = VOA Vial Sulphuric Preserved; SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Gl Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bad for Acid Sulphate Soils; B = Unpreserved Bag.   0

Subcon / Forward Lab / Split WO: ASS, NAPP, ANC, NAG, CRS, TOC, total carbon
Lab / Analysis: Sulfur / Brisbane
Organised By / Date:
Relinquished By / Date:
Connote / Courier:
WO No:
Attached By PO / Internal Sheet:

Environmental Division
Sydney
Work Order Reference
ES2025510

Telephone : + 61-2-8784 8555

ENFM (204/4)

23.7.20

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2025510**	Page	: 1 of 16
Client	: **WILPINJONG COAL PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CLARK POTTER	Contact	: Mary Monds (ALS Mudgee Sampler)
Address	: PEABODY ENERGY LOCKED BAG 2005 ABN 87104594694 MUDGEE NSW, AUSTRALIA 2850	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 6372 6735
Project	: PEABODY WILPINJONG	Date Samples Received	: 24-Jul-2020 14:36
Order number	: ----	Date Analysis Commenced	: 30-Jul-2020
C-O-C number	: ----	Issue Date	: 04-Aug-2020 17:59
Sampler	: ----		
Site	: ACIRL LITHGOW		
Quote number	: EN/222		
No. of samples received	: 10		
No. of samples analysed	: 10		

NATA

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ashesh Patel	Senior Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

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

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

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

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

- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ($CaCO_3$) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m3'.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H^+ + Al^{3+}).
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Client sample ID	E PIT 2 D/S	A PIT 3 N/S	A PIT 3 D/S	COAL M4 RIA STOCKPILE N/S	B1 PIT 6 N/S
			Client sampling date / time	10-Jul-2020 00:00	11-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00	13-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-001	ES2025510-002	ES2025510-003	ES2025510-004	ES2025510-005
				Result	Result	Result	Result	Result
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**6**	**24**	**30**	**27**	**37**
Total Alkalinity as CaCO3	----	1	mg/L	**6**	**24**	**30**	**27**	**37**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**32**	**27**	**31**	**26**	**28**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**7**	**5**	**7**	**6**	**6**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**2**	**7**	**8**	**6**	**9**
Magnesium	7439-95-4	1	mg/L	**3**	**5**	**6**	**4**	**5**
Sodium	7440-23-5	1	mg/L	**12**	**10**	**12**	**13**	**14**
Potassium	7440-09-7	1	mg/L	**2**	**2**	**2**	**2**	**2**
EG020W: Water Leachable Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.17**	**0.07**	**0.18**	**0.12**	**0.40**
ø Germanium	7440-56-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
ø Niobium	7440-03-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
ø Palladium	7440-05-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
ø Platinum	7440-06-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L	**0.185**	**0.070**	**0.069**	**0.050**	**0.043**
ø Rhenium	7440-15-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth	7440-69-9	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cerium	7440-45-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Caesium	7440-46-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	7440-47-3	0.001	mg/L	**0.004**	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	**0.005**	**0.003**	**0.002**	<0.001
Dysprosium	7429-91-6	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Erbium	7440-52-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Europium	7440-53-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Client sample ID	E PIT 2 D/S	A PIT 3 N/S	A PIT 3 D/S	COAL M4 RIA STOCKPILE N/S	B1 PIT 6 N/S
			Client sampling date / time	10-Jul-2020 00:00	11-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00	13-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-001	ES2025510-002	ES2025510-003	ES2025510-004	ES2025510-005
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS - Continued								
Gadolinium	7440-54-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Gallium	7440-55-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Hafnium	7440-58-6	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Holmium	7440-60-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lanthanum	7439-91-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium	7439-93-2	0.001	mg/L	**0.012**	**0.011**	**0.011**	**0.005**	**0.018**
Lutetium	7439-94-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	**0.062**	**0.002**	**0.002**	**0.002**	<0.001
Molybdenum	7439-98-7	0.001	mg/L	<0.001	**0.006**	**0.009**	**0.004**	**0.007**
Neodymium	7440-00-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	**0.006**	<0.001	<0.001	**0.001**	<0.001
Praseodymium	7440-10-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Rubidium	7440-17-7	0.001	mg/L	**0.003**	**0.004**	**0.004**	**0.004**	**0.004**
Samarium	7440-19-9	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L	**0.016**	**0.033**	**0.032**	**0.022**	**0.036**
Tellurium	22541-49-7	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Terbium	7440-27-9	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium	7440-28-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Thulium	7440-30-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	7440-32-6	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Ytterbium	7440-64-4	0.001	mg/L	<0.001	<0.001	<0.001	**0.001**	<0.001
Yttrium	7440-65-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.038**	**0.006**	**0.005**	**0.077**	**0.031**
Zirconium	7440-67-7	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	**0.08**	<0.05	**0.05**	<0.05	<0.05
Gold	7440-57-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: **DI WATER LEACHATE**
(Matrix: **WATER**)

			Client sample ID	E PIT 2 D/S	A PIT 3 N/S	A PIT 3 D/S	COAL M4 RIA STOCKPILE N/S	B1 PIT 6 N/S
			Client sampling date / time	10-Jul-2020 00:00	11-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00	13-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-001	ES2025510-002	ES2025510-003	ES2025510-004	ES2025510-005
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS - Continued								
Tungsten	7440-33-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Tantalum	7440-25-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.3**	**0.4**	**0.4**	**0.3**	**0.4**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.16**	<0.01	**0.01**	<0.01	<0.01
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	**0.03**	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.05**	**0.06**	**0.09**	**0.29**	**0.15**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.05**	**0.06**	**0.12**	**0.29**	**0.15**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.2**	<0.1	**0.2**	**0.3**	**0.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ **Total Nitrogen as N**	----	0.1	mg/L	**0.2**	<0.1	**0.3**	**0.6**	**0.4**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								
ø **Total Anions**	----	0.01	meq/L	**0.98**	**1.18**	**1.44**	**1.25**	**1.49**
ø **Total Cations**	----	0.01	meq/L	**0.92**	**1.25**	**1.47**	**1.24**	**1.52**

Analytical Results

Sub-Matrix: **DI WATER LEACHATE**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	B1/A/E PIT 1 N/S	COAL B1/E1 D/S	G PIT 1 D/S	B23 SP8 N/S	B23 SP8 D/S
Client sampling date / time				14-Jul-2020 00:00	16-Jul-2020 00:00	17-Jul-2020 00:00	17-Jul-2020 00:00	18-Jul-2020 00:00
				ES2025510-006	ES2025510-007	ES2025510-008	ES2025510-009	ES2025510-010
				Result	Result	Result	Result	Result
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	**2**	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**32**	**22**	**29**	**14**	**12**
Total Alkalinity as CaCO3	----	1	mg/L	**32**	**22**	**29**	**16**	**12**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**26**	**21**	**33**	**23**	**24**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**5**	**4**	**6**	**6**	**6**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**8**	**4**	**13**	**8**	**3**
Magnesium	7439-95-4	1	mg/L	**4**	**4**	**4**	**1**	**3**
Sodium	7440-23-5	1	mg/L	**10**	**9**	**10**	**9**	**10**
Potassium	7440-09-7	1	mg/L	**2**	**2**	**2**	**2**	**2**
EG020W: Water Leachable Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.05**	**0.07**	<0.01	<0.01	**0.21**
ø Germanium	7440-56-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
ø Niobium	7440-03-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	**0.003**	<0.001
ø Palladium	7440-05-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
ø Platinum	7440-06-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L	**0.105**	**0.059**	**0.103**	**0.067**	**0.058**
ø Rhenium	7440-15-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth	7440-69-9	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cerium	7440-45-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Caesium	7440-46-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.001**	**0.002**	<0.001	<0.001	<0.001
Dysprosium	7429-91-6	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Erbium	7440-52-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Europium	7440-53-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: **DI WATER LEACHATE** (Matrix: **WATER**)			Client sample ID	B1/A/E PIT 1 N/S	COAL B1/E1 D/S	G PIT 1 D/S	B23 SP8 N/S	B23 SP8 D/S
			Client sampling date / time	14-Jul-2020 00:00	16-Jul-2020 00:00	17-Jul-2020 00:00	17-Jul-2020 00:00	18-Jul-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	ES2025510-006	ES2025510-007	ES2025510-008	ES2025510-009	ES2025510-010
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS - Continued								
Gadolinium	7440-54-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Gallium	7440-55-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Hafnium	7440-58-6	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Holmium	7440-60-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lanthanum	7439-91-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium	7439-93-2	0.001	mg/L	**0.009**	**0.014**	**0.012**	**0.018**	**0.010**
Lutetium	7439-94-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	**0.002**	**0.007**	**0.002**	<0.001	**0.007**
Molybdenum	7439-98-7	0.001	mg/L	**0.009**	**0.006**	**0.005**	**0.004**	**0.003**
Neodymium	7440-00-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	**0.003**
Praseodymium	7440-10-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Rubidium	7440-17-7	0.001	mg/L	**0.002**	**0.004**	**0.004**	**0.004**	**0.004**
Samarium	7440-19-9	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L	**0.033**	**0.037**	**0.053**	**0.030**	**0.016**
Tellurium	22541-49-7	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Terbium	7440-27-9	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Thallium	7440-28-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Thulium	7440-30-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	7440-32-6	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Ytterbium	7440-64-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Yttrium	7440-65-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.007**	**0.028**	<0.005	<0.005	**0.032**
Zirconium	7440-67-7	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	**0.05**
Gold	7440-57-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Tungsten	7440-33-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)			Client sample ID	B1/A/E PIT 1 N/S	COAL B1/E1 D/S	G PIT 1 D/S	B23 SP8 N/S	B23 SP8 D/S
			Client sampling date / time	14-Jul-2020 00:00	16-Jul-2020 00:00	17-Jul-2020 00:00	17-Jul-2020 00:00	18-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-006	ES2025510-007	ES2025510-008	ES2025510-009	ES2025510-010
				Result	Result	Result	Result	Result
EG020W: Water Leachable Metals by ICP-MS - Continued								
Tantalum	7440-25-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.7**	**0.5**	**0.6**	**0.2**	**0.2**
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.08**	<0.01	**0.18**	**0.04**	**0.08**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	**0.02**	<0.01	**0.02**	<0.01	**0.01**
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.15**	**0.07**	**0.21**	**0.14**	**0.04**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.17**	**0.07**	**0.23**	**0.14**	**0.05**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.3**	<0.1	**0.2**	**0.1**	**0.3**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**0.5**	<0.1	**0.4**	**0.2**	**0.4**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**1.32**	**0.99**	**1.44**	**0.97**	**0.91**
ø Total Cations	----	0.01	meq/L	**1.21**	**0.97**	**1.46**	**0.92**	**0.88**

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	E PIT 2 D/S	A PIT 3 N/S	A PIT 3 D/S	COAL M4 RIA STOCKPILE N/S	B1 PIT 6 N/S
Client sampling date / time				10-Jul-2020 00:00	11-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00	13-Jul-2020 00:00
				ES2025510-001	ES2025510-002	ES2025510-003	ES2025510-004	ES2025510-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.8	8.7	8.9	8.4	9.0
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	22.4	<0.5	15.3	-3.3	-10.8
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	367	405	412	391	414
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	2.6	3.2	2.8	3.7	4.4
NAG (pH 4.5)	----	0.1	kg H2SO4/t	25.4	10.4	18.8	1.6	0.4
NAG (pH 7.0)	----	0.1	kg H2SO4/t	53.2	32.6	36.2	23.2	19.5
EA011A: Net Acid Generation - Sequential								
NAG at pH 4.5 (total)	----	0.1	kg H2SO4/t	68.1	44.5	51.5	30.3	7.6
NAG at pH 7.0 (total)	----	0.1	kg H2SO4/t	151	124	128	91.2	58.7
EA011S: pH OX (Stage 1)								
pH OX (Stage 1)	----	0.1	pH Unit	2.8	3.6	2.9	3.9	3.9
NAG at pH 4.5 (Stage 1)	----	0.1	kg H2SO4/t	12.9	4.5	8.7	3.4	1.9
NAG at pH 7.0 (Stage 1)	----	0.1	kg H2SO4/t	34.6	20.8	23.6	20.3	14.0
EA011S: pH OX (Stage 2)								
pH OX (Stage 2)	----	0.1	pH Unit	2.8	2.9	2.9	3.1	4.3
NAG at pH 4.5 (Stage 2)	----	0.1	kg H2SO4/t	15.2	19.7	14.1	14.0	1.5
NAG at pH 7.0 (Stage 2)	----	0.1	kg H2SO4/t	33.6	42.4	35.2	33.3	18.7
EA011S: pH OX (Stage 3)								
pH OX (Stage 3)	----	0.1	pH Unit	2.6	2.8	2.7	3.1	3.8
NAG at pH 4.5 (Stage 3)	----	0.1	kg H2SO4/t	25.4	17.9	23.0	6.5	2.8
NAG at pH 7.0 (Stage 3)	----	0.1	kg H2SO4/t	42.4	32.2	39.6	14.4	10.6
EA011S: pH OX (Stage 4)								
pH OX (Stage 4)	----	0.1	pH Unit	2.7	3.3	3.0	3.5	3.7
NAG at pH 4.5 (Stage 4)	----	0.1	kg H2SO4/t	12.9	1.8	4.7	5.9	1.0
NAG at pH 7.0 (Stage 4)	----	0.1	kg H2SO4/t	26.7	18.0	19.6	12.9	9.5
EA011S: pH OX (Stage 5)								
pH OX (Stage 5)	----	0.1	pH Unit	3.3	4.0	3.7	4.1	4.3
NAG at pH 4.5 (Stage 5)	----	0.1	kg H2SO4/t	1.7	0.6	1.0	0.5	0.4
NAG at pH 7.0 (Stage 5)	----	0.1	kg H2SO4/t	14.0	10.4	10.5	10.3	5.9
EA013: Acid Neutralising Capacity								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	E PIT 2 D/S	A PIT 3 N/S	A PIT 3 D/S	COAL M4 RIA STOCKPILE N/S	B1 PIT 6 N/S
			Client sampling date / time	10-Jul-2020 00:00	11-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00	13-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-001	ES2025510-002	ES2025510-003	ES2025510-004	ES2025510-005
				Result	Result	Result	Result	Result
EA013: Acid Neutralising Capacity - Continued								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	15.8	16.6	17.7	22.9	31.6
ANC as CaCO3	----	0.1	% CaCO3	1.6	1.7	1.8	2.3	3.2
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	6.2	7.5	8.6	7.8	8.8
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.871	0.229	0.764	0.310	0.342
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	543	143	476	193	213
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	----	1.83	1.82	1.75	3.45
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	----	366	364	350	689
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	----	0.59	0.58	0.56	1.10
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.87	<0.02	0.37	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t	543	<10	234	<10	<10
Liming Rate	----	1	kg CaCO3/t	41	<1	18	<1	<1
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.87	0.23	0.76	0.31	0.34
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	543	143	476	193	213
Liming Rate excluding ANC	----	1	kg CaCO3/t	41	11	36	14	16
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	40.2	40.5	46.7	43.7	42.1
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	----	2.6	4.1	9.6	10.4
Exchangeable Magnesium	----	0.2	meq/100g	----	1.8	3.4	4.1	4.5
Exchangeable Potassium	----	0.2	meq/100g	----	0.4	0.6	0.5	0.5
Exchangeable Sodium	----	0.2	meq/100g	----	0.4	1.0	1.1	1.4
Cation Exchange Capacity	----	0.2	meq/100g	----	5.2	9.1	15.3	16.8

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	E PIT 2 D/S	A PIT 3 N/S	A PIT 3 D/S	COAL M4 RIA STOCKPILE N/S	B1 PIT 6 N/S
			Client sampling date / time	10-Jul-2020 00:00	11-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00	13-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-001	ES2025510-002	ES2025510-003	ES2025510-004	ES2025510-005
				Result	Result	Result	Result	Result
ED006: Exchangeable Cations on Alkaline Soils - Continued								
Exchangeable Sodium Percent	----	0.2	%	----	7.7	10.7	7.4	8.5
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	2.1	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	3.1	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	0.4	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	<0.1	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	5.7	----	----	----	----
Exchangeable Sodium Percent	----	0.1	%	0.2	----	----	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	1.25	0.55	1.08	0.64	0.68
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	2080	1760	2060	2130	1920
Antimony	7440-36-0	5	mg/kg	<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg	<5	5	<5	6	<5
Barium	7440-39-3	10	mg/kg	110	220	150	260	180
Beryllium	7440-41-7	1	mg/kg	2	2	2	3	2
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	3	<2	2	<2
Cobalt	7440-48-4	2	mg/kg	<2	3	<2	2	<2
Copper	7440-50-8	5	mg/kg	13	19	16	16	12
Iron	7439-89-6	50	mg/kg	28800	20300	29100	27800	27800
Lead	7439-92-1	5	mg/kg	24	20	23	25	21
Manganese	7439-96-5	5	mg/kg	456	306	498	240	410
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg	4	14	5	10	6
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Silver	7440-22-4	2	mg/kg	<2	<2	<2	<2	<2
Strontium	7440-24-6	2	mg/kg	<2	11	<2	17	16
Tin	7440-31-5	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	7	9	8	17	9
Zinc	7440-66-6	5	mg/kg	42	48	57	37	33
Calcium	7440-70-2	50	mg/kg	840	1320	2170	5170	6480
Magnesium	7439-95-4	50	mg/kg	1140	1500	1400	2120	2700

Analytical Results

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

			Client sample ID	E PIT 2 D/S	A PIT 3 N/S	A PIT 3 D/S	COAL M4 RIA STOCKPILE N/S	B1 PIT 6 N/S
			Client sampling date / time	10-Jul-2020 00:00	11-Jul-2020 00:00	11-Jul-2020 00:00	12-Jul-2020 00:00	13-Jul-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2025510-001**	**ES2025510-002**	**ES2025510-003**	**ES2025510-004**	**ES2025510-005**
				Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES - Continued								
Sodium	7440-23-5	50	mg/kg	**430**	**400**	**530**	**620**	**530**
Potassium	7440-09-7	50	mg/kg	**600**	**760**	**620**	**610**	**530**
Sulfur as S	63705-05-5	50	mg/kg	**10300**	**2580**	**9730**	**3990**	**4280**
Phosphorus	7723-14-0	50	mg/kg	<50	<50	<50	**60**	<50
Titanium	7440-32-6	10	mg/kg	**30**	**30**	**30**	**60**	**50**
Thallium	7440-28-0	5	mg/kg	<5	<5	<5	<5	<5
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	**8.3**	**8.3**	**8.4**	**8.3**	**8.4**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**37.4**	**38.8**	**38.7**	**36.9**	**38.5**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**37.9**	**39.1**	**38.9**	**37.1**	**38.7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B1/A/E PIT 1 N/S	COAL B1/E1 D/S	G PIT 1 D/S	B23 SP8 N/S	B23 SP8 D/S
			Client sampling date / time	14-Jul-2020 00:00	16-Jul-2020 00:00	17-Jul-2020 00:00	17-Jul-2020 00:00	18-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-006	ES2025510-007	ES2025510-008	ES2025510-009	ES2025510-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.7	8.3	8.6	9.8	8.3
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-0.4	2.3	30.8	-3.4	3.9
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	365	321	404	319	329
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	3.3	3.4	2.9	2.6	2.7
NAG (pH 4.5)	----	0.1	kg H2SO4/t	6.1	13.5	30.8	91.6	8.4
NAG (pH 7.0)	----	0.1	kg H2SO4/t	27.8	33.0	48.8	148	44.4
EA011A: Net Acid Generation - Sequential								
NAG at pH 4.5 (total)	----	0.1	kg H2SO4/t	34.6	48.8	78.6	86.4	116
NAG at pH 7.0 (total)	----	0.1	kg H2SO4/t	104	128	168	185	222
EA011S: pH OX (Stage 1)								
pH OX (Stage 1)	----	0.1	pH Unit	3.5	3.4	2.8	3.3	2.6
NAG at pH 4.5 (Stage 1)	----	0.1	kg H2SO4/t	3.9	4.2	11.5	21.3	43.9
NAG at pH 7.0 (Stage 1)	----	0.1	kg H2SO4/t	19.8	20.3	27.8	50.0	80.0
EA011S: pH OX (Stage 2)								
pH OX (Stage 2)	----	0.1	pH Unit	3.2	3.0	2.7	2.6	2.4
NAG at pH 4.5 (Stage 2)	----	0.1	kg H2SO4/t	9.6	16.8	26.3	54.6	58.0
NAG at pH 7.0 (Stage 2)	----	0.1	kg H2SO4/t	29.3	41.6	55.2	88.8	92.9
EA011S: pH OX (Stage 3)								
pH OX (Stage 3)	----	0.1	pH Unit	2.9	2.8	2.6	2.8	2.7
NAG at pH 4.5 (Stage 3)	----	0.1	kg H2SO4/t	16.8	22.9	31.9	7.9	10.6
NAG at pH 7.0 (Stage 3)	----	0.1	kg H2SO4/t	32.4	40.6	53.0	18.4	22.7
EA011S: pH OX (Stage 4)								
pH OX (Stage 4)	----	0.1	pH Unit	3.3	3.2	2.9	3.4	3.1
NAG at pH 4.5 (Stage 4)	----	0.1	kg H2SO4/t	3.4	4.0	7.6	1.8	2.9
NAG at pH 7.0 (Stage 4)	----	0.1	kg H2SO4/t	13.0	15.9	20.8	17.2	15.8
EA011S: pH OX (Stage 5)								
pH OX (Stage 5)	----	0.1	pH Unit	3.7	3.8	3.6	3.9	3.8
NAG at pH 4.5 (Stage 5)	----	0.1	kg H2SO4/t	0.9	0.9	1.3	0.8	0.6
NAG at pH 7.0 (Stage 5)	----	0.1	kg H2SO4/t	10.0	9.4	10.7	10.5	10.5
EA013: Acid Neutralising Capacity								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B1/A/E PIT 1 N/S	COAL B1/E1 D/S	G PIT 1 D/S	B23 SP8 N/S	B23 SP8 D/S
			Client sampling date / time	14-Jul-2020 00:00	16-Jul-2020 00:00	17-Jul-2020 00:00	17-Jul-2020 00:00	18-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-006	ES2025510-007	ES2025510-008	ES2025510-009	ES2025510-010
				Result	Result	Result	Result	Result
EA013: Acid Neutralising Capacity - Continued								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	20.6	19.4	17.2	18.4	12.6
ANC as CaCO3	----	0.1	% CaCO3	2.1	2.0	1.8	1.9	1.3
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	8.4	7.7	8.0	9.3	7.3
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<2	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.346	0.358	0.937	0.126	0.192
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	216	223	584	79	120
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	2.98	2.60	3.08	1.28	0.74
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	595	520	614	255	147
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.95	0.83	0.98	0.41	0.24
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	0.28	<0.02	0.03
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	175	<10	21
Liming Rate	----	1	kg CaCO3/t	<1	<1	13	<1	2
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.35	0.36	0.94	0.13	0.19
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	216	223	584	79	120
Liming Rate excluding ANC	----	1	kg CaCO3/t	16	17	44	6	9
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	34.8	33.3	36.2	38.0	37.3
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	5.8	2.4	2.3	3.7	2.8
Exchangeable Magnesium	----	0.2	meq/100g	1.9	1.4	0.8	1.0	2.8
Exchangeable Potassium	----	0.2	meq/100g	0.3	0.2	0.2	0.5	0.5
Exchangeable Sodium	----	0.2	meq/100g	0.6	0.4	0.3	0.9	0.8
Cation Exchange Capacity	----	0.2	meq/100g	8.7	4.5	3.7	6.2	6.9

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B1/A/E PIT 1 N/S	COAL B1/E1 D/S	G PIT 1 D/S	B23 SP8 N/S	B23 SP8 D/S
			Client sampling date / time	14-Jul-2020 00:00	16-Jul-2020 00:00	17-Jul-2020 00:00	17-Jul-2020 00:00	18-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-006	ES2025510-007	ES2025510-008	ES2025510-009	ES2025510-010
				Result	Result	Result	Result	Result
ED006: Exchangeable Cations on Alkaline Soils - Continued								
Exchangeable Sodium Percent	----	0.2	%	7.1	9.1	9.4	14.3	11.8
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.66	0.71	1.57	0.49	0.54
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	1420	1420	1240	790	1130
Antimony	7440-36-0	5	mg/kg	<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	5
Barium	7440-39-3	10	mg/kg	140	150	260	190	140
Beryllium	7440-41-7	1	mg/kg	1	2	2	2	2
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	<2	<2	<2	<2	<2
Cobalt	7440-48-4	2	mg/kg	<2	<2	<2	<2	<2
Copper	7440-50-8	5	mg/kg	10	10	8	5	7
Iron	7439-89-6	50	mg/kg	24500	29600	34800	5590	7620
Lead	7439-92-1	5	mg/kg	20	18	20	8	11
Manganese	7439-96-5	5	mg/kg	487	476	638	138	146
Molybdenum	7439-98-7	2	mg/kg	<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg	2	4	4	7	13
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Silver	7440-22-4	2	mg/kg	<2	<2	<2	<2	<2
Strontium	7440-24-6	2	mg/kg	3	3	<2	2	2
Tin	7440-31-5	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	6	7	8	7	7
Zinc	7440-66-6	5	mg/kg	30	38	45	20	19
Calcium	7440-70-2	50	mg/kg	2360	1510	1770	2430	970
Magnesium	7439-95-4	50	mg/kg	1570	1410	1200	920	790
Sodium	7440-23-5	50	mg/kg	360	320	320	340	360
Potassium	7440-09-7	50	mg/kg	440	480	390	510	580
Sulfur as S	63705-05-5	50	mg/kg	3830	4650	10600	1740	2000
Phosphorus	7723-14-0	50	mg/kg	<50	<50	<50	<50	<50
Titanium	7440-32-6	10	mg/kg	30	40	40	40	40
Thallium	7440-28-0	5	mg/kg	<5	<5	<5	<5	<5
EN60: Bottle Leaching Procedure								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	B1/A/E PIT 1 N/S	COAL B1/E1 D/S	G PIT 1 D/S	B23 SP8 N/S	B23 SP8 D/S
			Client sampling date / time	14-Jul-2020 00:00	16-Jul-2020 00:00	17-Jul-2020 00:00	17-Jul-2020 00:00	18-Jul-2020 00:00
Compound	CAS Number	LOR	Unit	ES2025510-006	ES2025510-007	ES2025510-008	ES2025510-009	ES2025510-010
				Result	Result	Result	Result	Result
EN60: Bottle Leaching Procedure - Continued								
Final pH	----	0.1	pH Unit	**8.4**	**8.4**	**8.3**	**9.1**	**8.5**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**45.5**	**46.2**	**48.4**	**65.2**	**63.5**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	TC	0.02	%	**45.8**	**46.7**	**48.6**	**68.0**	**63.7**

QUALITY CONTROL REPORT

Work Order	: **ES2025510**	Page	: 1 of 15
Client	: **WILPINJONG COAL PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CLARK POTTER	Contact	: Mary Monds (ALS Mudgee Sampler)
Address	: PEABODY ENERGY LOCKED BAG 2005 ABN 87104594694 MUDGEE NSW, AUSTRALIA 2850	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 6372 6735
Project	: PEABODY WILPINJONG	Date Samples Received	: 24-Jul-2020
Order number	: ----	Date Analysis Commenced	: 30-Jul-2020
C-O-C number	: ----	Issue Date	: 04-Aug-2020
Sampler	: ----		
Site	: ACIRL LITHGOW		
Quote number	: EN/222		
No. of samples received	: 10		
No. of samples analysed	: 10		

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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ashesh Patel	Senior Chemist	Sydney Inorganics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3171364)									
ES2025185-027	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	50	60	0.00	No Limit
		EG005T: Titanium	7440-32-6	10	mg/kg	10	<10	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	6	4	32.1	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Strontium	7440-24-6	2	mg/kg	15	16	7.69	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	13	7	55.5	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	5	<5	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	13	14	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	20	8	84.7	No Limit
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	20	13	44.9	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	13	11	16.6	No Limit
		EG005T: Thallium	7440-28-0	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Aluminium	7429-90-5	50	mg/kg	1960	1750	11.4	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	0.267 %	3150	16.2	0% - 20%
		EG005T: Sulfur as S	63705-05-5	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Phosphorus	7723-14-0	50	mg/kg	80	60	18.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 3171364) - continued									
ES2025510-007	COAL B1/E1 D/S	EG005T: Beryllium	7440-41-7	1	mg/kg	2	2	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	150	150	0.00	0% - 50%
		EG005T: Titanium	7440-32-6	10	mg/kg	40	40	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	4	4	0.00	No Limit
		EG005T: Silver	7440-22-4	2	mg/kg	<2	<2	0.00	No Limit
		EG005T: Strontium	7440-24-6	2	mg/kg	3	4	0.00	No Limit
		EG005T: Antimony	7440-36-0	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	10	10	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	18	18	0.00	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	476	481	1.03	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Tin	7440-31-5	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	7	7	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	38	40	3.20	No Limit
		EG005T: Thallium	7440-28-0	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Aluminium	7429-90-5	50	mg/kg	1420	1440	2.02	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
		EG005T: Iron	7439-89-6	50	mg/kg	29600	29100	1.60	0% - 20%
		EG005T: Sulfur as S	63705-05-5	50	mg/kg	4650	4400	5.54	0% - 20%
		EG005T: Phosphorus	7723-14-0	50	mg/kg	<50	<50	0.00	No Limit
EA002: pH 1:5 (Soils) (QC Lot: 3171365)									
ES2025185-015	Anonymous	EA002: pH Value	----	0.1	pH Unit	5.5	5.5	0.00	0% - 20%
ES2025510-009	B23 SP8 N/S	EA002: pH Value	----	0.1	pH Unit	9.8	9.7	0.00	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 3171366)									
ES2025185-015	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	289	259	10.9	0% - 20%
ES2025510-009	B23 SP8 N/S	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	319	322	0.936	0% - 20%
EA011: Net Acid Generation (QC Lot: 3168543)									
ES2025510-001	E PIT 2 D/S	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	25.4	24.7	2.57	0% - 20%
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	53.2	51.5	3.40	0% - 20%
		EA011: pH (OX)	----	0.1	pH Unit	2.6	2.7	3.77	0% - 20%
EA011S: Net Acid Generation - Sequential (TOTAL) (QC Lot: 3168544)									
ES2025510-001	E PIT 2 D/S	EA011S: NAG at pH 4.5 (total)	----	0.1	kg H2SO4/t	68.1	66.8	1.93	0% - 20%
		EA011S: NAG at pH 7.0 (total)	----	0.1	kg H2SO4/t	151	148	1.94	0% - 20%
EA011S: pH OX (Stage 1) (QC Lot: 3168544)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EA011S: pH OX (Stage 1) (QC Lot: 3168544) - continued									
ES2025510-001	E PIT 2 D/S	EA011S: NAG at pH 4.5 (Stage 1)	----	0.1	kg H2SO4/t	12.9	13.2	1.81	0% - 20%
		EA011S: NAG at pH 7.0 (Stage 1)	----	0.1	kg H2SO4/t	34.6	34.1	1.32	0% - 20%
		EA011S: pH OX (Stage 1)	----	0.1	pH Unit	2.8	2.8	0.00	0% - 20%
EA011S: pH OX (Stage 2) (QC Lot: 3168544)									
ES2025510-001	E PIT 2 D/S	EA011S: NAG at pH 4.5 (Stage 2)	----	0.1	kg H2SO4/t	15.2	15.5	2.06	0% - 20%
		EA011S: NAG at pH 7.0 (Stage 2)	----	0.1	kg H2SO4/t	33.6	34.2	1.69	0% - 20%
		EA011S: pH OX (Stage 2)	----	0.1	pH Unit	2.8	2.8	0.00	0% - 20%
EA011S: pH OX (Stage 3) (QC Lot: 3168544)									
ES2025510-001	E PIT 2 D/S	EA011S: NAG at pH 4.5 (Stage 3)	----	0.1	kg H2SO4/t	25.4	24.4	3.91	0% - 20%
		EA011S: NAG at pH 7.0 (Stage 3)	----	0.1	kg H2SO4/t	42.4	42.1	0.644	0% - 20%
		EA011S: pH OX (Stage 3)	----	0.1	pH Unit	2.6	2.6	0.00	0% - 20%
EA011S: pH OX (Stage 4) (QC Lot: 3168544)									
ES2025510-001	E PIT 2 D/S	EA011S: NAG at pH 4.5 (Stage 4)	----	0.1	kg H2SO4/t	12.9	11.8	8.58	0% - 20%
		EA011S: NAG at pH 7.0 (Stage 4)	----	0.1	kg H2SO4/t	26.7	23.5	12.8	0% - 20%
		EA011S: pH OX (Stage 4)	----	0.1	pH Unit	2.7	2.9	7.14	0% - 20%
EA011S: pH OX (Stage 5) (QC Lot: 3168544)									
ES2025510-001	E PIT 2 D/S	EA011S: NAG at pH 4.5 (Stage 5)	----	0.1	kg H2SO4/t	1.7	1.9	13.2	0% - 50%
		EA011S: NAG at pH 7.0 (Stage 5)	----	0.1	kg H2SO4/t	14.0	14.5	3.16	0% - 20%
		EA011S: pH OX (Stage 5)	----	0.1	pH Unit	3.3	3.4	2.98	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 3168542)									
ES2025510-001	E PIT 2 D/S	EA013: ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	15.8	15.8	0.00	0% - 20%
EA033-A: Actual Acidity (QC Lot: 3168541)									
ES2025381-003	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.11	0.11	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	69	71	2.31	0% - 20%
		EA033: pH KCl (23A)	----	0.1	pH Unit	4.4	4.4	0.00	0% - 20%
ES2025510-008	G PIT 1 D/S	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.00	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.00	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	8.0	8.0	0.00	0% - 20%
EA033-B: Potential Acidity (QC Lot: 3168541)									
ES2025381-003	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.009	0.009	0.00	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.00	No Limit
ES2025510-008	G PIT 1 D/S	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.937	0.978	4.35	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	584	610	4.35	0% - 20%
EA033-C: Acid Neutralising Capacity (QC Lot: 3168541)									
ES2025510-008	G PIT 1 D/S	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	3.08	3.04	0.970	0% - 20%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EA033-C: Acid Neutralising Capacity (QC Lot: 3168541) - continued									
ES2025510-008	G PIT 1 D/S	EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.98	0.98	0.00	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	614	608	0.970	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3171368)									
ES2025493-001	Anonymous	EA055: Moisture Content	----	0.1	%	26.4	24.9	5.98	0% - 20%
ES2025510-010	B23 SP8 D/S	EA055: Moisture Content	----	0.1	%	37.3	37.7	0.942	0% - 20%
ED006: Exchangeable Cations on Alkaline Soils (QC Lot: 3178045)									
ES2025185-027	Anonymous	ED006: Exchangeable Sodium Percent	----	0.2	%	<0.2	<0.2	0.00	No Limit
		ED006: Exchangeable Calcium	----	0.2	meq/100g	6.3	6.7	6.70	0% - 20%
		ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	<0.2	0.00	No Limit
		ED006: Exchangeable Potassium	----	0.2	meq/100g	0.3	0.3	0.00	No Limit
		ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	<0.2	0.00	No Limit
		ED006: Cation Exchange Capacity	----	0.2	meq/100g	6.6	7.0	6.37	0% - 20%
ES2025510-002	A PIT 3 N/S	ED006: Exchangeable Sodium Percent	----	0.2	%	7.7	7.7	0.00	0% - 20%
		ED006: Exchangeable Calcium	----	0.2	meq/100g	2.6	2.9	8.27	0% - 50%
		ED006: Exchangeable Magnesium	----	0.2	meq/100g	1.8	1.9	6.61	No Limit
		ED006: Exchangeable Potassium	----	0.2	meq/100g	0.4	0.4	0.00	No Limit
		ED006: Exchangeable Sodium	----	0.2	meq/100g	0.4	0.4	0.00	No Limit
		ED006: Cation Exchange Capacity	----	0.2	meq/100g	5.2	5.5	7.05	0% - 20%
ED008: Exchangeable Cations (QC Lot: 3178212)									
ES2025510-001	E PIT 2 D/S	ED008: Exchangeable Sodium Percent	----	0.1	%	0.2	0.2	0.00	0% - 20%
		ED008: Exchangeable Calcium	----	0.1	meq/100g	2.1	2.2	0.00	0% - 20%
		ED008: Exchangeable Magnesium	----	0.1	meq/100g	3.1	3.1	0.00	0% - 20%
		ED008: Exchangeable Potassium	----	0.1	meq/100g	0.4	0.4	0.00	0% - 20%
		ED008: Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	0.00	0% - 20%
		ED008: Cation Exchange Capacity	----	0.1	meq/100g	5.7	5.7	0.00	0% - 20%
ED042T: Total Sulfur by LECO (QC Lot: 3175132)									
ES2025510-001	E PIT 2 D/S	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	1.25	1.30	4.48	0% - 20%
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 3175133)									
ES2025510-001	E PIT 2 D/S	EP003: Total Organic Carbon	----	0.02	%	37.4	37.6	0.355	0% - 20%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 3175134)									
ES2025510-001	E PIT 2 D/S	EP003TC: Total Carbon	TC	0.02	%	37.9	38.4	1.13	0% - 20%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
ED037P: Alkalinity by PC Titrator (QC Lot: 3173588)									
ES2025510-009	B23 SP8 N/S	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	2	<1	67.1	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	14	15	8.34	0% - 50%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
ED037P: Alkalinity by PC Titrator (QC Lot: 3173588) - continued									
ES2025510-009	B23 SP8 N/S	ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	16	16	0.00	0% - 50%
ES2024632-005	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.00	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	3	<1	106	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	8	9	0.00	No Limit
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	11	9	24.1	0% - 50%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 3174214)									
ES2025510-009	B23 SP8 N/S	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	23	23	0.00	0% - 20%
ES2024632-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	0.00	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 3174213)									
ES2025510-009	B23 SP8 N/S	ED045G: Chloride	16887-00-6	1	mg/L	6	6	0.00	No Limit
ES2024632-005	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	<1	<1	0.00	No Limit
ED093F: Dissolved Major Cations (QC Lot: 3174158)									
ES2025510-001	E PIT 2 D/S	ED093F: Calcium	7440-70-2	1	mg/L	2	2	0.00	No Limit
		ED093F: Magnesium	7439-95-4	1	mg/L	3	3	0.00	No Limit
		ED093F: Sodium	7440-23-5	1	mg/L	12	13	0.00	0% - 50%
		ED093F: Potassium	7440-09-7	1	mg/L	2	3	0.00	No Limit
ES2025984-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	59	57	3.15	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	24	24	0.00	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	79	82	4.23	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	12	12	0.00	0% - 50%
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174356)									
ES2025510-010	B23 SP8 D/S	EG020B-W: Bismuth	7440-69-9	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Cerium	7440-45-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Caesium	7440-46-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Rubidium	7440-17-7	0.001	mg/L	0.004	0.004	0.00	No Limit
		EG020B-W: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Strontium	7440-24-6	0.001	mg/L	0.016	0.016	0.00	0% - 50%
		EG020B-W: Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Tellurium	22541-49-7	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020B-W: Titanium	7440-32-6	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES2025510-001	E PIT 2 D/S	EG020B-W: Bismuth	7440-69-9	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Cerium	7440-45-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Caesium	7440-46-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Rubidium	7440-17-7	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020B-W: Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Strontium	7440-24-6	0.001	mg/L	0.016	0.015	0.00	0% - 50%
		EG020B-W: Thorium	7440-29-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020B-W: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174356) - continued									
ES2025510-001	E PIT 2 D/S	EG020B-W: Tellurium	22541-49-7	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020B-W: Titanium	7440-32-6	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174357)									
ES2025510-001	E PIT 2 D/S	EG020D-W: Dysprosium	7429-91-6	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Erbium	7440-52-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Europium	7440-53-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Gadolinium	7440-54-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Gallium	7440-55-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Holmium	7440-60-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Lanthanum	7439-91-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Lutetium	7439-94-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Neodymium	7440-00-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Praseodymium	7440-10-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Samarium	7440-19-9	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Terbium	7440-27-9	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Thulium	7440-30-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Ytterbium	7440-64-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Yttrium	7440-65-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020D-W: Zirconium	7440-67-7	0.005	mg/L	<0.005	<0.005	0.00	No Limit
		EG020D-W: Hafnium	7440-58-6	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174358)									
ES2025510-010	B23 SP8 D/S	EG020G-W: Germanium	7440-56-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Niobium	7440-03-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Palladium	7440-05-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Platinum	7440-06-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Rhenium	7440-15-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
ES2025510-001	E PIT 2 D/S	EG020G-W: Germanium	7440-56-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Niobium	7440-03-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Palladium	7440-05-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Platinum	7440-06-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020G-W: Rhenium	7440-15-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174359)									
ES2025510-010	B23 SP8 D/S	EG020E-W: Gold	7440-57-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020E-W: Tungsten	7440-33-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020E-W: Tantalum	7440-25-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
ES2025510-001	E PIT 2 D/S	EG020E-W: Gold	7440-57-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020E-W: Tungsten	7440-33-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020E-W: Tantalum	7440-25-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174360)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174360) - continued									
ES2025510-010	B23 SP8 D/S	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Barium	7440-39-3	0.001	mg/L	0.058	0.060	2.39	0% - 20%
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lithium	7439-93-2	0.001	mg/L	0.010	0.010	0.00	No Limit
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	0.007	0.007	0.00	No Limit
		EG020A-W: Molybdenum	7439-98-7	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-W: Thallium	7440-28-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	0.032	0.032	0.00	No Limit
		EG020A-W: Aluminium	7429-90-5	0.01	mg/L	0.21	0.18	13.5	0% - 50%
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	0.05	<0.05	0.00	No Limit
ES2025510-001	E PIT 2 D/S	EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-W: Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Barium	7440-39-3	0.001	mg/L	0.185	0.185	0.00	0% - 20%
		EG020A-W: Chromium	7440-47-3	0.001	mg/L	0.004	<0.001	112	No Limit
		EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Lithium	7439-93-2	0.001	mg/L	0.012	0.012	0.00	0% - 50%
		EG020A-W: Manganese	7439-96-5	0.001	mg/L	0.062	0.060	3.93	0% - 20%
		EG020A-W: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Nickel	7440-02-0	0.001	mg/L	0.006	<0.001	142	No Limit
		EG020A-W: Thallium	7440-28-0	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Tin	7440-31-5	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-W: Zinc	7440-66-6	0.005	mg/L	0.038	0.039	3.18	No Limit
		EG020A-W: Aluminium	7429-90-5	0.01	mg/L	0.17	0.15	12.8	0% - 50%
		EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-W: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020W: Water Leachable Metals by ICP-MS (QC Lot: 3174360) - continued									
ES2025510-001	E PIT 2 D/S	EG020A-W: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.00	No Limit
		EG020A-W: Iron	7439-89-6	0.05	mg/L	0.08	0.06	32.9	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 3173589)									
ES2025510-009	B23 SP8 N/S	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.00	No Limit
ES2024632-005	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.1	0.1	0.00	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 3173617)									
ES2025510-001	E PIT 2 D/S	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.16	0.18	9.58	0% - 50%
ES2025510-010	B23 SP8 D/S	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.07	0.00	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 3174211)									
ES2025510-009	B23 SP8 N/S	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES2024632-005	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.00	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 3173618)									
ES2025510-001	E PIT 2 D/S	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.05	0.05	0.00	No Limit
ES2025510-010	B23 SP8 D/S	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.05	0.05	0.00	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 3173614)									
ES2025510-001	E PIT 2 D/S	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.00	No Limit
ES2026269-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.9	1.8	8.52	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 3173613)									
ES2025510-001	E PIT 2 D/S	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.00	No Limit
ES2026269-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.12	0.10	19.0	0% - 50%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3171364)								
EG005T: Aluminium	7429-90-5	50	mg/kg	<50	13267 mg/kg	106	70.0	130
EG005T: Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	98 mg/kg	103	70.0	130
EG005T: Barium	7440-39-3	10	mg/kg	<10	79.4 mg/kg	116	70.0	130
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	0.5 mg/kg	107	70.0	130
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	85.6	70.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	15.4 mg/kg	117	70.0	130
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	9.8 mg/kg	72.8	70.0	130
EG005T: Copper	7440-50-8	5	mg/kg	<5	48 mg/kg	102	70.0	130
EG005T: Iron	7439-89-6	50	mg/kg	<50	27922 mg/kg	121	70.0	130
EG005T: Lead	7439-92-1	5	mg/kg	<5	50 mg/kg	107	70.0	130
EG005T: Manganese	7439-96-5	5	mg/kg	<5	482 mg/kg	125	70.0	130
EG005T: Molybdenum	7439-98-7	2	mg/kg	<2	----	----	----	----
EG005T: Nickel	7440-02-0	2	mg/kg	<2	12.4 mg/kg	94.6	70.0	130
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5 mg/kg	106	70.0	130
EG005T: Silver	7440-22-4	2	mg/kg	<2	2.4 mg/kg	126	70.0	130
EG005T: Strontium	7440-24-6	2	mg/kg	<2	----	----	----	----
EG005T: Tin	7440-31-5	5	mg/kg	<5	----	----	----	----
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	42 mg/kg	125	70.0	130
EG005T: Zinc	7440-66-6	5	mg/kg	<5	115 mg/kg	94.8	70.0	130
EG005T: Calcium	7440-70-2	50	mg/kg	<50	----	----	----	----
EG005T: Magnesium	7439-95-4	50	mg/kg	<50	----	----	----	----
EG005T: Sodium	7440-23-5	50	mg/kg	<50	----	----	----	----
EG005T: Potassium	7440-09-7	50	mg/kg	<50	----	----	----	----
EG005T: Sulfur as S	63705-05-5	50	mg/kg	<50	----	----	----	----
EG005T: Phosphorus	7723-14-0	50	mg/kg	<50	----	----	----	----
EG005T: Titanium	7440-32-6	10	mg/kg	<10	----	----	----	----
EG005T: Thallium	7440-28-0	5	mg/kg	<5	----	----	----	----
EA010: Conductivity (1:5) (QCLot: 3171366)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	101	92.0	108
EA011: Net Acid Generation (QCLot: 3168543)								
EA011: NAG (pH 7.0)	----	----	kg H2SO4/t	----	22.5 kg H2SO4/t	93.9	70.0	130
EA011S: pH OX (Stage 1) (QCLot: 3168544)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	High
EA011S: pH OX (Stage 1) (QCLot: 3168544) - continued								
EA011S: NAG at pH 7.0 (Stage 1)	----	----	kg H2SO4/t	----	22.5 kg H2SO4/t	95.7	70.0	130
EA011S: pH OX (Stage 2) (QCLot: 3168544)								
EA011S: NAG at pH 7.0 (Stage 2)	----	----	kg H2SO4/t	----	22.5 kg H2SO4/t	97.3	70.0	130
EA011S: pH OX (Stage 3) (QCLot: 3168544)								
EA011S: NAG at pH 7.0 (Stage 3)	----	----	kg H2SO4/t	----	22.5 kg H2SO4/t	88.7	70.0	130
EA011S: pH OX (Stage 4) (QCLot: 3168544)								
EA011S: NAG at pH 7.0 (Stage 4)	----	----	kg H2SO4/t	----	22.5 kg H2SO4/t	96.1	70.0	130
EA011S: pH OX (Stage 5) (QCLot: 3168544)								
EA011S: NAG at pH 7.0 (Stage 5)	----	----	kg H2SO4/t	----	22.5 kg H2SO4/t	96.0	70.0	130
EA013: Acid Neutralising Capacity (QCLot: 3168542)								
EA013: ANC as H2SO4	----	----	kg H2SO4 equiv./t	----	9.9 kg H2SO4 equiv./t	97.5	82.0	120
EA033-A: Actual Acidity (QCLot: 3168541)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	100	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	15 mole H+ / t	109	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 3168541)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.198 % S	96.1	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 3168541)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	101	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
ED006: Exchangeable Cations on Alkaline Soils (QCLot: 3178045)								
ED006: Exchangeable Calcium	----	0.2	meq/100g	<0.2	2.5 meq/100g	104	80.0	110
ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	4.17 meq/100g	98.3	80.0	110
ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	1.28 meq/100g	106	80.0	110
ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	2.17 meq/100g	101	80.0	110
ED006: Cation Exchange Capacity	----	0.2	meq/100g	<0.2	----	----	----	----
ED006: Exchangeable Sodium Percent	----	0.2	%	<0.2	----	----	----	----
ED008: Exchangeable Cations (QCLot: 3178212)								
ED008: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1 meq/100g	120	82.0	128
ED008: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	1.67 meq/100g	100	82.0	120
ED008: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.51 meq/100g	122	70.0	140
ED008: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.87 meq/100g	95.4	78.0	136
ED008: Exchangeable Sodium Percent	----	0.1	%	<0.1	----	----	----	----
ED008: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	----	----	----	----
ED042T: Total Sulfur by LECO (QCLot: 3175132)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
ED042T: Total Sulfur by LECO (QCLot: 3175132) - continued								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	1.66 %	95.8	70.0	130
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 3175133)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	28.3 %	102	70.0	130
				<0.02	0.48 %	117	70.0	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 3175134)								
EP003TC: Total Carbon	TC	0.02	%	<0.02	28.3 %	103	70.0	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
ED037P: Alkalinity by PC Titrator (QCLot: 3173588)								
ED037-P: Total Alkalinity as CaCO3	----	----	mg/L	----	200 mg/L	91.4	81.0	111
				----	50 mg/L	101	70.0	130
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3174214)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	91.9	82.0	122
				<1	500 mg/L	101	82.0	122
ED045G: Chloride by Discrete Analyser (QCLot: 3174213)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	107	80.9	127
				<1	1000 mg/L	103	80.9	127
ED093F: Dissolved Major Cations (QCLot: 3174158)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	50 mg/L	101	80.0	114
ED093F: Magnesium	7439-95-4	1	mg/L	<1	50 mg/L	111	90.0	116
ED093F: Sodium	7440-23-5	1	mg/L	<1	50 mg/L	107	82.0	120
ED093F: Potassium	7440-09-7	1	mg/L	<1	50 mg/L	107	85.0	113
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174356)								
EG020B-W: Bismuth	7440-69-9	0.001	mg/L	<0.001	0.1 mg/L	105	70.0	130
EG020B-W: Cerium	7440-45-1	0.001	mg/L	<0.001	0.1 mg/L	89.1	85.0	115
EG020B-W: Caesium	7440-46-2	0.001	mg/L	<0.001	----	----	----	----
EG020B-W: Rubidium	7440-17-7	0.001	mg/L	<0.001	0.1 mg/L	87.6	85.0	115
EG020B-W: Silver	7440-22-4	0.001	mg/L	<0.001	----	----	----	----
EG020B-W: Strontium	7440-24-6	0.001	mg/L	<0.001	0.1 mg/L	88.9	70.0	130
EG020B-W: Tellurium	22541-49-7	0.005	mg/L	<0.005	0.1 mg/L	94.7	70.0	130
EG020B-W: Thorium	7440-29-1	0.001	mg/L	<0.001	0.1 mg/L	114	85.0	115
EG020B-W: Titanium	7440-32-6	0.01	mg/L	<0.01	0.1 mg/L	99.4	70.0	130
EG020B-W: Uranium	7440-61-1	0.001	mg/L	<0.001	0.1 mg/L	114	85.0	115
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174357)								
EG020D-W: Dysprosium	7429-91-6	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Erbium	7440-52-0	0.001	mg/L	<0.001	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174357) - continued								
EG020D-W: Europium	7440-53-1	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Gadolinium	7440-54-2	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Gallium	7440-55-3	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Hafnium	7440-58-6	0.01	mg/L	<0.01	----	----	----	----
EG020D-W: Holmium	7440-60-0	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Lanthanum	7439-91-0	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Lutetium	7439-94-3	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Neodymium	7440-00-8	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Praseodymium	7440-10-0	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Samarium	7440-19-9	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Terbium	7440-27-9	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Thulium	7440-30-4	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Ytterbium	7440-64-4	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Yttrium	7440-65-5	0.001	mg/L	<0.001	----	----	----	----
EG020D-W: Zirconium	7440-67-7	0.005	mg/L	<0.005	----	----	----	----
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174358)								
EG020G-W: Germanium	7440-56-4	0.001	mg/L	<0.001	----	----	----	----
EG020G-W: Niobium	7440-03-1	0.001	mg/L	<0.001	----	----	----	----
EG020G-W: Palladium	7440-05-3	0.001	mg/L	<0.001	----	----	----	----
EG020G-W: Platinum	7440-06-4	0.001	mg/L	<0.001	----	----	----	----
EG020G-W: Rhenium	7440-15-5	0.001	mg/L	<0.001	----	----	----	----
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174359)								
EG020E-W: Gold	7440-57-5	0.001	mg/L	<0.001	----	----	----	----
EG020E-W: Tungsten	7440-33-7	0.001	mg/L	<0.001	----	----	----	----
EG020E-W: Tantalum	7440-25-7	0.001	mg/L	<0.001	----	----	----	----
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174360)								
EG020A-W: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.5 mg/L	103	81.0	121
EG020A-W: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	95.1	79.0	119
EG020A-W: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	97.6	81.0	109
EG020A-W: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	97.6	88.0	108
EG020A-W: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.8	84.0	108
EG020A-W: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.4	84.0	114
EG020A-W: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	88.4	81.0	115
EG020A-W: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	86.4	81.0	117
EG020A-W: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	92.2	83.0	115
EG020A-W: Lithium	7439-93-2	0.001	mg/L	<0.001	0.1 mg/L	97.7	79.0	121
EG020A-W: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	91.9	84.0	112
EG020A-W: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.1 mg/L	95.5	81.0	121

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174360) - continued								
EG020A-W: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	94.1	80.0	116
EG020A-W: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	93.5	74.0	122
EG020A-W: Thallium	7440-28-0	0.001	mg/L	<0.001	0.1 mg/L	95.5	85.0	117
EG020A-W: Tin	7440-31-5	0.001	mg/L	<0.001	0.1 mg/L	93.4	81.0	121
EG020A-W: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	90.9	83.0	113
EG020A-W: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	87.4	80.0	114
EG020A-W: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	106	74.0	128
EG020A-W: Iron	7439-89-6	0.05	mg/L	<0.05	0.5 mg/L	89.9	83.0	117
EK040P: Fluoride by PC Titrator (QCLot: 3173589)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	5 mg/L	101	82.0	116
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3173617)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	103	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3174211)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	85.4	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3173618)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	99.4	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3173614)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	86.9	69.0	101
				<0.1	1 mg/L	99.4	70.0	118
				<0.1	5 mg/L	102	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3173613)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	94.9	71.0	101
				<0.01	0.442 mg/L	102	72.0	108
				<0.01	1 mg/L	108	70.0	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3171364)							
ES2025185-027	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	74.7	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	81.4	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	84.2	70.0	130
		EG005T: Copper	7440-50-8	250 mg/kg	88.9	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	87.1	70.0	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 3171364) - continued							
ES2025185-027	Anonymous	EG005T: Nickel	7440-02-0	50 mg/kg	78.1	70.0	130
		EG005T: Zinc	7440-66-6	250 mg/kg	86.2	70.0	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike Concentration	SpikeRecovery(%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 3174214)							
ES2024632-005	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	10 mg/L	86.3	70.0	130
ED045G: Chloride by Discrete Analyser (QCLot: 3174213)							
ES2024632-005	Anonymous	ED045G: Chloride	16887-00-6	250 mg/L	105	70.0	130
EG020W: Water Leachable Metals by ICP-MS (QCLot: 3174360)							
ES2025510-002	A PIT 3 N/S	EG020A-W: Arsenic	7440-38-2	1 mg/L	85.1	70.0	130
		EG020A-W: Beryllium	7440-41-7	1 mg/L	90.0	70.0	130
		EG020A-W: Barium	7440-39-3	1 mg/L	86.8	70.0	130
		EG020A-W: Cadmium	7440-43-9	0.25 mg/L	87.5	70.0	130
		EG020A-W: Chromium	7440-47-3	1 mg/L	101	70.0	130
		EG020A-W: Cobalt	7440-48-4	1 mg/L	101	70.0	130
		EG020A-W: Copper	7440-50-8	1 mg/L	76.9	70.0	130
		EG020A-W: Lead	7439-92-1	1 mg/L	130	70.0	130
		EG020A-W: Manganese	7439-96-5	1 mg/L	99.9	70.0	130
		EG020A-W: Nickel	7440-02-0	1 mg/L	84.8	70.0	130
		EG020A-W: Vanadium	7440-62-2	1 mg/L	97.4	70.0	130
		EG020A-W: Zinc	7440-66-6	1 mg/L	78.4	70.0	130
EK040P: Fluoride by PC Titrator (QCLot: 3173589)							
ES2025510-001	E PIT 2 D/S	EK040P: Fluoride	16984-48-8	5 mg/L	89.4	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 3173617)							
ES2025510-001	E PIT 2 D/S	EK055G: Ammonia as N	7664-41-7	1 mg/L	92.2	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 3174211)							
ES2024632-005	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	83.5	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 3173618)							
ES2025510-001	E PIT 2 D/S	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	89.3	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 3173614)							
ES2025510-002	A PIT 3 N/S	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	96.2	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 3173613)							
ES2025510-002	A PIT 3 N/S	EK067G: Total Phosphorus as P	----	1 mg/L	97.4	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2025510**	Page	: 1 of 23
Client	: **WILPINJONG COAL PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR CLARK POTTER	Telephone	: +61 2 6372 6735
Project	: PEABODY WILPINJONG	Date Samples Received	: 24-Jul-2020
Site	: ACIRL LITHGOW	Issue Date	: 04-Aug-2020
Sampler	: ----	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 10

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA002: pH 1:5 (Soils)						
Soil Glass Jar - Unpreserved E PIT 2 D/S	30-Jul-2020	17-Jul-2020	**13**	----	----	----
Soil Glass Jar - Unpreserved A PIT 3 N/S, A PIT 3 D/S	30-Jul-2020	18-Jul-2020	**12**	----	----	----
Soil Glass Jar - Unpreserved COAL M4 RIA STOCKPILE N/S	30-Jul-2020	19-Jul-2020	**11**	----	----	----
Soil Glass Jar - Unpreserved B1 PIT 6 N/S	30-Jul-2020	20-Jul-2020	**10**	----	----	----
Soil Glass Jar - Unpreserved B1/A/E PIT 1 N/S	30-Jul-2020	21-Jul-2020	**9**	----	----	----
Soil Glass Jar - Unpreserved COAL B1/E1 D/S	30-Jul-2020	23-Jul-2020	**7**	----	----	----
Soil Glass Jar - Unpreserved G PIT 1 D/S, B23 SP8 N/S	30-Jul-2020	24-Jul-2020	**6**	----	----	----
Soil Glass Jar - Unpreserved B23 SP8 D/S	30-Jul-2020	25-Jul-2020	**5**	----	----	----
EA010: Conductivity (1:5)						
Soil Glass Jar - Unpreserved E PIT 2 D/S	30-Jul-2020	17-Jul-2020	**13**	----	----	----
Soil Glass Jar - Unpreserved A PIT 3 N/S, A PIT 3 D/S	30-Jul-2020	18-Jul-2020	**12**	----	----	----
Soil Glass Jar - Unpreserved COAL M4 RIA STOCKPILE N/S	30-Jul-2020	19-Jul-2020	**11**	----	----	----
Soil Glass Jar - Unpreserved B1 PIT 6 N/S	30-Jul-2020	20-Jul-2020	**10**	----	----	----
Soil Glass Jar - Unpreserved B1/A/E PIT 1 N/S	30-Jul-2020	21-Jul-2020	**9**	----	----	----
Soil Glass Jar - Unpreserved COAL B1/E1 D/S	30-Jul-2020	23-Jul-2020	**7**	----	----	----
Soil Glass Jar - Unpreserved G PIT 1 D/S, B23 SP8 N/S	30-Jul-2020	24-Jul-2020	**6**	----	----	----
Soil Glass Jar - Unpreserved B23 SP8 D/S	30-Jul-2020	25-Jul-2020	**5**	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)						
Soil Glass Jar - Unpreserved E PIT 2 D/S	----	----	----	30-Jul-2020	24-Jul-2020	**6**
Soil Glass Jar - Unpreserved A PIT 3 N/S, A PIT 3 D/S	----	----	----	30-Jul-2020	25-Jul-2020	**5**

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C) - Analysis Holding Time Compliance						
Soil Glass Jar - Unpreserved COAL M4 RIA STOCKPILE N/S	----	----	----	30-Jul-2020	26-Jul-2020	**4**
Soil Glass Jar - Unpreserved B1 PIT 6 N/S	----	----	----	30-Jul-2020	27-Jul-2020	**3**
Soil Glass Jar - Unpreserved B1/A/E PIT 1 N/S	----	----	----	30-Jul-2020	28-Jul-2020	**2**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)							
Soil Glass Jar - Unpreserved (EA002) E PIT 2 D/S	**10-Jul-2020**	**30-Jul-2020**	17-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA002) A PIT 3 N/S, A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	18-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA002) COAL M4 RIA STOCKPILE N/S	**12-Jul-2020**	**30-Jul-2020**	19-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA002) B1 PIT 6 N/S	**13-Jul-2020**	**30-Jul-2020**	20-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA002) B1/A/E PIT 1 N/S	**14-Jul-2020**	**30-Jul-2020**	21-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA002) COAL B1/E1 D/S	**16-Jul-2020**	**30-Jul-2020**	23-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA002) G PIT 1 D/S, B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	24-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA002) B23 SP8 D/S	**18-Jul-2020**	**30-Jul-2020**	25-Jul-2020	×	**31-Jul-2020**	31-Jul-2020	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010: Conductivity (1:5)								
Soil Glass Jar - Unpreserved (EA010) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	17-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
Soil Glass Jar - Unpreserved (EA010) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	18-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
Soil Glass Jar - Unpreserved (EA010) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	19-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
Soil Glass Jar - Unpreserved (EA010) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	20-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
Soil Glass Jar - Unpreserved (EA010) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	21-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
Soil Glass Jar - Unpreserved (EA010) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	23-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
Soil Glass Jar - Unpreserved (EA010) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	24-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
Soil Glass Jar - Unpreserved (EA010) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	25-Jul-2020	×	**31-Jul-2020**	27-Aug-2020	✓
EA011: Net Acid Generation								
Pulp Bag (EA011) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA011A: Net Acid Generation - Sequential								
Pulp Bag (EA011S) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
EA011S: pH OX (Stage 1)								
Pulp Bag (EA011S) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA011S: pH OX (Stage 2)								
Pulp Bag (EA011S) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
EA011S: pH OX (Stage 3)								
Pulp Bag (EA011S) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA011S: pH OX (Stage 4)								
Pulp Bag (EA011S) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
EA011S: pH OX (Stage 5)								
Pulp Bag (EA011S) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA011S) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA013: Acid Neutralising Capacity								
Pulp Bag (EA013) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA013) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA013) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA013) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA013) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA013) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA013) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
Pulp Bag (EA013) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	26-Jan-2021	✓
EA033-A: Actual Acidity								
Pulp Bag (EA033) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-B: Potential Acidity								
Pulp Bag (EA033) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
EA033-C: Acid Neutralising Capacity								
Pulp Bag (EA033) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-D: Retained Acidity								
Pulp Bag (EA033) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
EA033-E: Acid Base Accounting								
Pulp Bag (EA033) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	10-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	11-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	12-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	13-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	14-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	16-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	17-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓
Pulp Bag (EA033) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	18-Jul-2021	✓	**30-Jul-2020**	28-Oct-2020	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055) E PIT 2 D/S		**10-Jul-2020**	----	----	----	**30-Jul-2020**	24-Jul-2020	×
Soil Glass Jar - Unpreserved (EA055) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	----	----	----	**30-Jul-2020**	25-Jul-2020	×
Soil Glass Jar - Unpreserved (EA055) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	----	----	----	**30-Jul-2020**	26-Jul-2020	×
Soil Glass Jar - Unpreserved (EA055) B1 PIT 6 N/S		**13-Jul-2020**	----	----	----	**30-Jul-2020**	27-Jul-2020	×
Soil Glass Jar - Unpreserved (EA055) B1/A/E PIT 1 N/S		**14-Jul-2020**	----	----	----	**30-Jul-2020**	28-Jul-2020	×
Soil Glass Jar - Unpreserved (EA055) COAL B1/E1 D/S		**16-Jul-2020**	----	----	----	**30-Jul-2020**	30-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA055) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	----	----	----	**30-Jul-2020**	31-Jul-2020	✓
Soil Glass Jar - Unpreserved (EA055) B23 SP8 D/S		**18-Jul-2020**	----	----	----	**30-Jul-2020**	01-Aug-2020	✓
ED006: Exchangeable Cations on Alkaline Soils								
Soil Glass Jar - Unpreserved (ED006) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**04-Aug-2020**	08-Aug-2020	✓	**04-Aug-2020**	08-Aug-2020	✓
Soil Glass Jar - Unpreserved (ED006) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**04-Aug-2020**	09-Aug-2020	✓	**04-Aug-2020**	09-Aug-2020	✓
Soil Glass Jar - Unpreserved (ED006) B1 PIT 6 N/S		**13-Jul-2020**	**04-Aug-2020**	10-Aug-2020	✓	**04-Aug-2020**	10-Aug-2020	✓
Soil Glass Jar - Unpreserved (ED006) B1/A/E PIT 1 N/S		**14-Jul-2020**	**04-Aug-2020**	11-Aug-2020	✓	**04-Aug-2020**	11-Aug-2020	✓
Soil Glass Jar - Unpreserved (ED006) COAL B1/E1 D/S		**16-Jul-2020**	**04-Aug-2020**	13-Aug-2020	✓	**04-Aug-2020**	13-Aug-2020	✓
Soil Glass Jar - Unpreserved (ED006) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**04-Aug-2020**	14-Aug-2020	✓	**04-Aug-2020**	14-Aug-2020	✓
Soil Glass Jar - Unpreserved (ED006) B23 SP8 D/S		**18-Jul-2020**	**04-Aug-2020**	15-Aug-2020	✓	**04-Aug-2020**	15-Aug-2020	✓
ED008: Exchangeable Cations								
Soil Glass Jar - Unpreserved (ED008) E PIT 2 D/S		**10-Jul-2020**	**04-Aug-2020**	07-Aug-2020	✓	**04-Aug-2020**	07-Aug-2020	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED042T: Total Sulfur by LECO								
Pulp Bag (ED042T) E PIT 2 D/S		**10-Jul-2020**	**03-Aug-2020**	06-Jan-2021	✓	**03-Aug-2020**	06-Jan-2021	✓
Pulp Bag (ED042T) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**03-Aug-2020**	07-Jan-2021	✓	**03-Aug-2020**	07-Jan-2021	✓
Pulp Bag (ED042T) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**03-Aug-2020**	08-Jan-2021	✓	**03-Aug-2020**	08-Jan-2021	✓
Pulp Bag (ED042T) B1 PIT 6 N/S		**13-Jul-2020**	**03-Aug-2020**	09-Jan-2021	✓	**03-Aug-2020**	09-Jan-2021	✓
Pulp Bag (ED042T) B1/A/E PIT 1 N/S		**14-Jul-2020**	**03-Aug-2020**	10-Jan-2021	✓	**03-Aug-2020**	10-Jan-2021	✓
Pulp Bag (ED042T) COAL B1/E1 D/S		**16-Jul-2020**	**03-Aug-2020**	12-Jan-2021	✓	**03-Aug-2020**	12-Jan-2021	✓
Pulp Bag (ED042T) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**03-Aug-2020**	13-Jan-2021	✓	**03-Aug-2020**	13-Jan-2021	✓
Pulp Bag (ED042T) B23 SP8 D/S		**18-Jul-2020**	**03-Aug-2020**	14-Jan-2021	✓	**03-Aug-2020**	14-Jan-2021	✓
EG005(ED093)T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	06-Jan-2021	✓	**31-Jul-2020**	06-Jan-2021	✓
Soil Glass Jar - Unpreserved (EG005T) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	07-Jan-2021	✓	**31-Jul-2020**	07-Jan-2021	✓
Soil Glass Jar - Unpreserved (EG005T) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	08-Jan-2021	✓	**31-Jul-2020**	08-Jan-2021	✓
Soil Glass Jar - Unpreserved (EG005T) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	09-Jan-2021	✓	**31-Jul-2020**	09-Jan-2021	✓
Soil Glass Jar - Unpreserved (EG005T) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	10-Jan-2021	✓	**31-Jul-2020**	10-Jan-2021	✓
Soil Glass Jar - Unpreserved (EG005T) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	12-Jan-2021	✓	**31-Jul-2020**	12-Jan-2021	✓
Soil Glass Jar - Unpreserved (EG005T) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	13-Jan-2021	✓	**31-Jul-2020**	13-Jan-2021	✓
Soil Glass Jar - Unpreserved (EG005T) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	14-Jan-2021	✓	**31-Jul-2020**	14-Jan-2021	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EN60: Bottle Leaching Procedure								
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) E PIT 2 D/S		**10-Jul-2020**	**30-Jul-2020**	07-Aug-2020	✓	**----**	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**30-Jul-2020**	08-Aug-2020	✓	**----**	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**30-Jul-2020**	09-Aug-2020	✓	**----**	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) B1 PIT 6 N/S		**13-Jul-2020**	**30-Jul-2020**	10-Aug-2020	✓	**----**	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) B1/A/E PIT 1 N/S		**14-Jul-2020**	**30-Jul-2020**	11-Aug-2020	✓	**----**	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) COAL B1/E1 D/S		**16-Jul-2020**	**30-Jul-2020**	13-Aug-2020	✓	**----**	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**30-Jul-2020**	14-Aug-2020	✓	**----**	----	----
Non-Volatile Leach: 28 day HT(e.g. Hg, CrVI) (EN60-Dla) B23 SP8 D/S		**18-Jul-2020**	**30-Jul-2020**	15-Aug-2020	✓	**----**	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag (EP003) E PIT 2 D/S		**10-Jul-2020**	**03-Aug-2020**	07-Aug-2020	✓	**03-Aug-2020**	07-Aug-2020	✓
Pulp Bag (EP003) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**03-Aug-2020**	08-Aug-2020	✓	**03-Aug-2020**	08-Aug-2020	✓
Pulp Bag (EP003) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**03-Aug-2020**	09-Aug-2020	✓	**03-Aug-2020**	09-Aug-2020	✓
Pulp Bag (EP003) B1 PIT 6 N/S		**13-Jul-2020**	**03-Aug-2020**	10-Aug-2020	✓	**03-Aug-2020**	10-Aug-2020	✓
Pulp Bag (EP003) B1/A/E PIT 1 N/S		**14-Jul-2020**	**03-Aug-2020**	11-Aug-2020	✓	**03-Aug-2020**	11-Aug-2020	✓
Pulp Bag (EP003) COAL B1/E1 D/S		**16-Jul-2020**	**03-Aug-2020**	13-Aug-2020	✓	**03-Aug-2020**	13-Aug-2020	✓
Pulp Bag (EP003) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**03-Aug-2020**	14-Aug-2020	✓	**03-Aug-2020**	14-Aug-2020	✓
Pulp Bag (EP003) B23 SP8 D/S		**18-Jul-2020**	**03-Aug-2020**	15-Aug-2020	✓	**03-Aug-2020**	15-Aug-2020	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EP003TC: Total Carbon (TC) in Soil								
Pulp Bag (EP003TC) E PIT 2 D/S		**10-Jul-2020**	**03-Aug-2020**	07-Aug-2020	✓	**03-Aug-2020**	07-Aug-2020	✓
Pulp Bag (EP003TC) A PIT 3 N/S,	A PIT 3 D/S	**11-Jul-2020**	**03-Aug-2020**	08-Aug-2020	✓	**03-Aug-2020**	08-Aug-2020	✓
Pulp Bag (EP003TC) COAL M4 RIA STOCKPILE N/S		**12-Jul-2020**	**03-Aug-2020**	09-Aug-2020	✓	**03-Aug-2020**	09-Aug-2020	✓
Pulp Bag (EP003TC) B1 PIT 6 N/S		**13-Jul-2020**	**03-Aug-2020**	10-Aug-2020	✓	**03-Aug-2020**	10-Aug-2020	✓
Pulp Bag (EP003TC) B1/A/E PIT 1 N/S		**14-Jul-2020**	**03-Aug-2020**	11-Aug-2020	✓	**03-Aug-2020**	11-Aug-2020	✓
Pulp Bag (EP003TC) COAL B1/E1 D/S		**16-Jul-2020**	**03-Aug-2020**	13-Aug-2020	✓	**03-Aug-2020**	13-Aug-2020	✓
Pulp Bag (EP003TC) G PIT 1 D/S,	B23 SP8 N/S	**17-Jul-2020**	**03-Aug-2020**	14-Aug-2020	✓	**03-Aug-2020**	14-Aug-2020	✓
Pulp Bag (EP003TC) B23 SP8 D/S		**18-Jul-2020**	**03-Aug-2020**	15-Aug-2020	✓	**03-Aug-2020**	15-Aug-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator								
Clear Plastic Bottle - Natural (ED037-P) E PIT 2 D/S, A PIT 3 D/S, B1 PIT 6 N/S, COAL B1/E1 D/S, B23 SP8 N/S,	A PIT 3 N/S, COAL M4 RIA STOCKPILE N/S, B1/A/E PIT 1 N/S, G PIT 1 D/S, B23 SP8 D/S	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	13-Aug-2020	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Clear Plastic Bottle - Natural (ED041G) E PIT 2 D/S, A PIT 3 D/S, B1 PIT 6 N/S, COAL B1/E1 D/S, B23 SP8 N/S,	A PIT 3 N/S, COAL M4 RIA STOCKPILE N/S, B1/A/E PIT 1 N/S, G PIT 1 D/S, B23 SP8 D/S	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	27-Aug-2020	✓
ED045G: Chloride by Discrete Analyser								
Clear Plastic Bottle - Natural (ED045G) E PIT 2 D/S, A PIT 3 D/S, B1 PIT 6 N/S, COAL B1/E1 D/S, B23 SP8 N/S,	A PIT 3 N/S, COAL M4 RIA STOCKPILE N/S, B1/A/E PIT 1 N/S, G PIT 1 D/S, B23 SP8 D/S	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	27-Aug-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations								
Clear Plastic Bottle - Natural (ED093F)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	06-Aug-2020	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							
EG020W: Water Leachable Metals by ICP-MS								
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG020G-W)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**01-Aug-2020**	26-Jan-2021	✓	**01-Aug-2020**	26-Jan-2021	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							
EK040P: Fluoride by PC Titrator								
Clear Plastic Bottle - Natural (EK040P)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	27-Aug-2020	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	27-Aug-2020	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	01-Aug-2020	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**----**	----	----	**31-Jul-2020**	27-Aug-2020	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**31-Jul-2020**	27-Aug-2020	✓	**31-Jul-2020**	27-Aug-2020	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
E PIT 2 D/S,	A PIT 3 N/S,	**30-Jul-2020**	**31-Jul-2020**	27-Aug-2020	✓	**31-Jul-2020**	27-Aug-2020	✓
A PIT 3 D/S,	COAL M4 RIA STOCKPILE N/S,							
B1 PIT 6 N/S,	B1/A/E PIT 1 N/S,							
COAL B1/E1 D/S,	G PIT 1 D/S,							
B23 SP8 N/S,	B23 SP8 D/S							

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	1	1	**100.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation	EA011	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation - Sequential	EA011S	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chromium Suite for Acid Sulphate Soils	EA033	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation	EA011	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Net Acid Generation - Sequential	EA011S	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Electrical Conductivity (1:5)	EA010	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfur - Total as S (LECO)	ED042T	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Carbon	EP003TC	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: ✗ = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type *Analytical Methods*	*Method*	*Count* QC	Regular	*Rate (%)* **Actual**	**Expected**	*Evaluation*	*Quality Control Specification*
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite C	EG020D-W	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite E	EG020E-W	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite G	EG020G-W	2	10	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Ammonia as N by Discrete analyser	EK055G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Water Leachable Metals by ICP-MS - Suite C	EG020D-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite E	EG020E-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite G	EG020G-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Fluoride by PC Titrator	EK040P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Net Acid Production Potential	EA009	SOIL	In house: Referenced to Coastech Research (Canada)(Mod.). NAPP = Acid Production Potential (APP or MAP-Maximum Acid Potential) minus Neutralising Capacity (ANC). NAPP may be +ve, zero or -ve.
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Net Acid Generation	EA011	SOIL	In house: Referenced to Miller (1998) Titremetric procedure determines net acidity in a soil following peroxide oxidation. Titrations to both pH 4.5 and pH 7 are reported.
Net Acid Generation - Sequential	EA011S	SOIL	In house: Referenced to Miller (1998) Titremetric procedure determines net acidity in a soil following peroxide oxidation. Titrations to both pH 4.5 and pH 7 are reported.
Acid Neutralising Capacity (ANC)	EA013	SOIL	In house: Referenced to USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations on Alkaline Soils	ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Higginson Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Alkalinity by PC Titrator	ED037-P	SOIL	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	SOIL	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM Schedule B(3)
Sulfur - Total as S (LECO)	ED042T	SOIL	In house: Dried and pulverised sample is combusted in a high temperature furnace in the presence of strong oxidants / catalysts. The evolved S (as SO2) is measured by infra-red detector

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Chloride by Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocyanate forms highly-coloured ferric thiocyanate which is measured at 480 nm APHA seal method 2 017-1-L
Major Cations - Dissolved	ED093F	SOIL	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM Schedule B(3)
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Water Leachable Metals by ICP-MS - Suite A	EG020A-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, AS 4439.3, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Water Leachable Metals by ICP-MS - Suite B	EG020B-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Water Leachable Metals by ICP-MS - Suite C	EG020D-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Water Leachable Metals by ICP-MS - Suite E	EG020E-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Water Leachable Metals by ICP-MS - Suite G	* EG020G-W	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Fluoride by PC Titrator	EK040P	SOIL	In house: Referenced to APHA 4500-F C: CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM Schedule B(3)
Ammonia as N by Discrete analyser	EK055G	SOIL	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	SOIL	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Nitrate as N by Discrete Analyser	EK058G	SOIL	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	SOIL	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	SOIL	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	SOIL	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	SOIL	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	* EN055 - PG	SOIL	In house: Referenced to APHA 1030F. This method is compliant with NEPM Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automatically measured by infra-red detector.
Total Carbon	EP003TC	SOIL	In house C-IR07. Dried and pulverised sample is combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved Carbon (as CO2) is measured by infra-red detector

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method (Alkaline Soils)	ED006PR	SOIL	In house: Referenced to Rayment and Lyons method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
TKN/TP Digestion	EK061/EK067	SOIL	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
Digestion for Total Recoverable Metals in DI Water Leachate	EN25W	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM Schedule B(3)
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Deionised Water Leach	EN60-DIa	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Dry and Pulverise (up to 100g)	GEO30	SOIL	#

APPENDIX C

Kinetic NAG Tests

ALS Environmental

Kinetic Net Acid Generation (NAG) Report

Batch: EB2028135

CONTACT:	MR CLARK POTTER	**LABORATORY:**	Brisbane
CLIENT:	WILPINJONG COAL PTY LTD	**DATE SAMPLED:**	As per report
ADDRESS:	PEABODY ENERGY LOCKED BAG 2005 ABN 87104594694 MUDGEE NSW, AUSTRALIA 2850	**DATE RECEIVED:**	27/10/2020
		DATE COMPLETED:	3/11/2020
		SAMPLE TYPE:	Soil
		No. of SAMPLES:	8

COMMENTS

EA011K: This method is not NATA accredited

ISSUING LABORATORY: ALS BRISBANE

Address:	2 Byth Street STAFFORD QLD 4053 AUSTRALIA	**Telephone:**	07 3243 7222
		Facsimile:	07 3243 7218
		E-mail:	Satishkumar.Trivedi@alsglobal.com

Signatory

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	EB2028135 001	EB2028135 001 Check	EB2028135 002
Sub Matrix	Soil	Soil	Soil
Client Sample Identification 1	**A PIT 3 N/S**	**A PIT 3 N/S**	**B1 PIT 6 N/S**
Client Sample Identification 2	Stage 1	Stage 1	Stage 1
Sample Date	11/07/2020	11/07/2020	13/07/2020

EA011-K: (A) Titration information

Time (mins)	pH	Temp	pH	Temp	pH	Temp
0	5.48	20.9	5.37	22.8	6.24	21.6
10	5.28	23.2	5.19	23.3	6.58	23.4
20	4.85	23.7	4.86	23.7	6.52	23.9
30	4.54	24.1	4.60	24.2	6.45	24.4
40	4.33	24.5	4.35	24.6	6.35	24.9
50	4.08	24.9	4.11	24.9	6.23	25.4
60	3.89	25.2	3.90	25.1	6.12	25.7
70	3.71	25.2	3.72	25.1	6.03	25.6
80	3.55	25.1	3.57	24.9	5.96	25.6
90	3.41	25.2	3.45	25.0	5.88	25.7
100	3.30	25.4	3.33	25.2	5.80	25.8
110	3.21	25.6	3.24	25.5	5.71	26.1
120	3.14	25.9	3.16	25.8	5.61	26.4
130	3.08	26.1	3.10	25.9	5.51	26.4
140	3.01	26.2	3.04	25.9	5.42	26.1
150	2.96	26.0	3.01	25.7	5.31	25.9
160	2.92	26.1	2.97	25.8	5.20	25.9
170	2.90	26.3	2.93	26.0	5.08	26.0
180	2.86	26.4	2.89	26.2	4.95	26.2
190	2.82	26.7	2.87	26.5	4.81	26.4
200	2.77	26.9	2.85	26.6	4.67	26.4
210	2.76	26.8	2.83	26.5	4.53	26.1
220	2.74	26.7	2.81	26.3	4.40	25.9
230	2.70	26.5	2.78	26.2	4.27	25.8
240	2.71	26.6	2.77	26.2	4.17	25.9
250	2.67	26.7	2.75	26.4	4.06	26.0
260	2.67	26.9	2.74	26.6	3.97	26.2
270	2.66	27.0	2.72	26.6	3.87	26.1
280	2.65	26.8	2.69	26.4	3.79	25.9
290	2.64	26.6	2.70	26.1	3.73	25.6
300	2.62	26.4	2.70	26.0	3.67	25.6
310	2.61	26.5	2.68	26.1	3.63	25.7
320	2.61	26.6	2.68	26.2	3.58	25.7
330	2.59	26.5	2.68	26.1	3.55	25.6
340	2.59	26.3	2.64	25.8	3.52	25.3
350	2.58	26.1	2.65	25.6	3.50	25.1
360	2.57	26.1	2.64	25.7	3.48	25.1

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

Sub Matrix	Soil	Soil	Soil
Client Sample Identification 1	**B1/A/E PIT 1 N/S**	**B23 SP8 D/S**	**B23 SP8 N/S**
Client Sample Identification 2	Stage 1	Stage 1	Stage 1
Sample Date	14/07/2020	18/07/2020	17/07/2020
	EB2028135 003	**EB2028135 004**	**EB2028135 005**

EA011-K: (A) Titration information

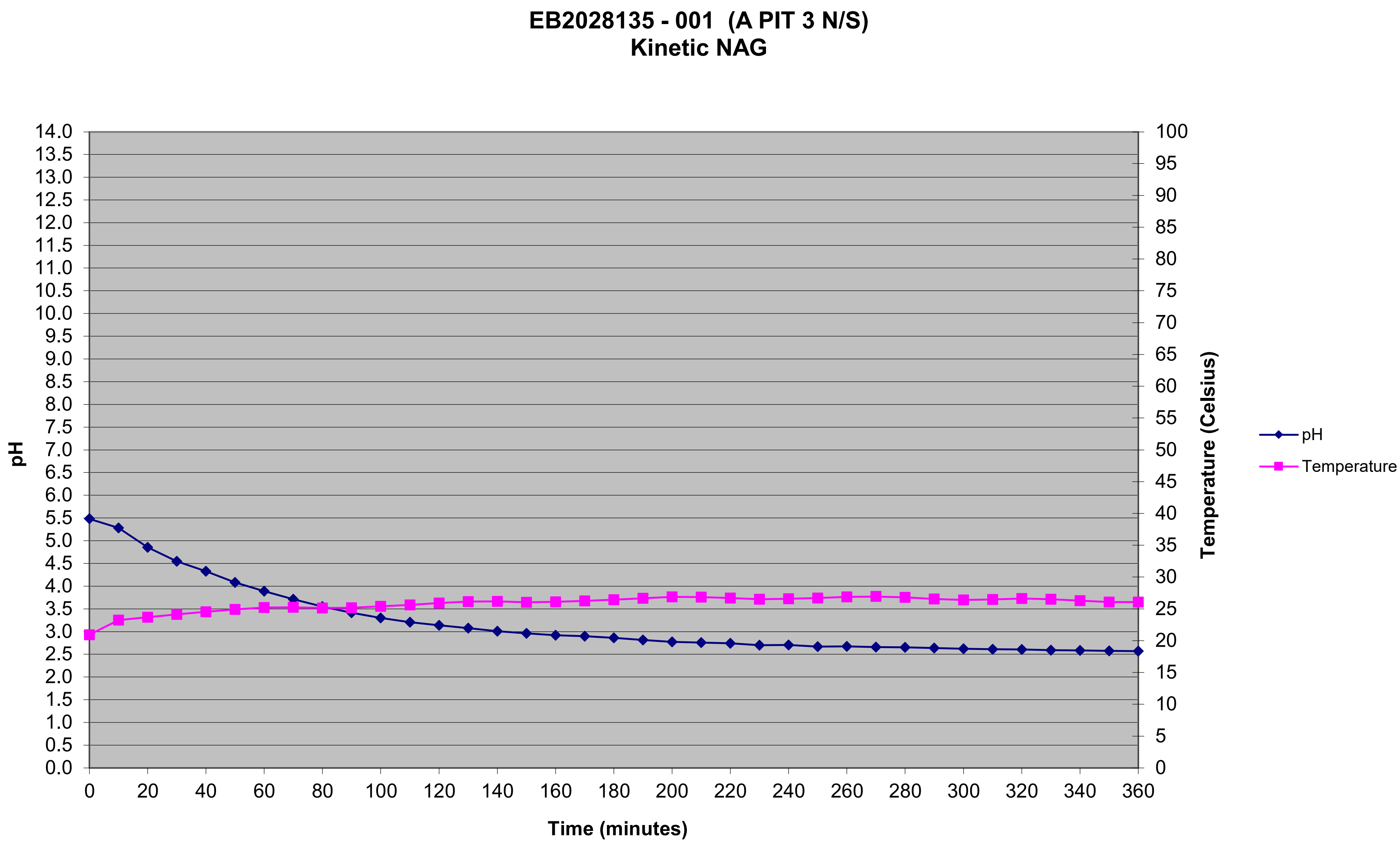
Time (mins)	pH	Temp	pH	Temp	pH	Temp
0	5.46	21.2	4.49	20.3	5.40	20.8
10	5.82	23.5	4.16	21.3	6.08	21.3
20	5.51	24.1	4.09	21.7	6.06	21.6
30	5.16	24.6	3.90	22.0	6.03	22.0
40	4.71	25.1	3.77	22.4	6.04	22.4
50	4.26	25.5	3.49	22.8	6.04	22.7
60	3.80	25.7	3.38	22.8	6.04	22.8
70	3.48	25.7	3.26	22.9	6.00	22.7
80	3.26	25.7	3.17	23.1	6.05	22.9
90	3.11	25.9	3.05	23.4	6.03	23.1
100	3.03	26.2	2.96	23.7	6.06	23.4
110	2.97	26.6	2.87	23.9	6.04	23.6
120	2.93	27.1	2.83	23.8	6.03	23.4
130	2.89	27.2	2.78	23.7	6.01	23.3
140	2.87	27.1	2.74	23.8	6.03	23.4
150	2.85	27.1	2.72	24.0	6.04	23.5
160	2.83	27.3	2.70	24.2	6.00	23.7
170	2.82	27.5	2.66	24.4	6.02	23.9
180	2.81	27.9	2.62	24.7	6.01	24.1
190	2.80	28.3	2.60	24.6	6.02	24.1
200	2.80	28.5	2.60	24.4	5.97	23.9
210	2.79	28.4	2.57	24.4	6.00	23.9
220	2.78	28.1	2.55	24.5	5.98	24.0
230	2.78	28.1	2.55	24.7	5.93	24.1
240	2.78	28.3	2.56	24.8	5.96	24.3
250	2.78	28.6	2.53	25.0	5.96	24.5
260	2.77	28.9	2.53	25.2	5.95	24.7
270	2.77	28.9	2.52	25.3	5.91	24.8
280	2.77	28.8	2.48	25.5	5.87	25.0
290	2.77	28.6	2.48	25.5	5.85	25.0
300	2.76	28.6	2.50	25.2	5.83	24.7
310	2.76	28.8	2.47	25.0	5.82	24.5
320	2.76	28.9	2.47	25.0	5.82	24.5
330	2.76	28.7	2.48	25.0	5.76	24.5
340	2.76	28.5	2.45	25.1	5.75	24.6
350	2.76	28.4	2.44	25.2	5.73	24.7
360	2.76	28.5	2.42	25.3	5.67	24.8

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

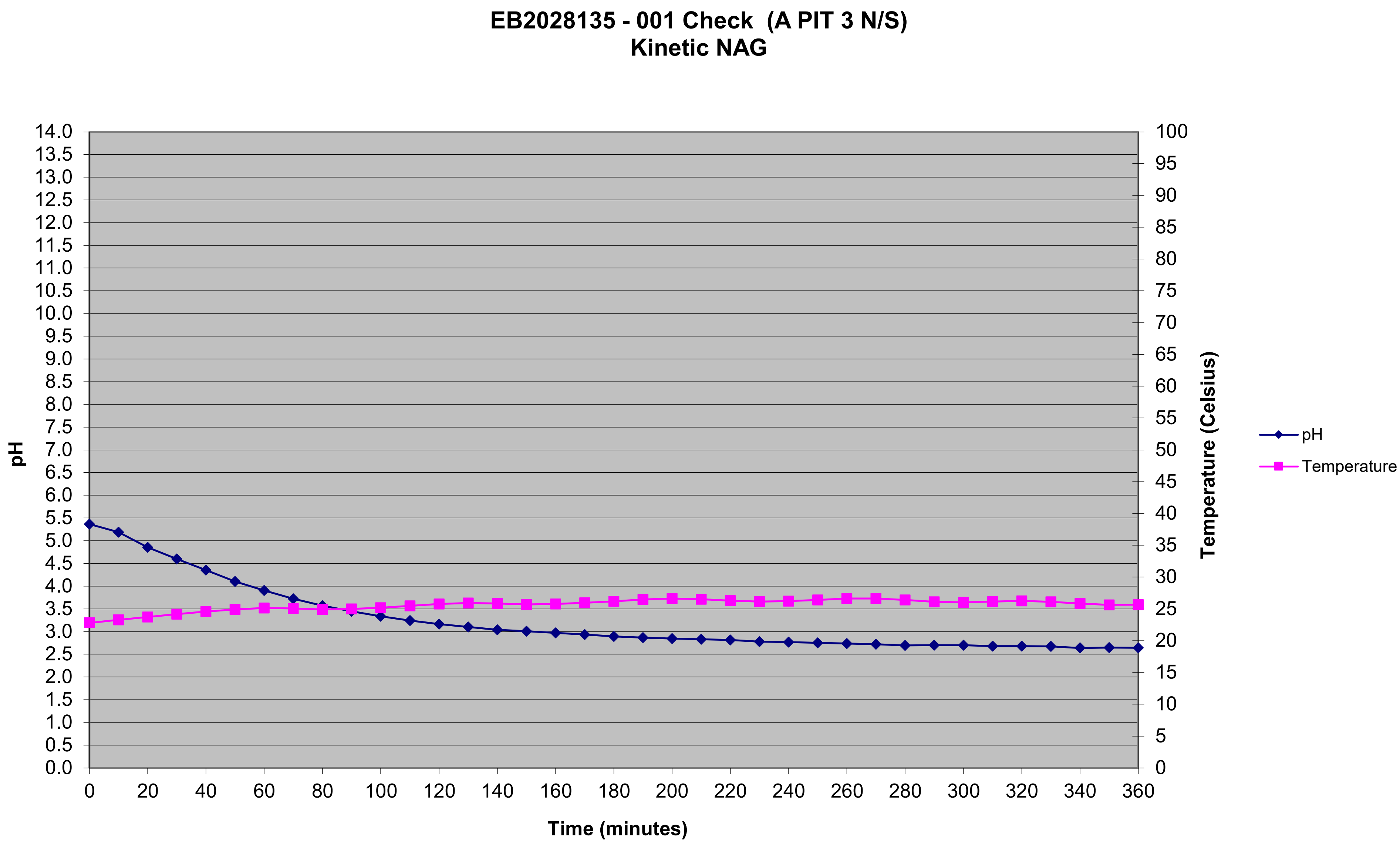
Sub Matrix	Soil	Soil	Soil
Client Sample Identification 1	COAL B1/E1 D/S	COAL M4 RIA STOCKPILI	G PIT 1 D/S
Client Sample Identification 2	Stage 1	Stage 1	
Sample Date	16/07/2020	12/07/2020	11/07/2020
	EB2028135 006	EB2028135 007	EB2028135 008

EA011-K: (A) Titration information

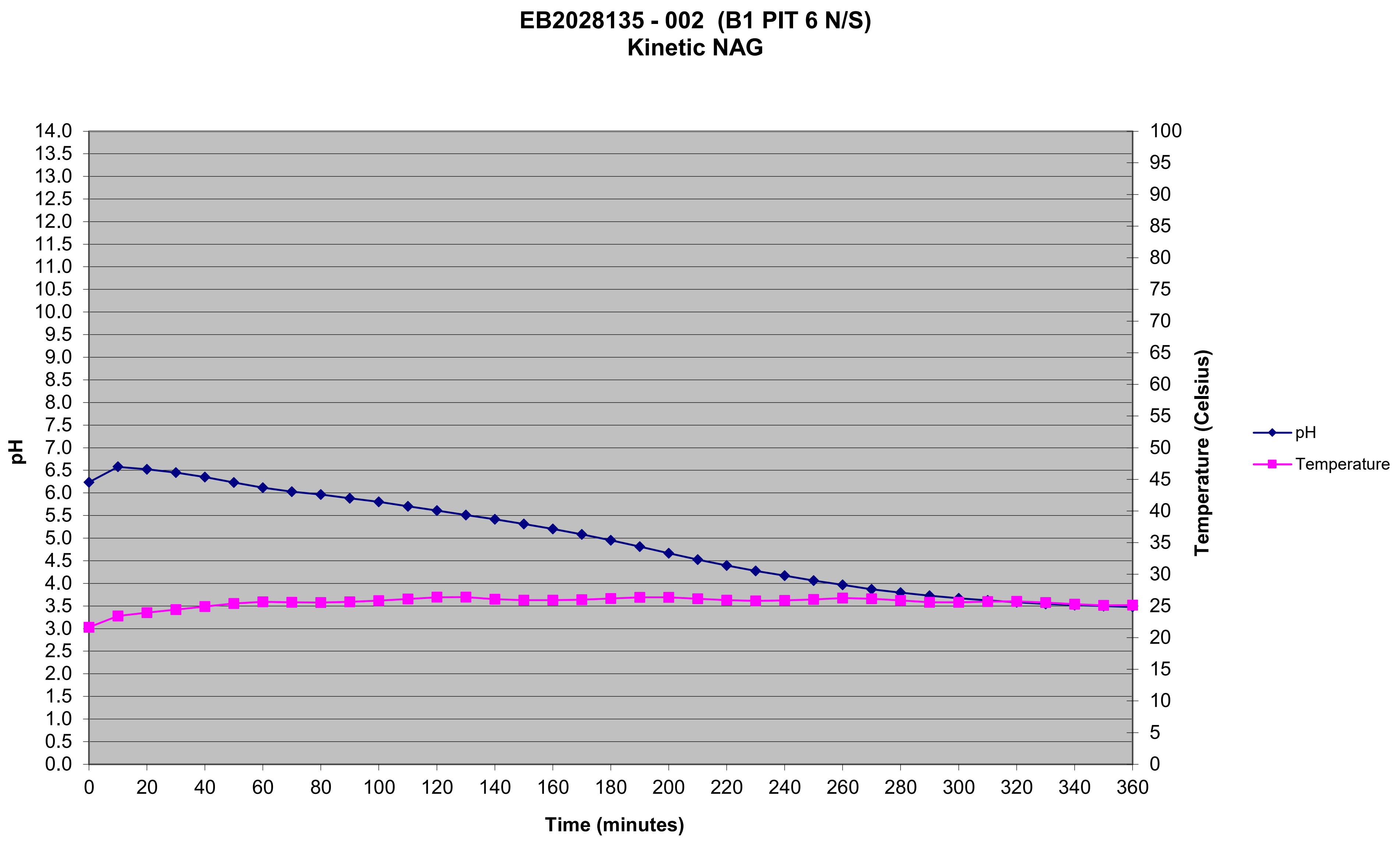
Time (mins)	pH	Temp	pH	Temp	pH	Temp
0	5.10	21.1	5.77	22.2	5.01	25.4
10	4.94	21.6	6.00	21.7	2.63	25.2
20	4.41	22.0	5.72	22.0	2.32	26.7
30	3.90	22.4	5.56	22.3	2.22	29.0
40	3.59	22.9	5.38	22.7	2.18	32.3
50	3.35	23.3	5.23	23.0	2.16	37.8
60	3.18	23.4	5.15	23.1	2.15	48.1
70	3.06	23.5	5.01	23.1	2.34	90.2
80	2.98	23.9	4.90	23.2	2.47	73.1
90	2.91	24.3	4.76	23.5	2.56	61.0
100	2.86	24.8	4.63	23.8	2.59	52.8
110	2.82	25.2	4.50	23.9	2.60	46.9
120	2.78	25.2	4.36	23.8	2.60	42.4
130	2.76	25.2	4.22	23.7	2.60	39.2
140	2.74	25.4	4.12	23.8	2.60	36.7
150	2.72	25.7	3.99	23.9	2.60	34.8
160	2.71	26.1	3.89	24.1	2.60	33.0
170	2.70	26.5	3.79	24.4	2.60	31.3
180	2.70	26.9	3.68	24.6	2.60	29.9
190	2.69	26.9	3.58	24.6	2.61	29.0
200	2.68	26.8	3.48	24.4	2.61	28.4
210	2.68	27.0	3.39	24.5	2.62	28.0
220	2.67	27.2	3.31	24.6	2.61	27.2
230	2.67	27.5	3.24	24.8	2.62	26.4
240	2.67	27.9	3.18	25.0	2.62	25.8
250	2.67	28.2	3.13	25.2	2.62	25.6
260	2.66	28.6	3.07	25.4	2.63	25.5
270	2.66	29.0	3.04	25.6	2.63	25.1
280	2.66	29.4	3.00	25.8	2.63	24.6
290	2.66	29.5	2.97	25.8	2.63	24.3
300	2.65	29.2	2.94	25.5	2.64	24.3
310	2.65	29.0	2.91	25.3	2.64	24.3
320	2.66	29.0	2.89	25.2	2.65	24.1
330	2.66	29.1	2.87	25.3	2.64	23.7
340	2.66	29.3	2.86	25.4	2.65	23.5
350	2.66	29.5	2.85	25.5	2.65	23.5
360	2.66	29.7	2.84	25.6	2.65	23.6

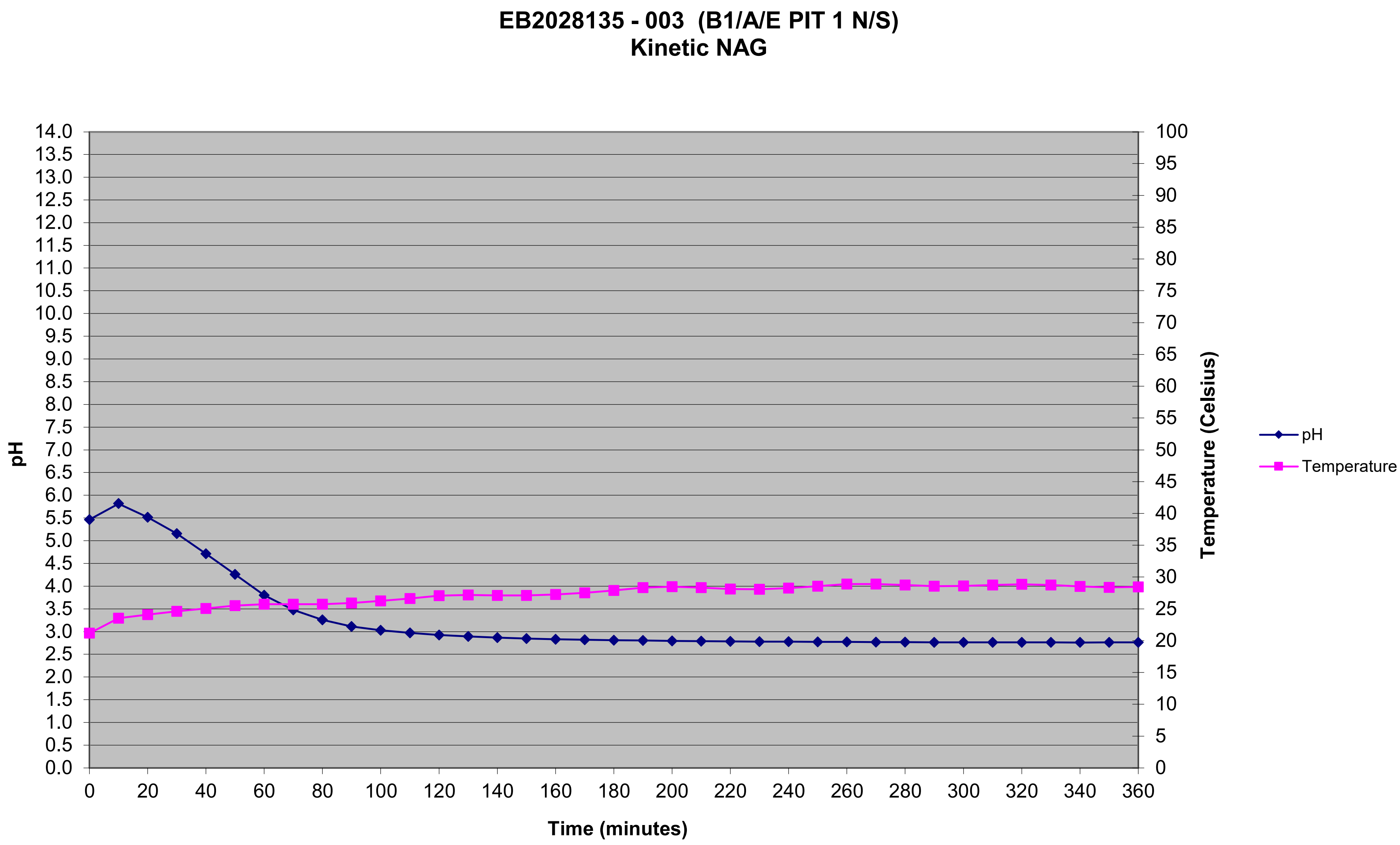


EB2028135 - 001 (A PIT 3 N/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360



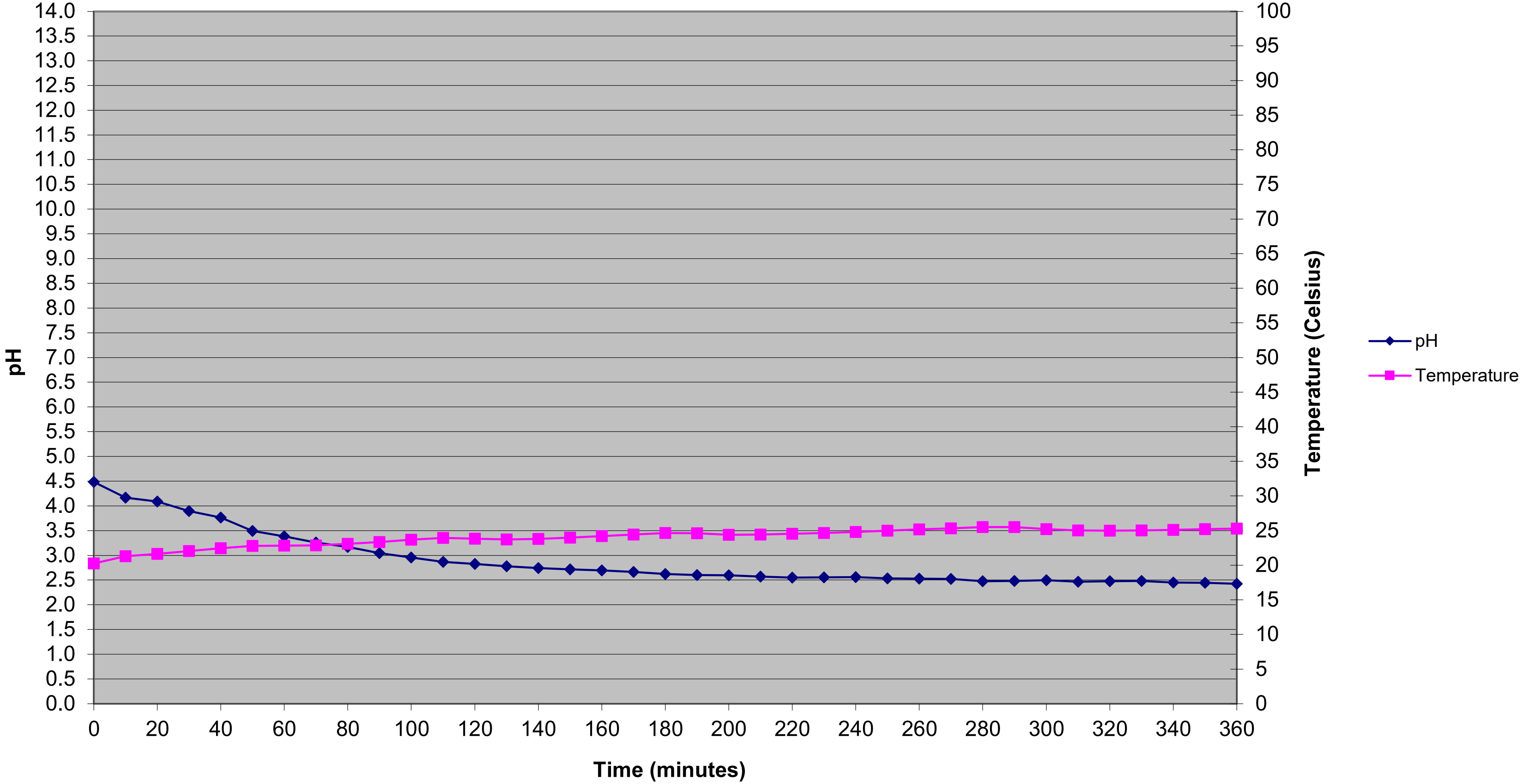
EB2028135 - 001 Check (A PIT 3 N/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature

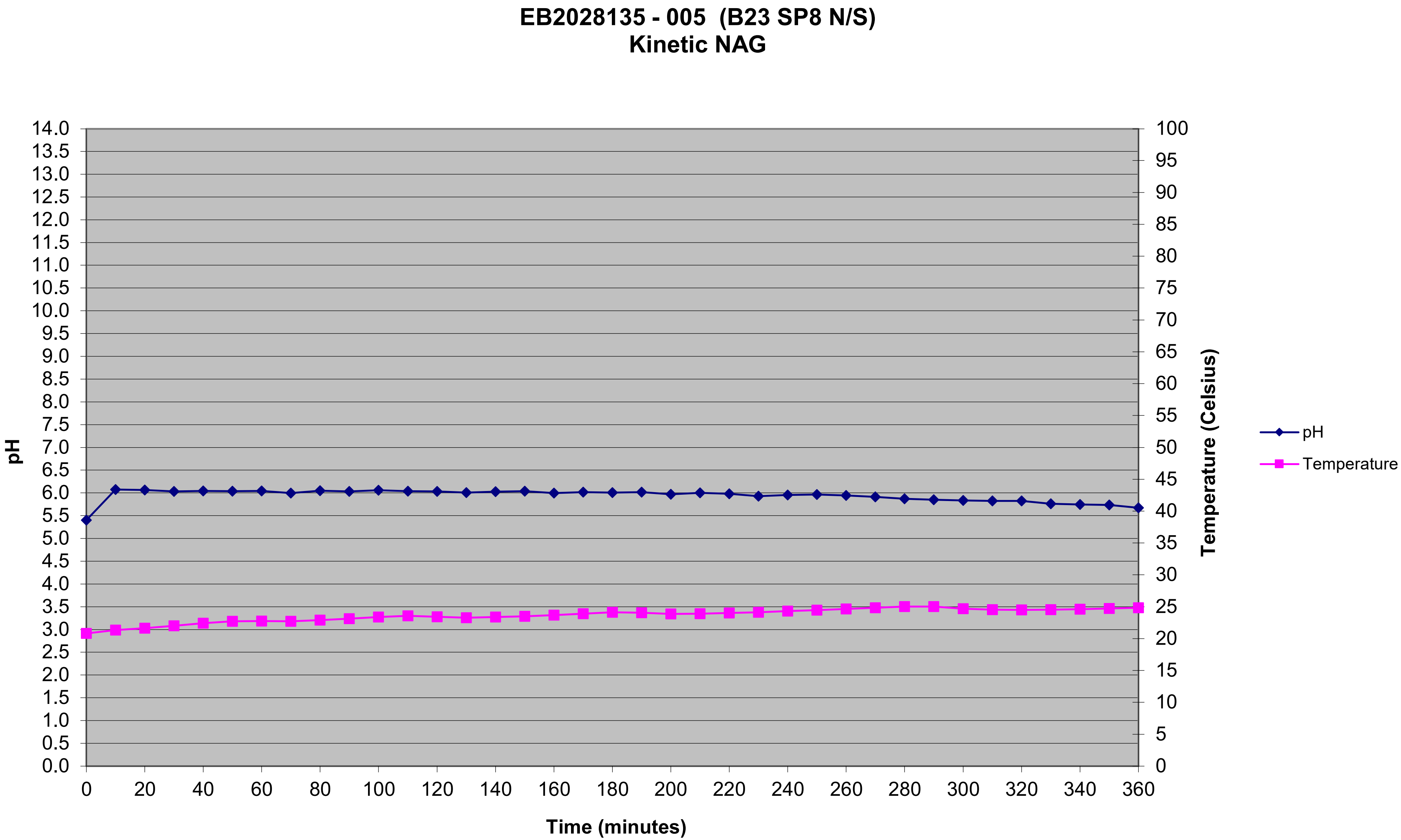

EB2028135 - 002 (B1 PIT 6 N/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360

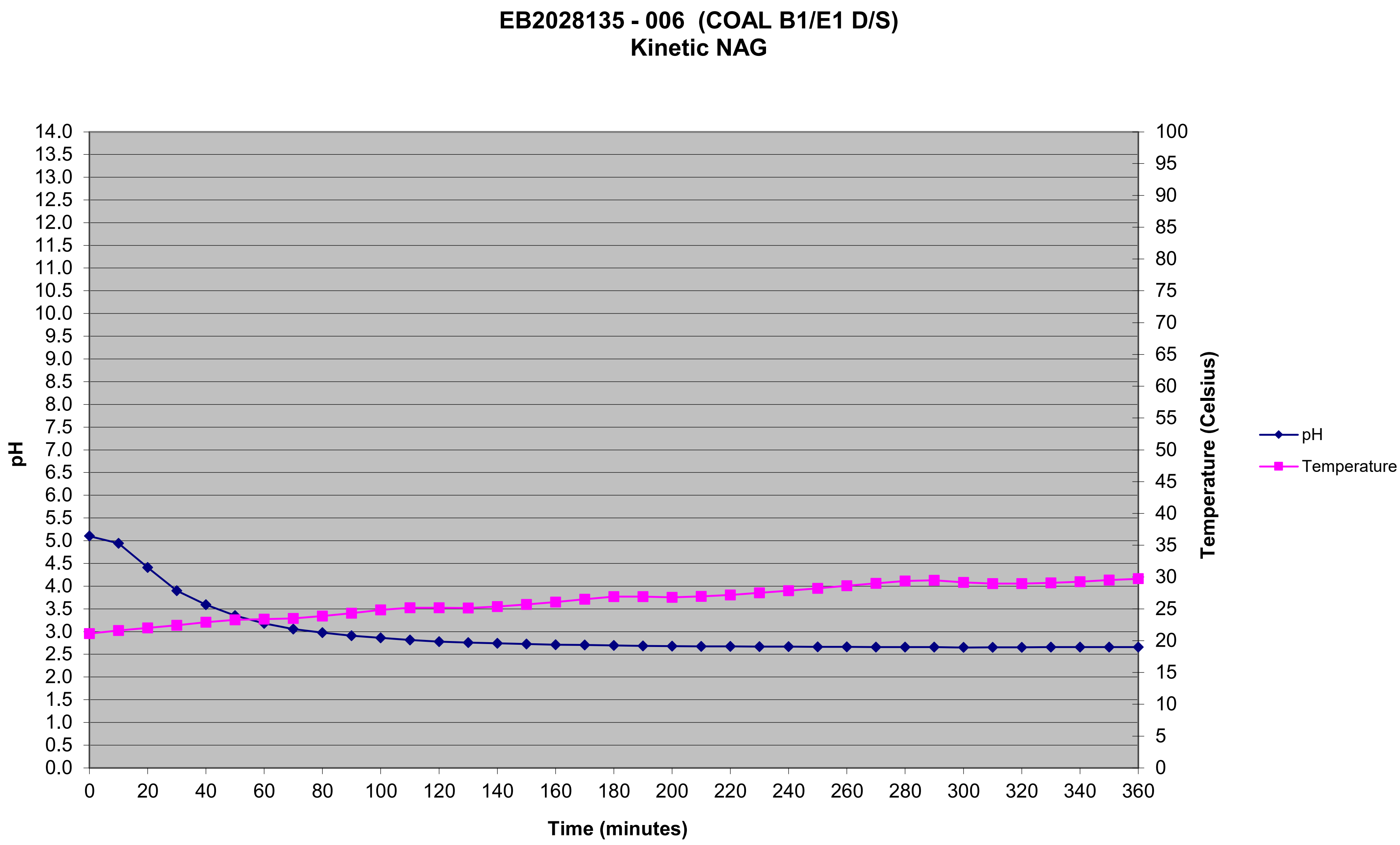


EB2028135 - 003 (B1/A/E PIT 1 N/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360

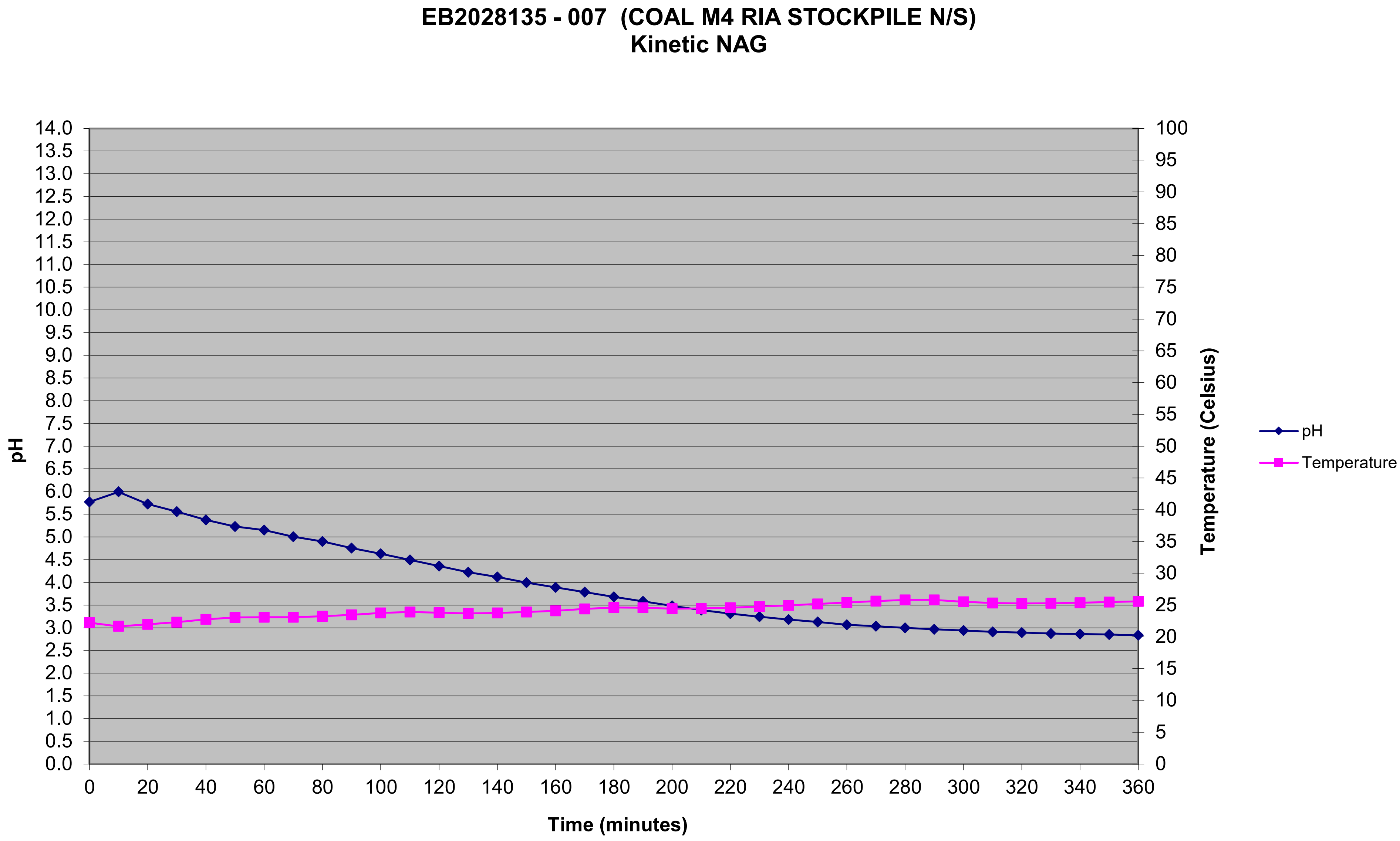
EB2028135 - 004 (B23 SP8 D/S)
Kinetic NAG




EB2028135 - 005 (B23 SP8 N/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360



EB2028135 - 006 (COAL B1/E1 D/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360


EB2028135 - 007 (COAL M4 RIA STOCKPILE N/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
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2.0
1.5
1.0
0.5
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100
95
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140
160
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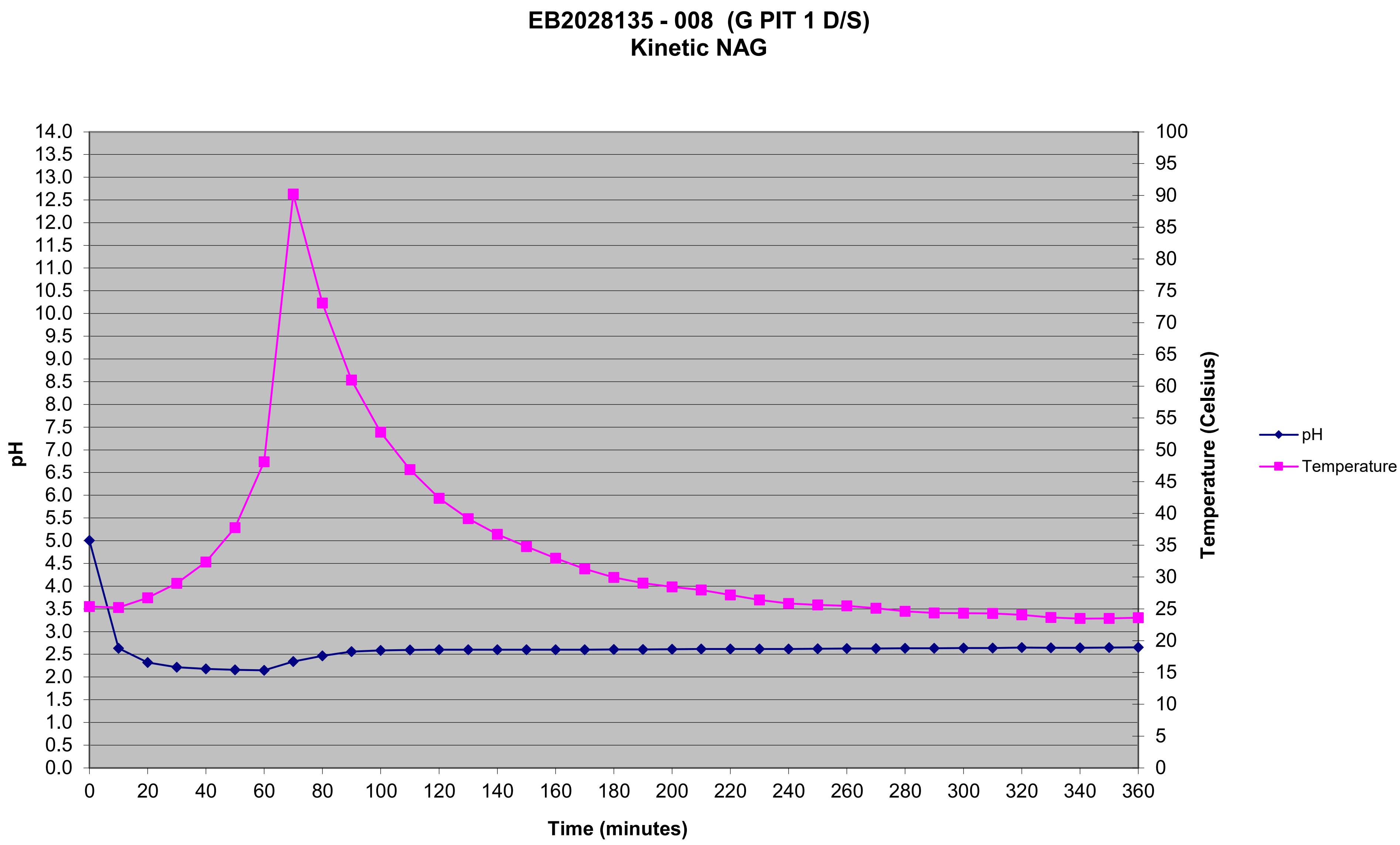
220
240
260
280
300
320
340
360


EB2028135 - 008 (G PIT 1 D/S)
Kinetic NAG
pH
Temperature (Celsius)
Time (minutes)
pH
Temperature
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
100
95
90
85
80
75
70
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60
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140
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300
320
340
360

APPENDIX D

ABCC

ALS Environmental

Acid Buffering Characteristic Curve (ABCC) REPORT

Batch: **EB2028135**

CONTACT:	MR CLARK POTTER	**LABORATORY:**	Brisbane
CLIENT:	WILPINJONG COAL PTY LTD	**DATE SAMPLED:**	As per report
ADDRESS:	PEABODY ENERGY LOCKED BAG 2005 ABN 87104594694 MUDGEE NSW, AUSTRALIA 2850	**DATE RECEIVED:**	27/10/2020
		DATE COMPLETED:	3/11/2020
		SAMPLE TYPE:	Soil
		No. of SAMPLES:	8

COMMENTS

EA046 : NATA accreditation does not cover performance of this service.

ISSUING LABORATORY: ALS BRISBANE

Address:	2 Byth Street STAFFORD QLD 4053 AUSTRALIA	**Telephone:**	07 3243 7222
		Facsimile:	07 3243 7218
		E-mail:	Satishkumar.Trivedi@alsglobal.com

Signatory

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			A PIT 3 N/S
	Client Sample Identification 2			Stage 1
	Sample Date			11/07/2020
Method	Analyte	Units	LOR	
				001 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**16.6**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	8.13	36	7.2	17.64	2.77
1	0.2	0.49	7.34	37	7.4	18.13	2.77
2	0.4	0.98	6.82	38	7.6	18.62	2.76
3	0.6	1.47	6.09	39	7.8	19.11	2.75
4	0.8	1.96	5.41	40	8	19.6	2.75
5	1	2.45	5.01	41	8.2	20.09	2.74
6	1.2	2.94	4.71	42	8.4	20.58	2.73
7	1.4	3.43	4.46	43	8.6	21.07	2.73
8	1.6	3.92	4.24	44	8.8	21.56	2.72
9	1.8	4.41	4.03	45	9	22.05	2.72
10	2	4.9	3.86	46	9.2	22.54	2.71
11	2.2	5.39	3.75	47	9.4	23.03	2.70
12	2.4	5.88	3.63	48	9.6	23.52	2.70
13	2.6	6.37	3.53	49	9.8	24.01	2.69
14	2.8	6.86	3.43	50	10	24.5	2.69
15	3	7.35	3.35	51	10.2	24.99	2.68
16	3.2	7.84	3.28	52	10.4	25.48	2.67
17	3.4	8.33	3.22	53	10.6	25.97	2.67
18	3.6	8.82	3.17	54	10.8	26.46	2.66
19	3.8	9.31	3.12	55	11	26.95	2.65
20	4	9.8	3.08	56	11.2	27.44	2.64
21	4.2	10.29	3.05	57	11.4	27.93	2.64
22	4.4	10.78	3.01	58	11.6	28.42	2.63
23	4.6	11.27	2.98	59	11.8	28.91	2.62
24	4.8	11.76	2.96	60	12	29.4	2.62
25	5	12.25	2.93	61	12.2	29.89	2.61
26	5.2	12.74	2.91	62	12.4	30.38	2.60
27	5.4	13.23	2.89	63	12.6	30.87	2.59
28	5.6	13.72	2.87	64	12.8	31.36	2.59
29	5.8	14.21	2.86	65	13	31.85	2.58
30	6	14.7	2.84	66	13.2	32.34	2.57
31	6.2	15.19	2.83	67	13.4	32.83	2.56
32	6.4	15.68	2.81	68	13.6	33.32	2.55
33	6.6	16.17	2.80	69	13.8	33.81	2.55
34	6.8	16.66	2.79	70	14	34.3	2.54
35	7	17.15	2.78	71	14.2	34.79	2.53

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			A PIT 3 N/S
	Client Sample Identification 2			Stage 1
	Sample Date			11/07/2020
Method	Analyte	Units	LOR	
				001 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**16.6**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH
72	14.4	35.28	2.52
73	14.6	35.77	2.51
74	14.8	36.26	2.50
75	15	36.75	2.50

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			A PIT 3 N/S
	Client Sample Identification 2			Stage 1
	Sample Date			11/07/2020
Method	Analyte	Units	LOR	001 Check EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**16.6**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	8.22	36	7.2	17.64	2.78
1	0.2	0.49	7.33	37	7.4	18.13	2.78
2	0.4	0.98	6.78	38	7.6	18.62	2.78
3	0.6	1.47	6.05	39	7.8	19.11	2.77
4	0.8	1.96	5.39	40	8	19.6	2.76
5	1	2.45	5.00	41	8.2	20.09	2.76
6	1.2	2.94	4.71	42	8.4	20.58	2.75
7	1.4	3.43	4.46	43	8.6	21.07	2.75
8	1.6	3.92	4.24	44	8.8	21.56	2.75
9	1.8	4.41	4.03	45	9	22.05	2.74
10	2	4.9	3.86	46	9.2	22.54	2.74
11	2.2	5.39	3.71	47	9.4	23.03	2.73
12	2.4	5.88	3.58	48	9.6	23.52	2.73
13	2.6	6.37	3.48	49	9.8	24.01	2.72
14	2.8	6.86	3.39	50	10	24.5	2.72
15	3	7.35	3.32	51	10.2	24.99	2.71
16	3.2	7.84	3.25	52	10.4	25.48	2.71
17	3.4	8.33	3.19	53	10.6	25.97	2.70
18	3.6	8.82	3.14	54	10.8	26.46	2.70
19	3.8	9.31	3.10	55	11	26.95	2.69
20	4	9.8	3.06	56	11.2	27.44	2.68
21	4.2	10.29	3.02	57	11.4	27.93	2.68
22	4.4	10.78	2.99	58	11.6	28.42	2.67
23	4.6	11.27	2.97	59	11.8	28.91	2.67
24	4.8	11.76	2.94	60	12	29.4	2.66
25	5	12.25	2.92	61	12.2	29.89	2.66
26	5.2	12.74	2.90	62	12.4	30.38	2.65
27	5.4	13.23	2.88	63	12.6	30.87	2.64
28	5.6	13.72	2.86	64	12.8	31.36	2.64
29	5.8	14.21	2.84	65	13	31.85	2.63
30	6	14.7	2.83	66	13.2	32.34	2.62
31	6.2	15.19	2.82	67	13.4	32.83	2.61
32	6.4	15.68	2.81	68	13.6	33.32	2.61
33	6.6	16.17	2.80	69	13.8	33.81	2.60
34	6.8	16.66	2.79	70	14	34.3	2.59
35	7	17.15	2.79	71	14.2	34.79	2.58

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			A PIT 3 N/S
	Client Sample Identification 2			Stage 1
	Sample Date			11/07/2020
Method	Analyte	Units	LOR	
				001 Check EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**16.6**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
72	14.4	35.28	2.58				
73	14.6	35.77	2.57				
74	14.8	36.26	2.56				
75	15	36.75	2.55				
76	15.2	37.24	2.54				
77	15.4	37.73	2.54				
78	15.6	38.22	2.53				
79	15.8	38.71	2.52				
80	16	39.2	2.51				
81	16.2	39.69	2.50				
82	16.4	40.18	2.49				

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			B1 PIT 6 N/S
	Client Sample Identification 2			Stage 1
	Sample Date			13/07/2020
Method	Analyte	Units	LOR	
				002 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**31.6**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	9.10	36	18	44.1	2.54
1	0.5	1.225	8.52	37	18.5	45.325	2.53
2	1	2.45	8.03	38	19	46.55	2.51
3	1.5	3.675	7.66	39	19.5	47.775	2.49
4	2	4.9	7.41	40			
5	2.5	6.125	7.19	41			
6	3	7.35	6.95	42			
7	3.5	8.575	6.66	43			
8	4	9.8	6.32	44			
9	4.5	11.025	5.97	45			
10	5	12.25	5.63	46			
11	5.5	13.475	5.30	47			
12	6	14.7	4.98	48			
13	6.5	15.925	4.68	49			
14	7	17.15	4.40	50			
15	7.5	18.375	4.14	51			
16	8	19.6	3.89	52			
17	8.5	20.825	3.68	53			
18	9	22.05	3.50	54			
19	9.5	23.275	3.36	55			
20	10	24.5	3.24	56			
21	10.5	25.725	3.14	57			
22	11	26.95	3.05	58			
23	11.5	28.175	2.98	59			
24	12	29.4	2.92	60			
25	12.5	30.625	2.86	61			
26	13	31.85	2.82	62			
27	13.5	33.075	2.78	63			
28	14	34.3	2.74	64			
29	14.5	35.525	2.71	65			
30	15	36.75	2.68	66			
31	15.5	37.975	2.65	67			
32	16	39.2	2.63	68			
33	16.5	40.425	2.61	69			
34	17	41.65	2.58	70			
35	17.5	42.875	2.56	71			

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			B1/A/E PIT 1 N/S
	Client Sample Identification 2			Stage 1
	Sample Date			14/07/2020
Method	Analyte	Units	LOR	003 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**20.6**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	8.87				
1	0.5	1.225	7.43				
2	1	2.45	6.63				
3	1.5	3.675	5.70				
4	2	4.9	4.87				
5	2.5	6.125	4.22				
6	3	7.35	3.76				
7	3.5	8.575	3.47				
8	4	9.8	3.28				
9	4.5	11.025	3.15				
10	5	12.25	3.05				
11	5.5	13.475	2.98				
12	6	14.7	2.91				
13	6.5	15.925	2.87				
14	7	17.15	2.83				
15	7.5	18.375	2.80				
16	8	19.6	2.77				
17	8.5	20.825	2.75				
18	9	22.05	2.73				
19	9.5	23.275	2.72				
20	10	24.5	2.71				
21	10.5	25.725	2.69				
22	11	26.95	2.68				
23	11.5	28.175	2.67				
24	12	29.4	2.66				
25	12.5	30.625	2.64				
26	13	31.85	2.63				
27	13.5	33.075	2.62				
28	14	34.3	2.60				
29	14.5	35.525	2.59				
30	15	36.75	2.57				
31	15.5	37.975	2.56				
32	16	39.2	2.54				
33	16.5	40.425	2.52				
34	17	41.65	2.51				
35	17.5	42.875	2.49				

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			B23 SP8 D/S
	Client Sample Identification 2			Stage 1
	Sample Date			18/07/2020
Method	Analyte	Units	LOR	004 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**12.6**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	7.67	36	7.2	17.64	2.64
1	0.2	0.49	6.46	37	7.4	18.13	2.63
2	0.4	0.98	5.67	38	7.6	18.62	2.61
3	0.6	1.47	5.04	39	7.8	19.11	2.60
4	0.8	1.96	4.54	40	8	19.6	2.59
5	1	2.45	4.16	41	8.2	20.09	2.57
6	1.2	2.94	3.89	42	8.4	20.58	2.56
7	1.4	3.43	3.69	43	8.6	21.07	2.55
8	1.6	3.92	3.54	44	8.8	21.56	2.53
9	1.8	4.41	3.43	45	9	22.05	2.52
10	2	4.9	3.34	46	9.2	22.54	2.51
11	2.2	5.39	3.26	47	9.4	23.03	2.50
12	2.4	5.88	3.19				
13	2.6	6.37	3.14				
14	2.8	6.86	3.09				
15	3	7.35	3.04				
16	3.2	7.84	3.01				
17	3.4	8.33	2.98				
18	3.6	8.82	2.95				
19	3.8	9.31	2.92				
20	4	9.8	2.90				
21	4.2	10.29	2.88				
22	4.4	10.78	2.86				
23	4.6	11.27	2.84				
24	4.8	11.76	2.83				
25	5	12.25	2.81				
26	5.2	12.74	2.79				
27	5.4	13.23	2.78				
28	5.6	13.72	2.76				
29	5.8	14.21	2.75				
30	6	14.7	2.73				
31	6.2	15.19	2.72				
32	6.4	15.68	2.70				
33	6.6	16.17	2.69				
34	6.8	16.66	2.67				
35	7	17.15	2.66				

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			B23 SP8 N/S
	Client Sample Identification 2			Stage 1
	Sample Date			17/07/2020
Method	Analyte	Units	LOR	
				005 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**18.4**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	9.54	36	7.2	17.64	2.73
1	0.2	0.49	9.08	37	7.4	18.13	2.71
2	0.4	0.98	8.73	38	7.6	18.62	2.69
3	0.6	1.47	8.42	39	7.8	19.11	2.67
4	0.8	1.96	7.83	40	8	19.6	2.65
5	1	2.45	7.37	41	8.2	20.09	2.63
6	1.2	2.94	7.09	42	8.4	20.58	2.62
7	1.4	3.43	6.89	43	8.6	21.07	2.60
8	1.6	3.92	6.72	44	8.8	21.56	2.58
9	1.8	4.41	6.54	45	9	22.05	2.56
10	2	4.9	6.35	46	9.2	22.54	2.55
11	2.2	5.39	6.11	47	9.4	23.03	2.53
12	2.4	5.88	5.81	48	9.6	23.52	2.51
13	2.6	6.37	5.36	49	9.8	24.01	2.50
14	2.8	6.86	4.88				
15	3	7.35	4.47				
16	3.2	7.84	4.12				
17	3.4	8.33	3.87				
18	3.6	8.82	3.68				
19	3.8	9.31	3.53				
20	4	9.8	3.42				
21	4.2	10.29	3.32				
22	4.4	10.78	3.24				
23	4.6	11.27	3.18				
24	4.8	11.76	3.12				
25	5	12.25	3.07				
26	5.2	12.74	3.02				
27	5.4	13.23	2.98				
28	5.6	13.72	2.95				
29	5.8	14.21	2.91				
30	6	14.7	2.88				
31	6.2	15.19	2.85				
32	6.4	15.68	2.83				
33	6.6	16.17	2.80				
34	6.8	16.66	2.78				
35	7	17.15	2.76				

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			COAL B1/E1 D/S
	Client Sample Identification 2			Stage 1
	Sample Date			16/07/2020
Method	Analyte	Units	LOR	006 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**19.4**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	8.12	36	7.2	17.64	2.96
1	0.2	0.49	7.16	37	7.4	18.13	2.95
2	0.4	0.98	6.51	38	7.6	18.62	2.94
3	0.6	1.47	6.00	39	7.8	19.11	2.94
4	0.8	1.96	5.50	40	8	19.6	2.93
5	1	2.45	5.08	41	8.2	20.09	2.93
6	1.2	2.94	4.74	42	8.4	20.58	2.92
7	1.4	3.43	4.46	43	8.6	21.07	2.92
8	1.6	3.92	4.23	44	8.8	21.56	2.91
9	1.8	4.41	4.03	45	9	22.05	2.90
10	2	4.9	3.87	46	9.2	22.54	2.90
11	2.2	5.39	3.75	47	9.4	23.03	2.89
12	2.4	5.88	3.64	48	9.6	23.52	2.88
13	2.6	6.37	3.55	49	9.8	24.01	2.88
14	2.8	6.86	3.47	50	10	24.5	2.87
15	3	7.35	3.42	51	10.2	24.99	2.86
16	3.2	7.84	3.36	52	10.4	25.48	2.85
17	3.4	8.33	3.32	53	10.6	25.97	2.84
18	3.6	8.82	3.28	54	10.8	26.46	2.84
19	3.8	9.31	3.24	55	11	26.95	2.83
20	4	9.8	3.21	56	11.2	27.44	2.82
21	4.2	10.29	3.18	57	11.4	27.93	2.81
22	4.4	10.78	3.16	58	11.6	28.42	2.80
23	4.6	11.27	3.13	59	11.8	28.91	2.79
24	4.8	11.76	3.11	60	12	29.4	2.79
25	5	12.25	3.09	61	12.2	29.89	2.78
26	5.2	12.74	3.07	62	12.4	30.38	2.78
27	5.4	13.23	3.06	63	12.6	30.87	2.77
28	5.6	13.72	3.04	64	12.8	31.36	2.76
29	5.8	14.21	3.03	65	13	31.85	2.76
30	6	14.7	3.01	66	13.2	32.34	2.76
31	6.2	15.19	3.00	67	13.4	32.83	2.75
32	6.4	15.68	2.99	68	13.6	33.32	2.75
33	6.6	16.17	2.98	69	13.8	33.81	2.74
34	6.8	16.66	2.98	70	14	34.3	2.74
35	7	17.15	2.97	71	14.2	34.79	2.73

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			COAL B1/E1 D/S
	Client Sample Identification 2			Stage 1
	Sample Date			16/07/2020
Method	Analyte	Units	LOR	006 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**19.4**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
72	14.4	35.28	2.73	108	21.6	52.92	2.60
73	14.6	35.77	2.72	109	21.8	53.41	2.59
74	14.8	36.26	2.72	110	22	53.9	2.59
75	15	36.75	2.72	111	22.2	54.39	2.58
76	15.2	37.24	2.71	112	22.4	54.88	2.57
77	15.4	37.73	2.71	113	22.6	55.37	2.57
78	15.6	38.22	2.71	114	22.8	55.86	2.56
79	15.8	38.71	2.70	115	23	56.35	2.56
80	16	39.2	2.70	116	23.2	56.84	2.55
81	16.2	39.69	2.69	117	23.4	57.33	2.54
82	16.4	40.18	2.69	118	23.6	57.82	2.54
83	16.6	40.67	2.69	119	23.8	58.31	2.53
84	16.8	41.16	2.69	120	24	58.8	2.53
85	17	41.65	2.68	121	24.2	59.29	2.52
86	17.2	42.14	2.68	122	24.4	59.78	2.51
87	17.4	42.63	2.68	123	24.6	60.27	2.51
88	17.6	43.12	2.68	124	24.8	60.76	2.50
89	17.8	43.61	2.68	125	25	61.25	2.49
90	18	44.1	2.67				
91	18.2	44.59	2.67				
92	18.4	45.08	2.67				
93	18.6	45.57	2.67				
94	18.8	46.06	2.67				
95	19	46.55	2.66				
96	19.2	47.04	2.66				
97	19.4	47.53	2.66				
98	19.6	48.02	2.65				
99	19.8	48.51	2.65				
100	20	49	2.65				
101	20.2	49.49	2.64				
102	20.4	49.98	2.64				
103	20.6	50.47	2.63				
104	20.8	50.96	2.62				
105	21	51.45	2.62				
106	21.2	51.94	2.61				
107	21.4	52.43	2.61				

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			COAL M4 RIA STOCKPILE N/S
	Client Sample Identification 2			Stage 1
	Sample Date			12/07/2020
Method	Analyte	Units	LOR	
				007 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**22.9**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	8.15				
1	0.5	1.225	7.22				
2	1	2.45	6.61				
3	1.5	3.675	6.15				
4	2	4.9	5.76				
5	2.5	6.125	5.43				
6	3	7.35	5.11				
7	3.5	8.575	4.81				
8	4	9.8	4.52				
9	4.5	11.025	4.25				
10	5	12.25	4.00				
11	5.5	13.475	3.77				
12	6	14.7	3.56				
13	6.5	15.925	3.38				
14	7	17.15	3.23				
15	7.5	18.375	3.10				
16	8	19.6	3.00				
17	8.5	20.825	2.91				
18	9	22.05	2.83				
19	9.5	23.275	2.76				
20	10	24.5	2.70				
21	10.5	25.725	2.65				
22	11	26.95	2.60				
23	11.5	28.175	2.56				
24	12	29.4	2.52				
25	12.5	30.625	2.49				

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			G PIT 1 D/S
	Client Sample Identification 2			
	Sample Date			11/07/2020
Method	Analyte	Units	LOR	
				008 EB2028135

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**17.2**

EA046 -B - Curve information

Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
0	0	0	9.20	36	7.2	17.64	2.97
1	0.2	0.49	7.80	37	7.4	18.13	2.96
2	0.4	0.98	6.85	38	7.6	18.62	2.95
3	0.6	1.47	6.18	39	7.8	19.11	2.94
4	0.8	1.96	5.31	40	8	19.6	2.93
5	1	2.45	4.78	41	8.2	20.09	2.93
6	1.2	2.94	4.38	42	8.4	20.58	2.92
7	1.4	3.43	4.10	43	8.6	21.07	2.91
8	1.6	3.92	3.90	44	8.8	21.56	2.90
9	1.8	4.41	3.76	45	9	22.05	2.90
10	2	4.9	3.65	46	9.2	22.54	2.89
11	2.2	5.39	3.57	47	9.4	23.03	2.88
12	2.4	5.88	3.49	48	9.6	23.52	2.87
13	2.6	6.37	3.43	49	9.8	24.01	2.86
14	2.8	6.86	3.38	50	10	24.5	2.85
15	3	7.35	3.34	51	10.2	24.99	2.84
16	3.2	7.84	3.30	52	10.4	25.48	2.83
17	3.4	8.33	3.27	53	10.6	25.97	2.82
18	3.6	8.82	3.24	54	10.8	26.46	2.81
19	3.8	9.31	3.21	55	11	26.95	2.81
20	4	9.8	3.19	56	11.2	27.44	2.79
21	4.2	10.29	3.17	57	11.4	27.93	2.79
22	4.4	10.78	3.15	58	11.6	28.42	2.78
23	4.6	11.27	3.13	59	11.8	28.91	2.77
24	4.8	11.76	3.11	60	12	29.4	2.76
25	5	12.25	3.09	61	12.2	29.89	2.75
26	5.2	12.74	3.08	62	12.4	30.38	2.75
27	5.4	13.23	3.07	63	12.6	30.87	2.74
28	5.6	13.72	3.05	64	12.8	31.36	2.73
29	5.8	14.21	3.04	65	13	31.85	2.73
30	6	14.7	3.03	66	13.2	32.34	2.72
31	6.2	15.19	3.02	67	13.4	32.83	2.72
32	6.4	15.68	3.01	68	13.6	33.32	2.71
33	6.6	16.17	3.00	69	13.8	33.81	2.71
34	6.8	16.66	2.99	70	14	34.3	2.70
35	7	17.15	2.98	71	14.2	34.79	2.70

Work Order :	EB2028135	Client ID:	WILPINJONG COAL PTY LTD

	Sub Matrix			Soil
	Client Sample Identification 1			G PIT 1 D/S
	Client Sample Identification 2			
	Sample Date			11/07/2020
Method	Analyte	Units	LOR	
				008 EB2028135

EA046 - A Titration information

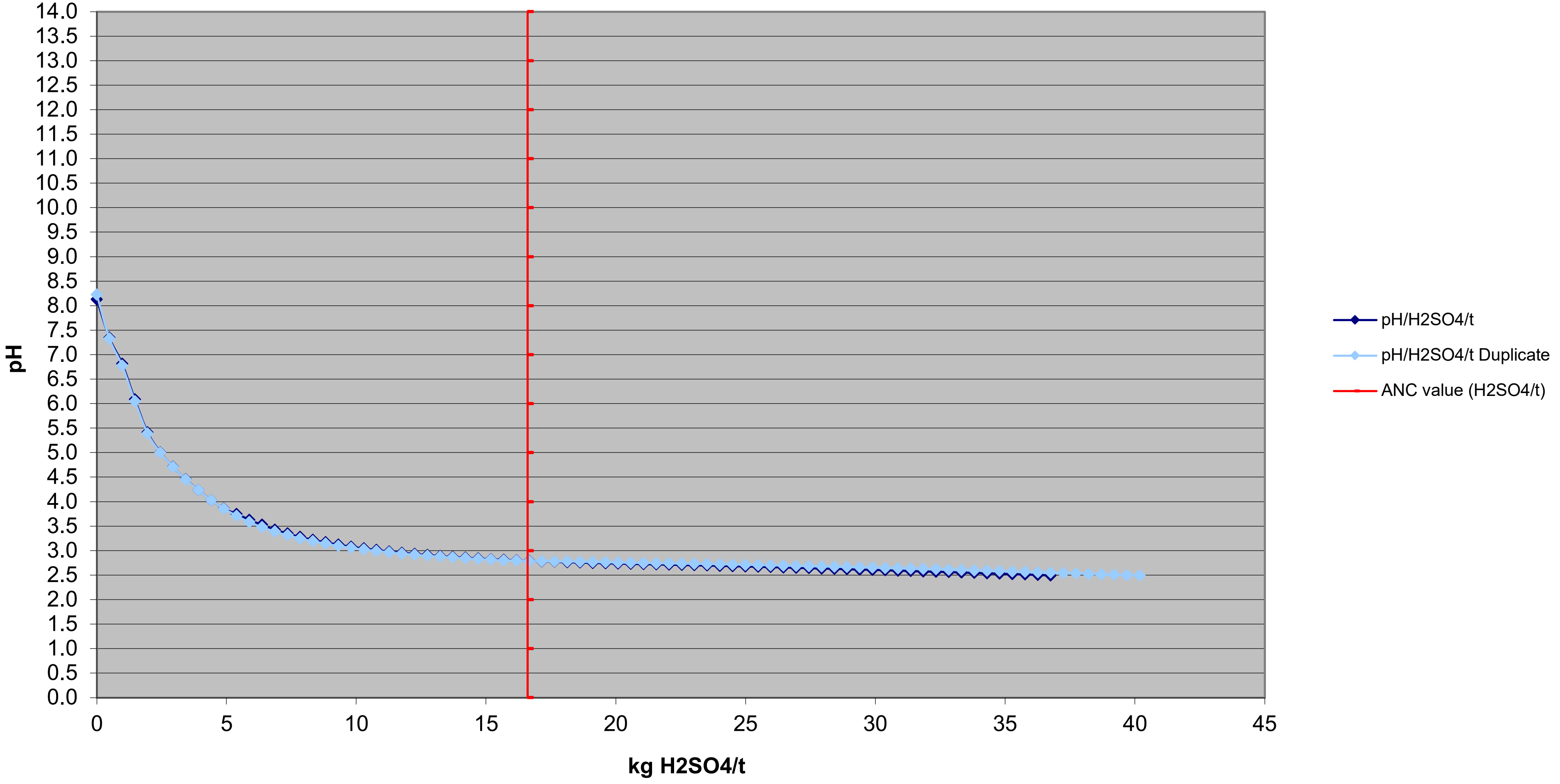
HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**17.2**

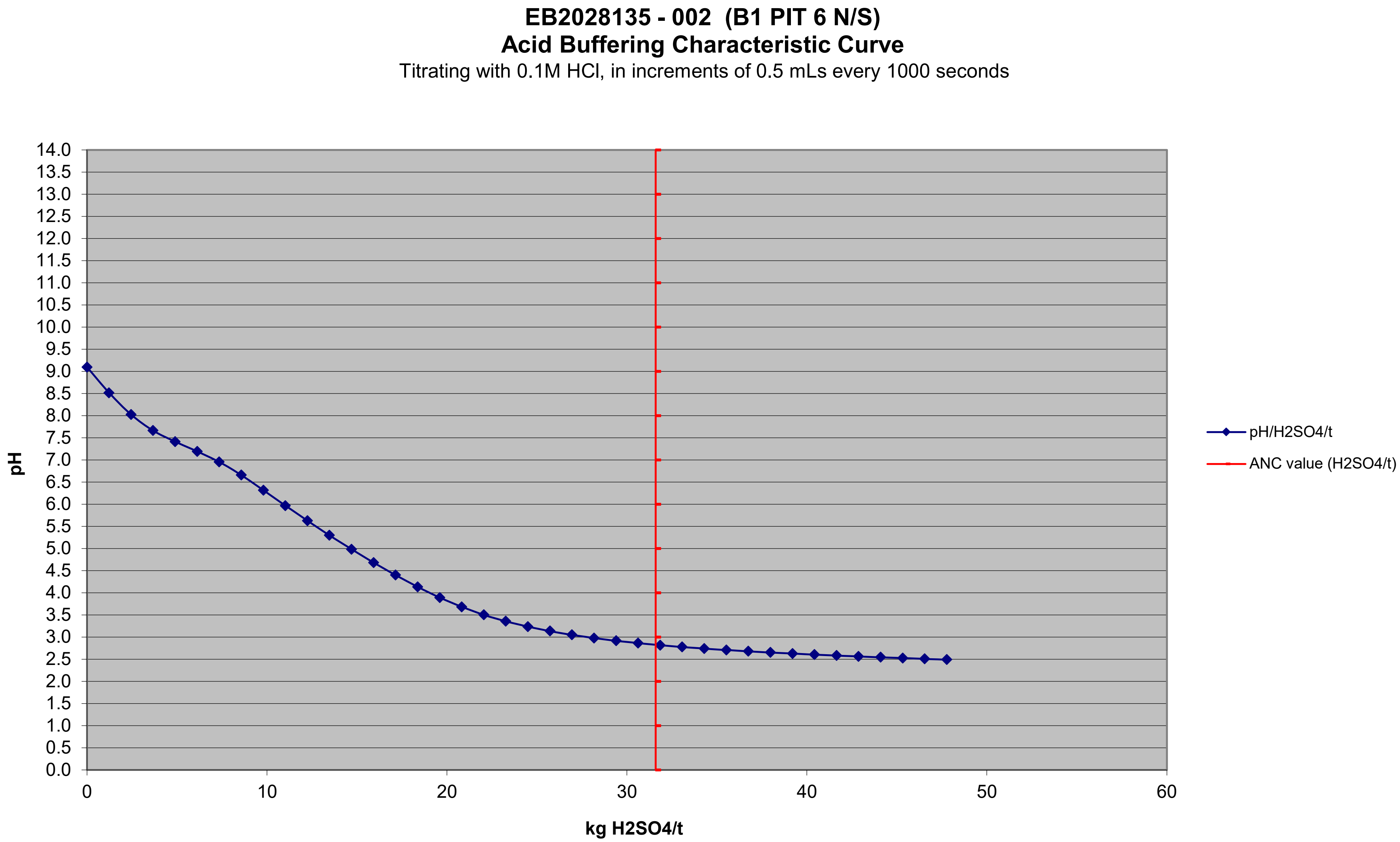
EA046 -B - Curve information

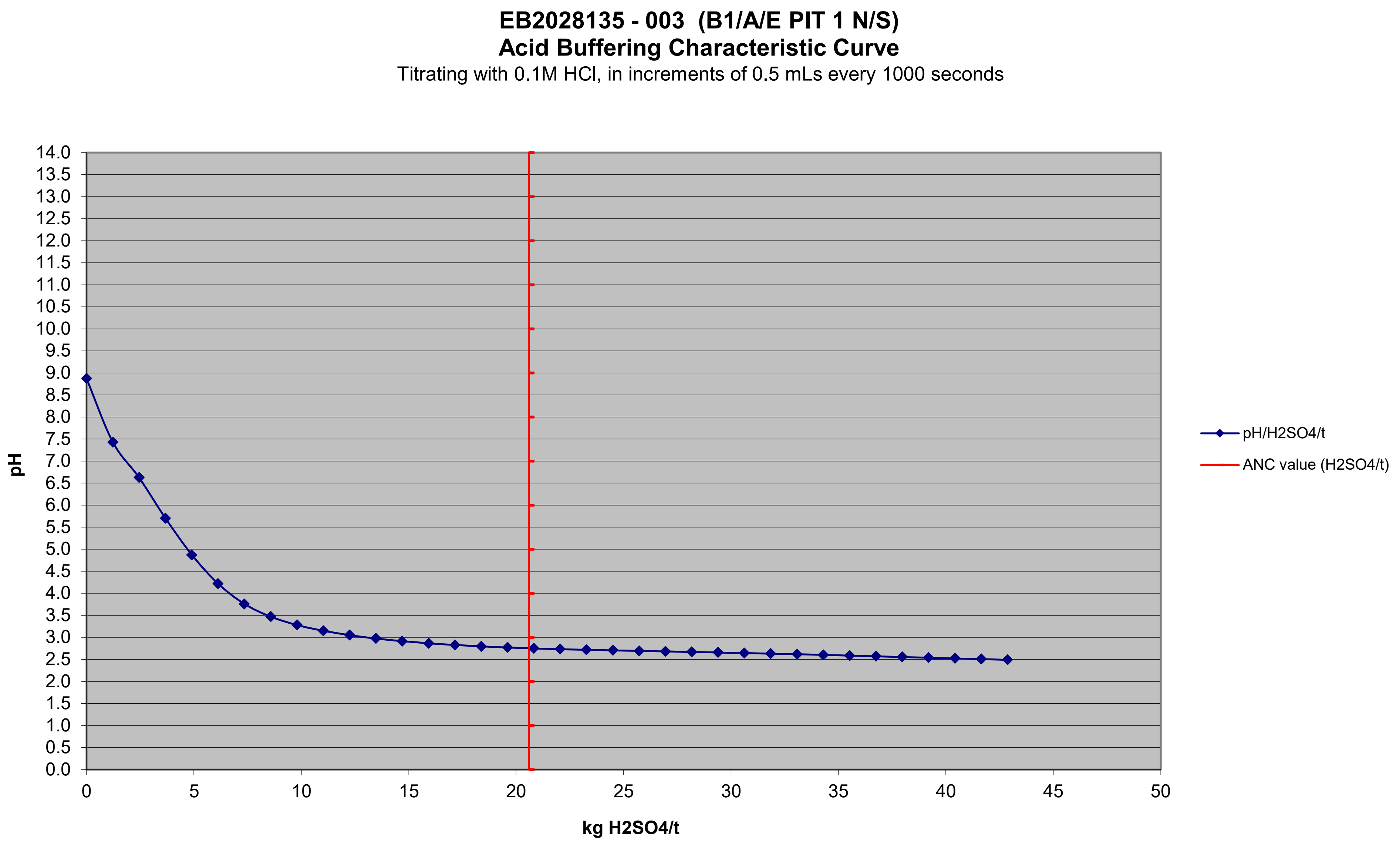
Addition	mLs added (total)	kg H2SO4/t	pH	Addition	mLs added (total)	kg H2SO4/t	pH
72	14.2	34.79	2.70	108	21.4	52.43	2.55
73	14.4	35.28	2.69	109	21.6	52.92	2.54
74	14.6	35.77	2.69	110	21.8	53.41	2.53
75	14.8	36.26	2.68	111	22	53.9	2.53
76	15	36.75	2.68	112	22.2	54.39	2.52
77	15.2	37.24	2.67	113	22.4	54.88	2.51
78	15.4	37.73	2.67	114	22.6	55.37	2.51
79	15.6	38.22	2.67	115	22.8	55.86	2.50
80	15.8	38.71	2.66	116	23	56.35	2.49
81	16	39.2	2.66	117			
82	16.2	39.69	2.65	118			
83	16.4	40.18	2.65	119			
84	16.6	40.67	2.65	120			
85	16.8	41.16	2.64	121			
86	17	41.65	2.64	122			
87	17.2	42.14	2.64	123			
88	17.4	42.63	2.63	124			
89	17.6	43.12	2.63	125			
90	17.8	43.61	2.63	126			
91	18	44.1	2.63	127			
92	18.2	44.59	2.62	128			
93	18.4	45.08	2.62	129			
94	18.6	45.57	2.62	130			
95	18.8	46.06	2.62	131			
96	19	46.55	2.61	132			
97	19.2	47.04	2.61	133			
98	19.4	47.53	2.60	134			
99	19.6	48.02	2.60	135			
100	19.8	48.51	2.60	136			
101	20	49	2.59	137			
102	20.2	49.49	2.59	138			
103	20.4	49.98	2.58	139			
104	20.6	50.47	2.57	140			
105	20.8	50.96	2.57	141			
106	21	51.45	2.56	142			
107	21.2	51.94	2.55	143			

EB2028135 - 001 and Check 001 (A PIT 3 N/S)
Acid Buffering Characteristic Curve

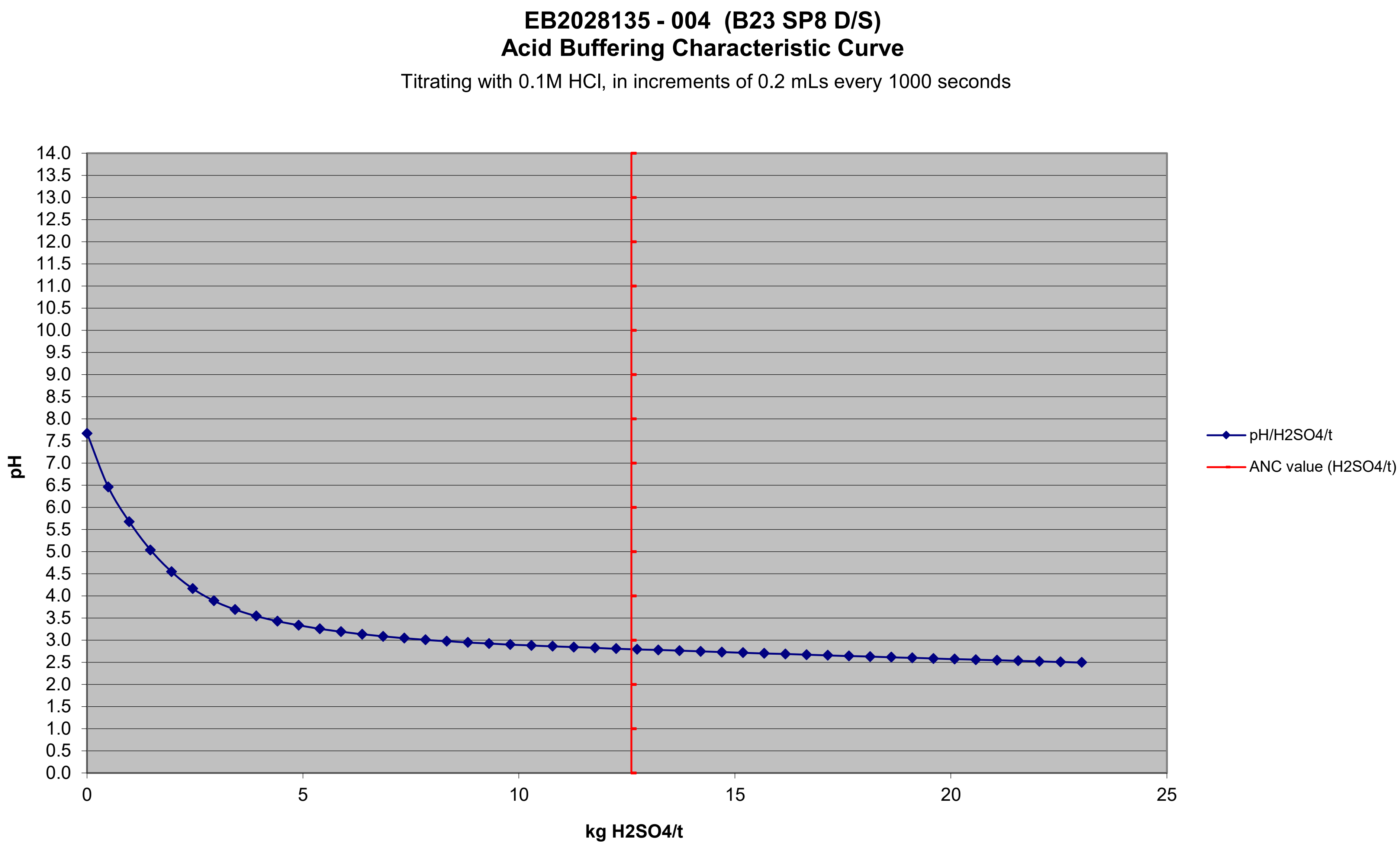
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds

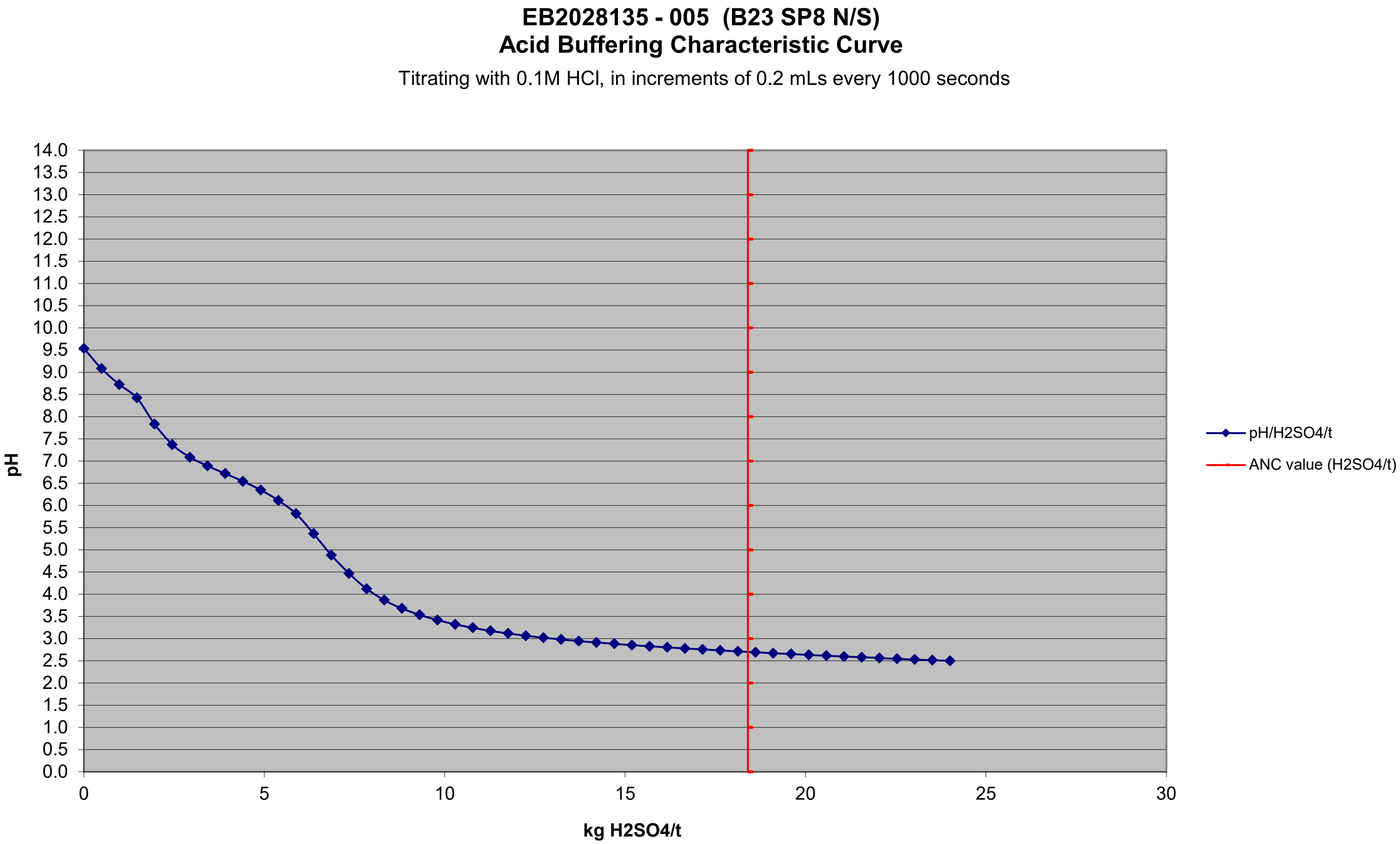



EB2028135 - 002 (B1 PIT 6 N/S)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
60
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)



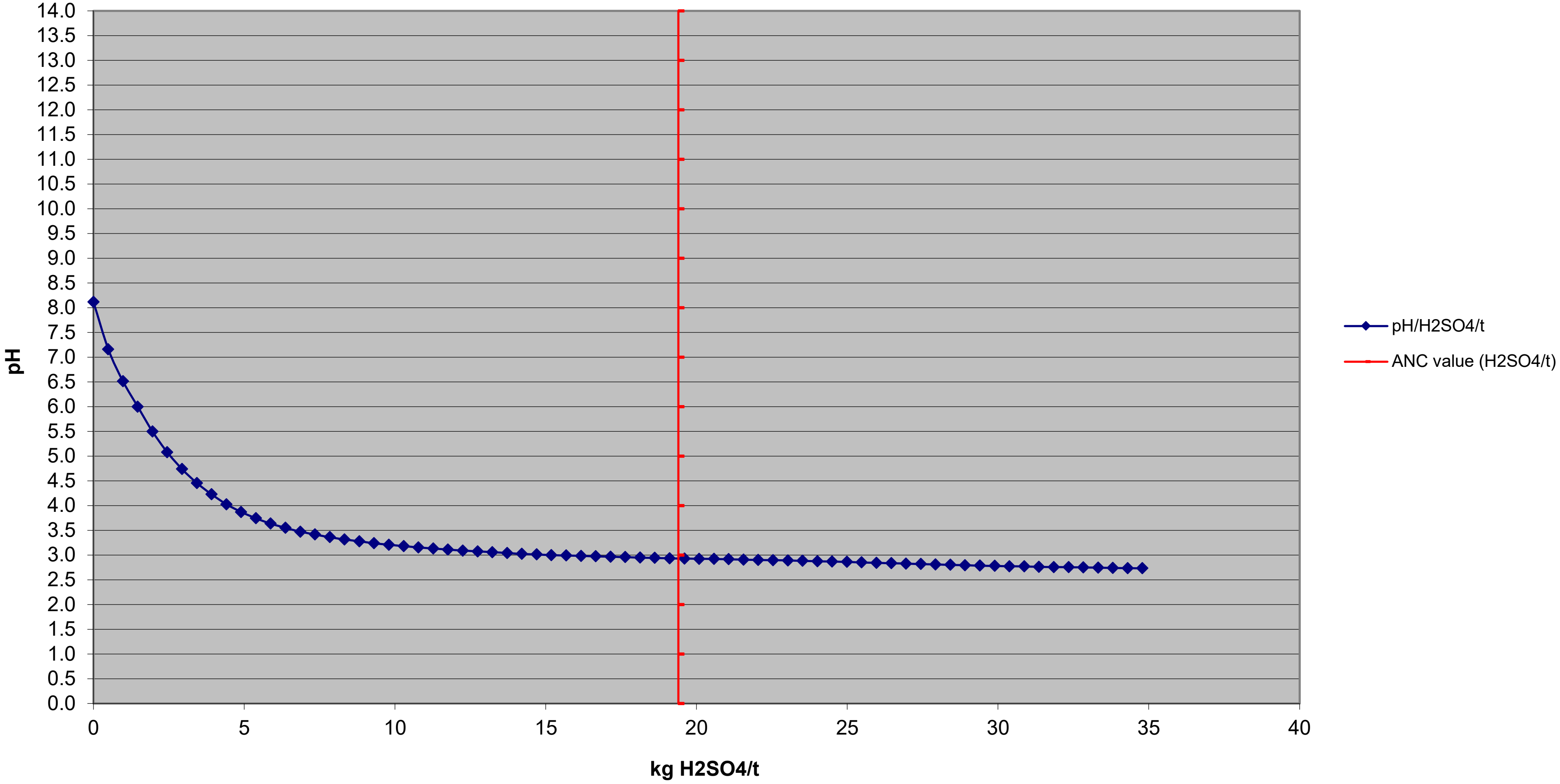
EB2028135 - 003 (B1/A/E PIT 1 N/S)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
35
40
45
50
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)


EB2028135 - 004 (B23 SP8 D/S)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds
pH
kg H2SO4/t
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
pH/H2SO4/t
ANC value (H2SO4/t)



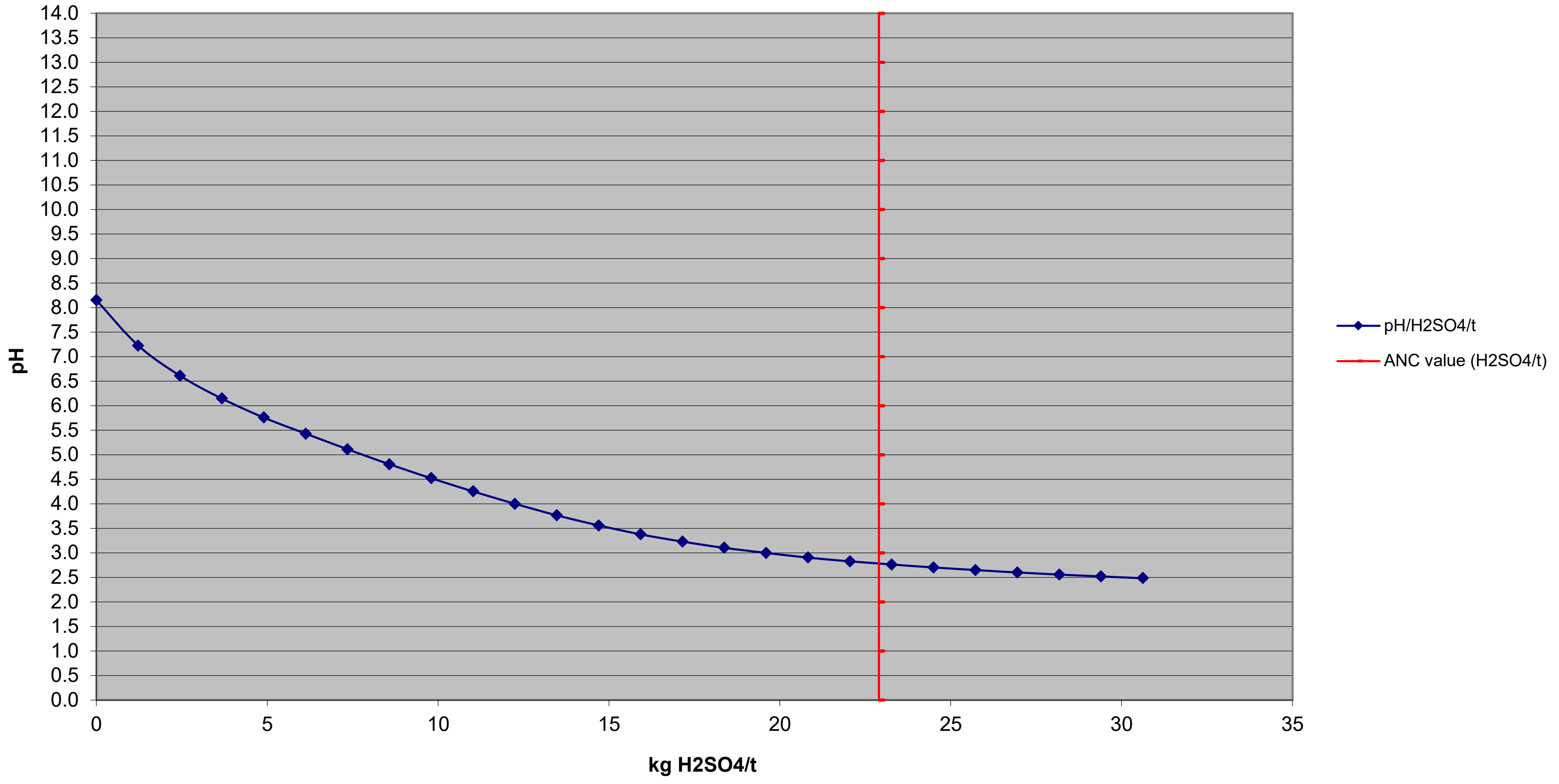
EB2028135 - 005 (B23 SP8 N/S)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)

EB2028135 - 006 (COAL B1/E1 D/S)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds

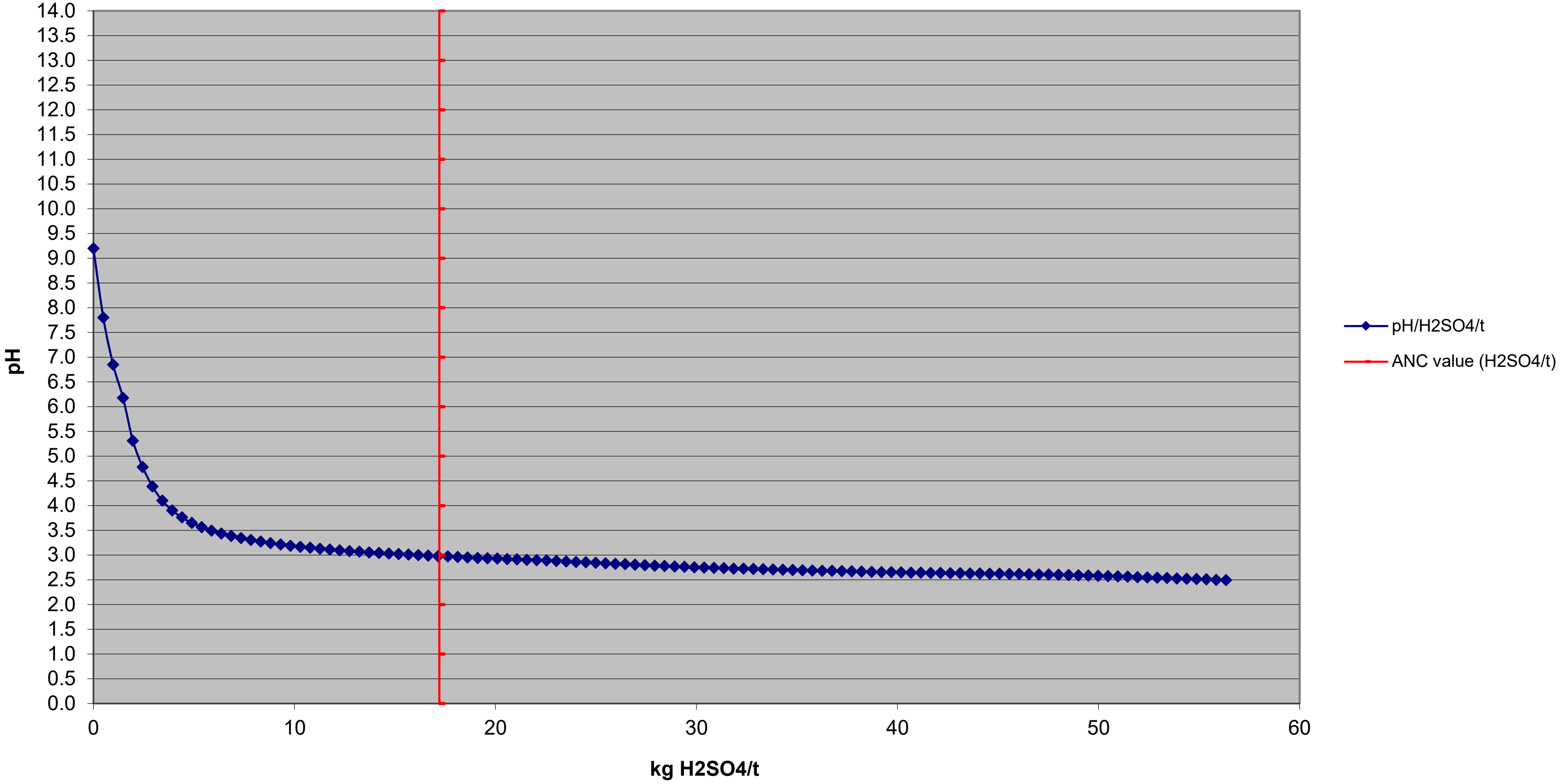


EB2028135 - 007 (COAL M4 RIA STOCKPILE N/S)
Acid Buffering Characteristic Curve

Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds



EB2028135 - 008 (G PIT 1 D/S)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds



APPENDIX E

TOC and SO4 Results

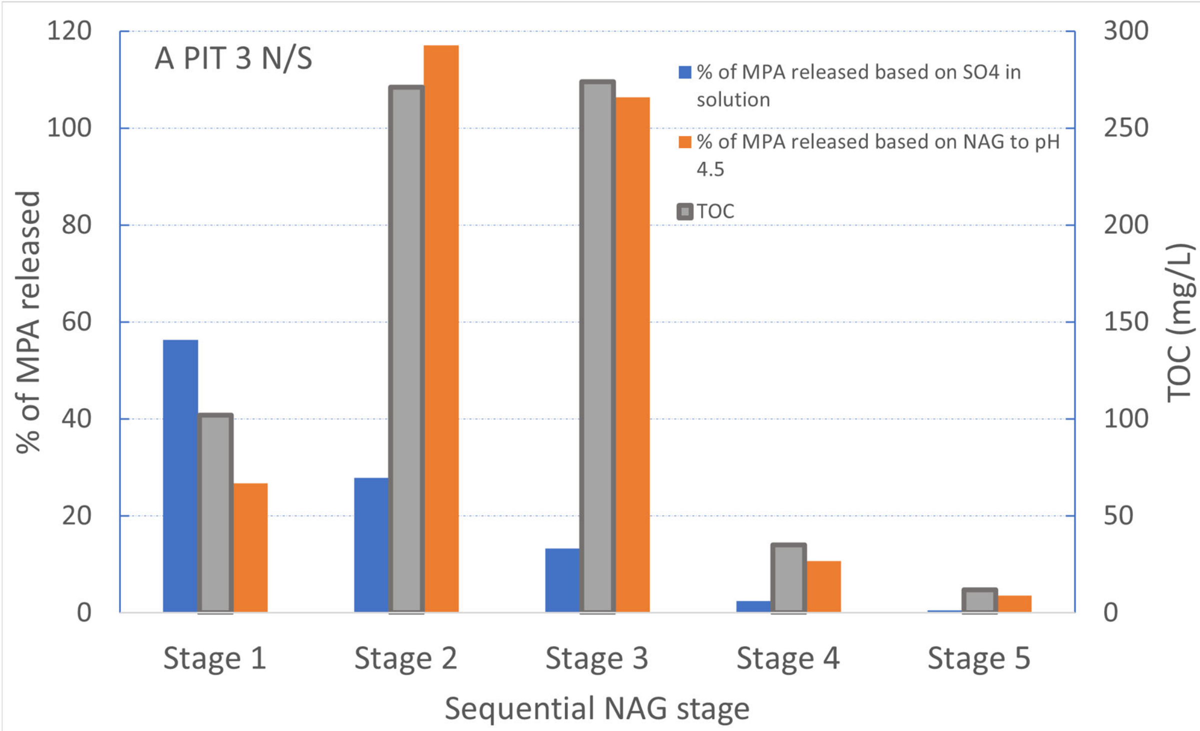


Figure 1: Relative contribution of S and OC in generated acid – A PIT 3 N/S

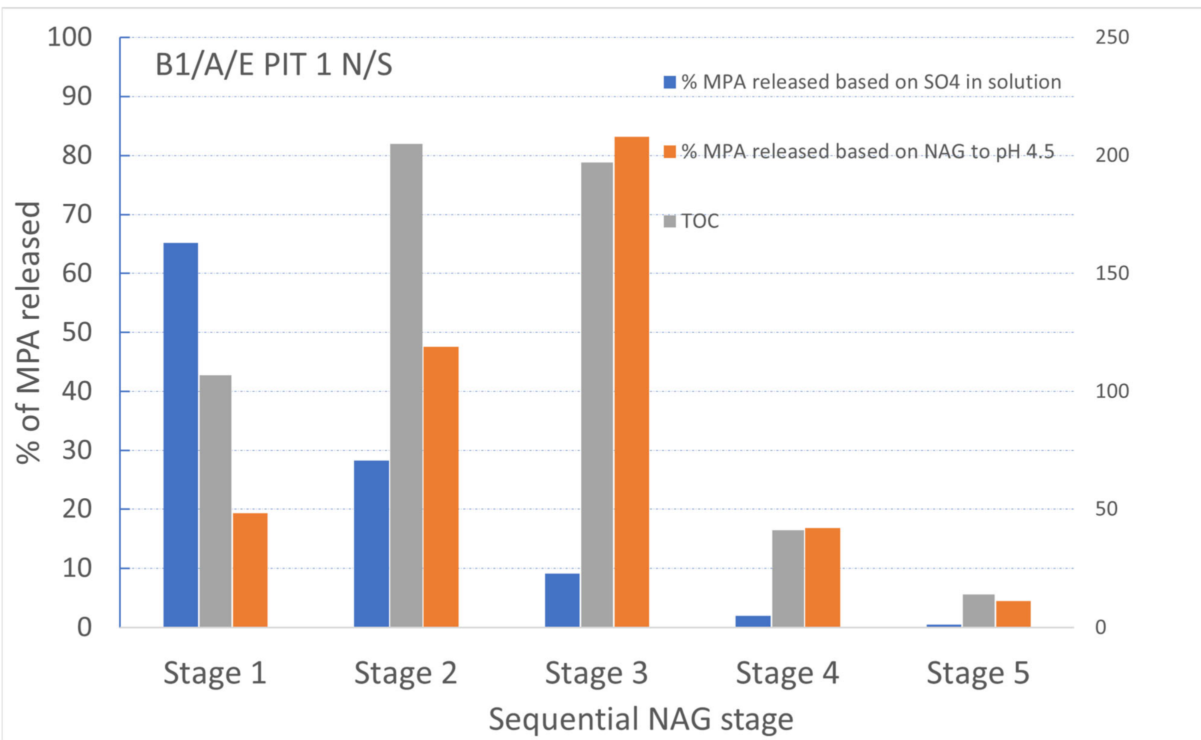


Figure 2: Relative contribution of S and OC in generated acid – B1/A/E PIT 1 N/S

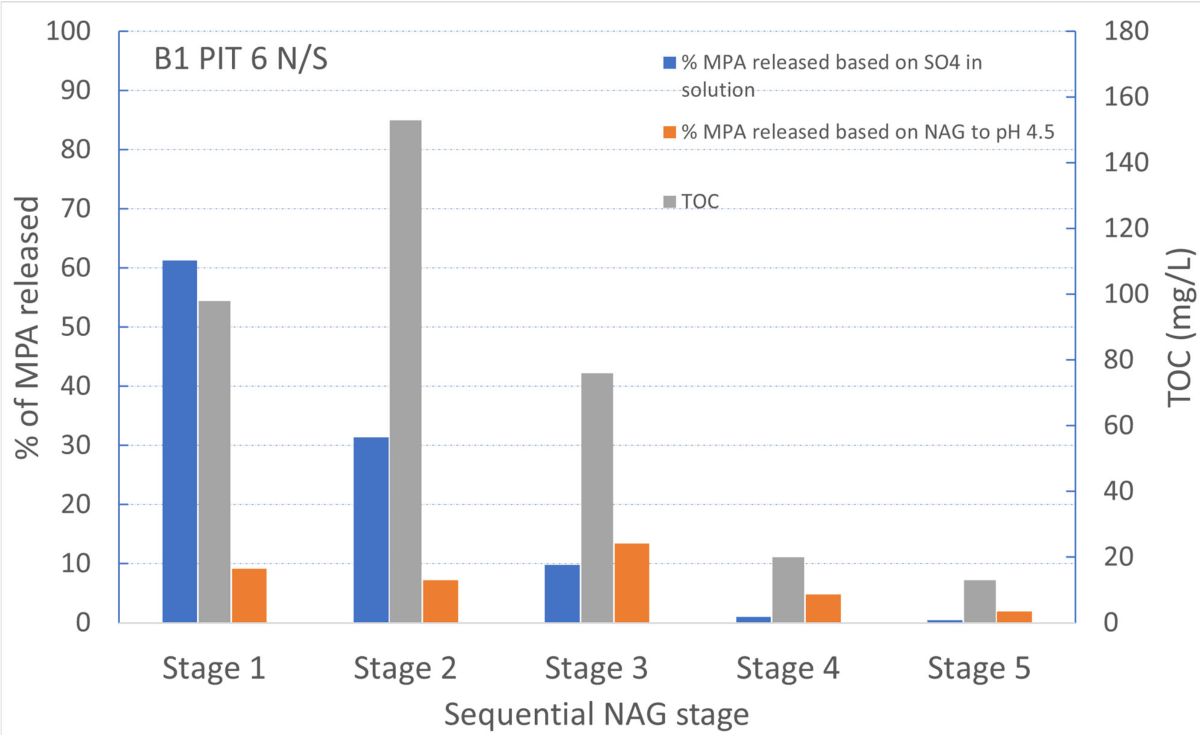


Figure 3: Relative contribution of S and OC in generated acid – B1 PIT 6 N/S

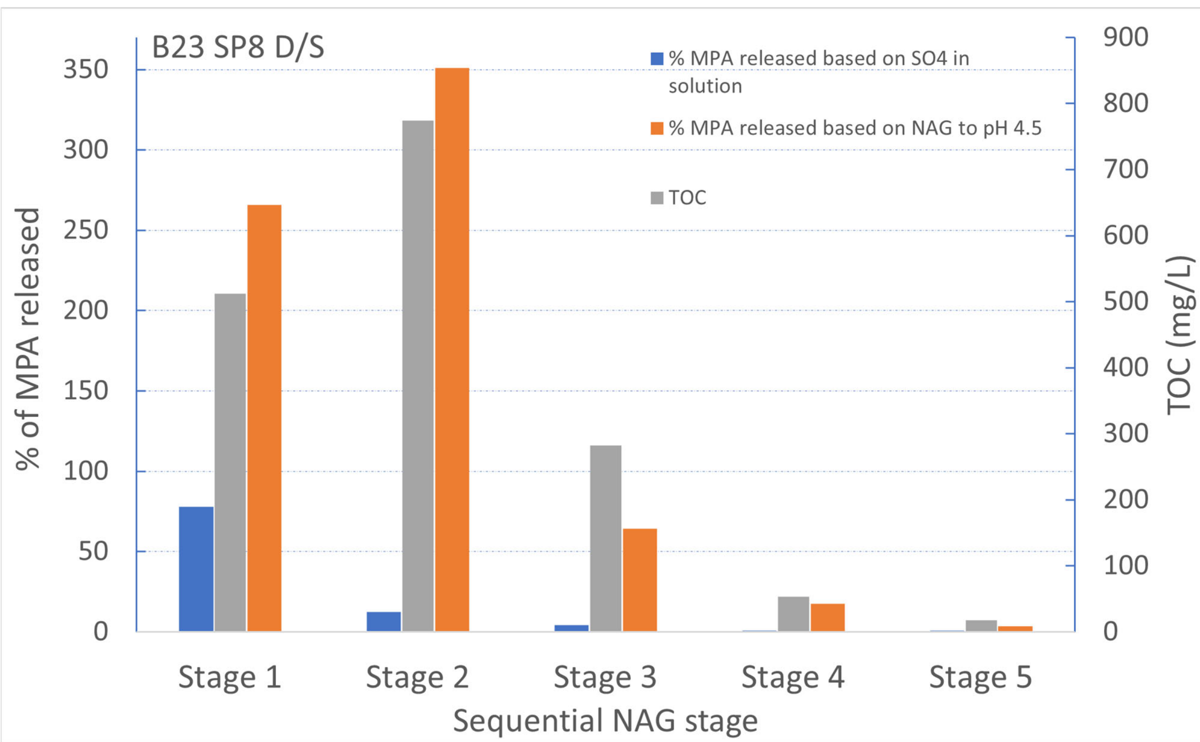


Figure 4: Relative contribution of S and OC in generated acid – B23 SP8 D/S

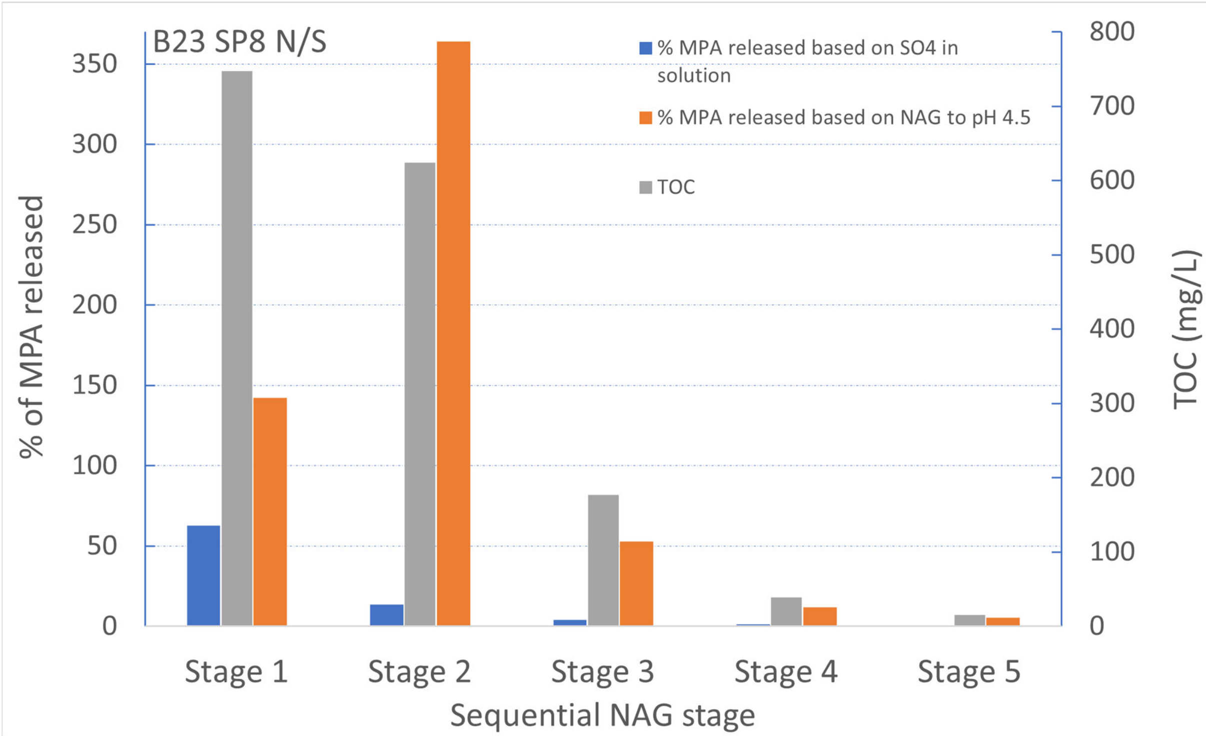


Figure 5: Relative contribution of S and OC in generated acid – B23 SP8 N/S

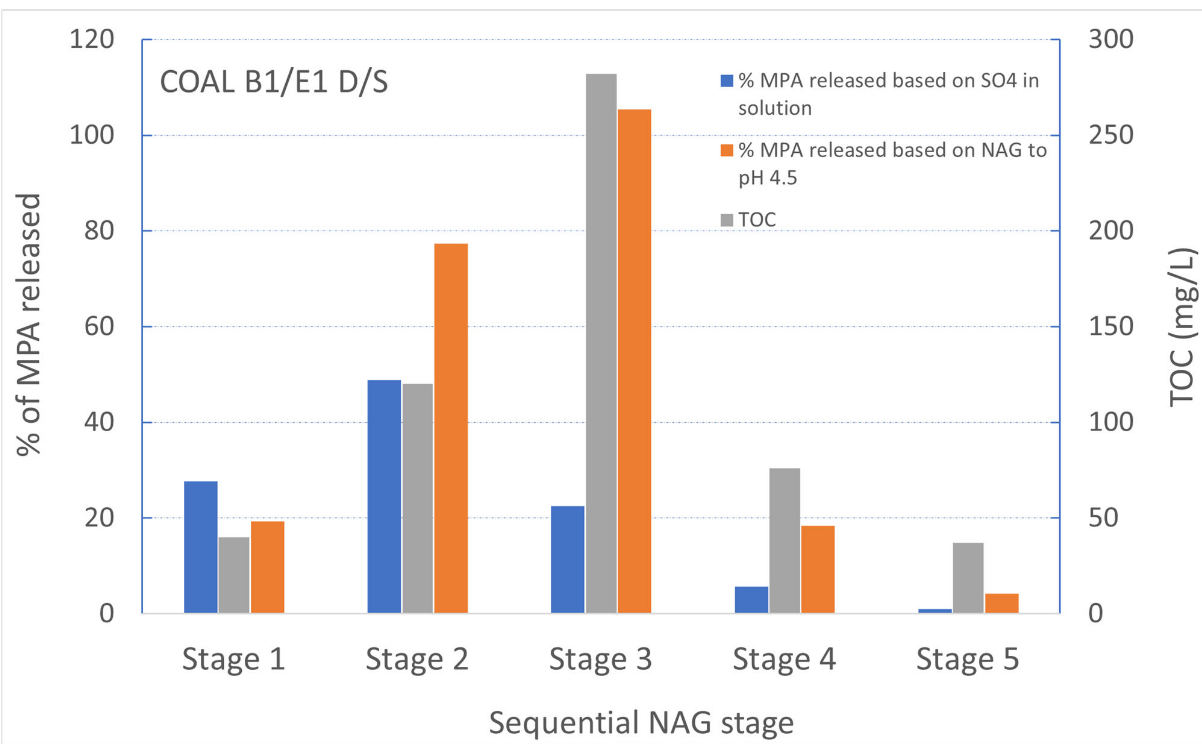


Figure 6: Relative contribution of S and OC in generated acid – COAL B1/E1 D/S

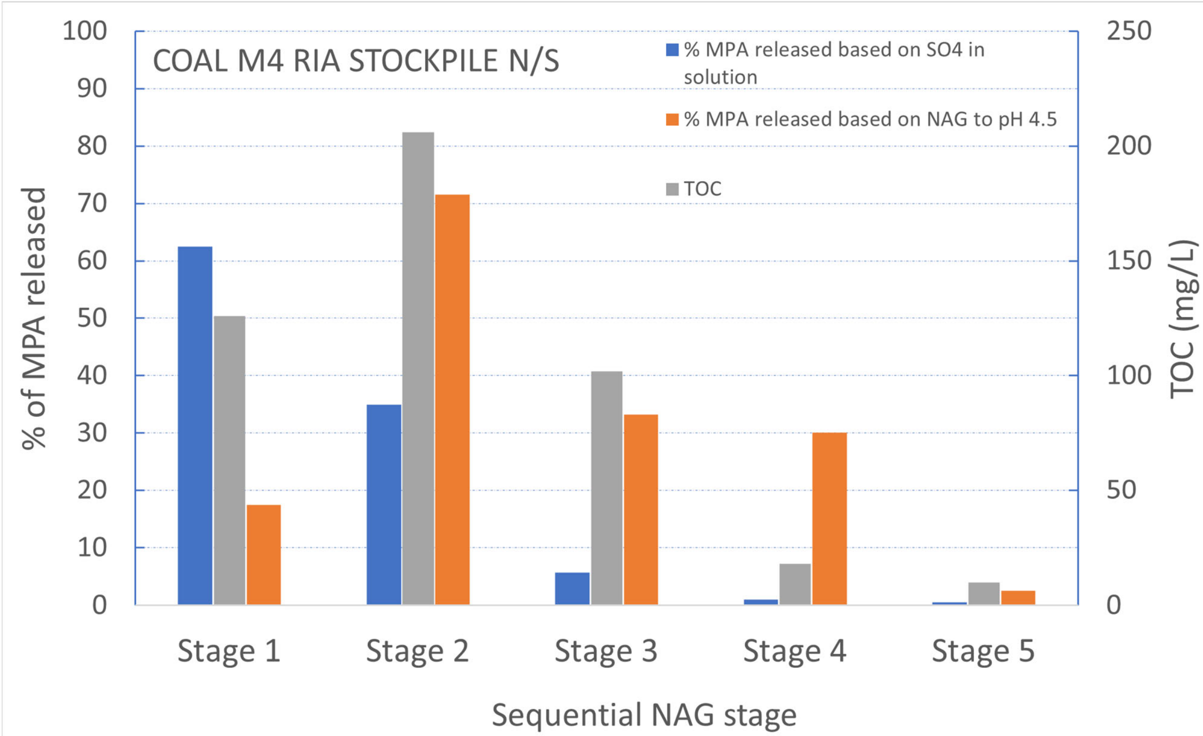


Figure 7: Relative contribution of S and OC in generated acid – COAL M4 RIA STOCKPILE N/S

APPENDIX F

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APPENDIX E

Rehabilitation Soil Analysis (2020)

2020 REHABILITATION SOIL ANALYSIS

Wilpinjong Mine

Prepared by Global Soil Systems

March 2020

Global Soil Systems
environmental consultants & contractors

1.0 Introduction

Global Soil Systems were engaged by Wilpinjong Mine to conduct topsoil sampling on rehabilitation areas across the mine which are scheduled to be sown with native vegetation in late 2020. The aim of the topsoil sampling is to provide results and recommendations which will enhance soil health and provide optimal conditions for native tree, shrub and grass establishment.

Fieldwork was conducted by Craig Outridge on 2nd and 3rd March 2020.

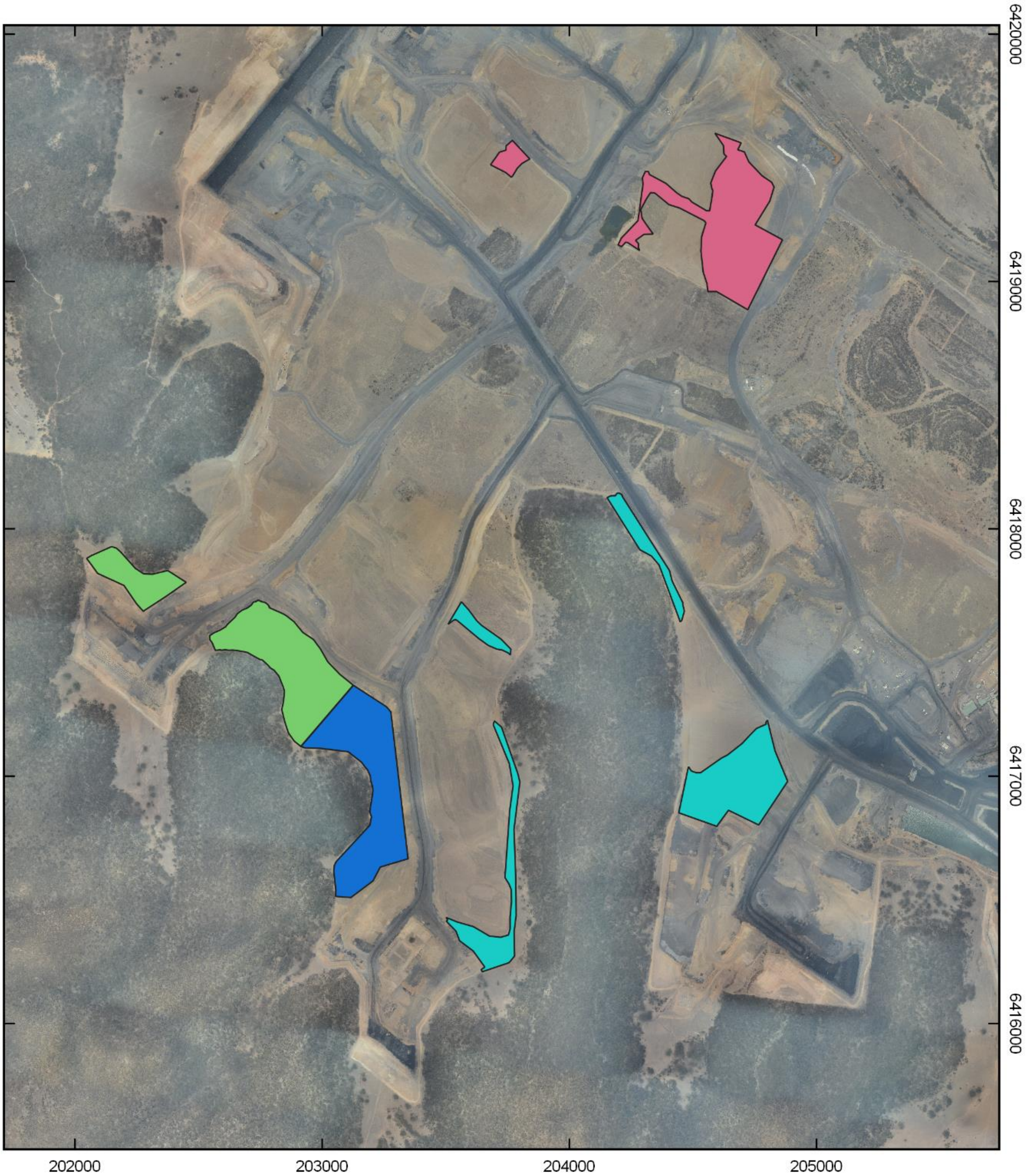
2.0 Methodology

Approximately 150Ha of temporary rehabilitation areas were broken into ten sampling areas of approximately 15Ha each. Within each sampling area ten cores were taken and combined to provide a composite sample that is representative of the larger area. This process was repeated across all sampling areas, with 100 cores being taken to create 10 composite samples. Composite sampling areas can be seen in ***Figure 1 & 2,*** and are labelled Composite Sample A through to Composite Sample J.

Composite samples were analysed for (pH, EC, TSS, TOM, TOC), exchangeable cations (Ca, Mg, Na, K, H, CEC, Adj. H, Adj. CEC, Cation %'s of Adj. CEC), available nutrients including trace elements (Ca, Mg, Na, K, P, N (nitrate), S, Cu, Zn, Fe, Mn, Co, B, Mo), desirable levels (exchangeable cations, cation %'s) and soil biological activity.

Analysis, results and recommendations for rates needed for cation balance using the most appropriate material (gypsum/lime) are listed, as well as suggested rates for balanced plant nutrient requirements (NPKS, trace elements) and soil biological management recommendations.

Figure 1 – Rehabilitation Areas (West)



Wilpinjong

Rehabilitation Areas

Legend

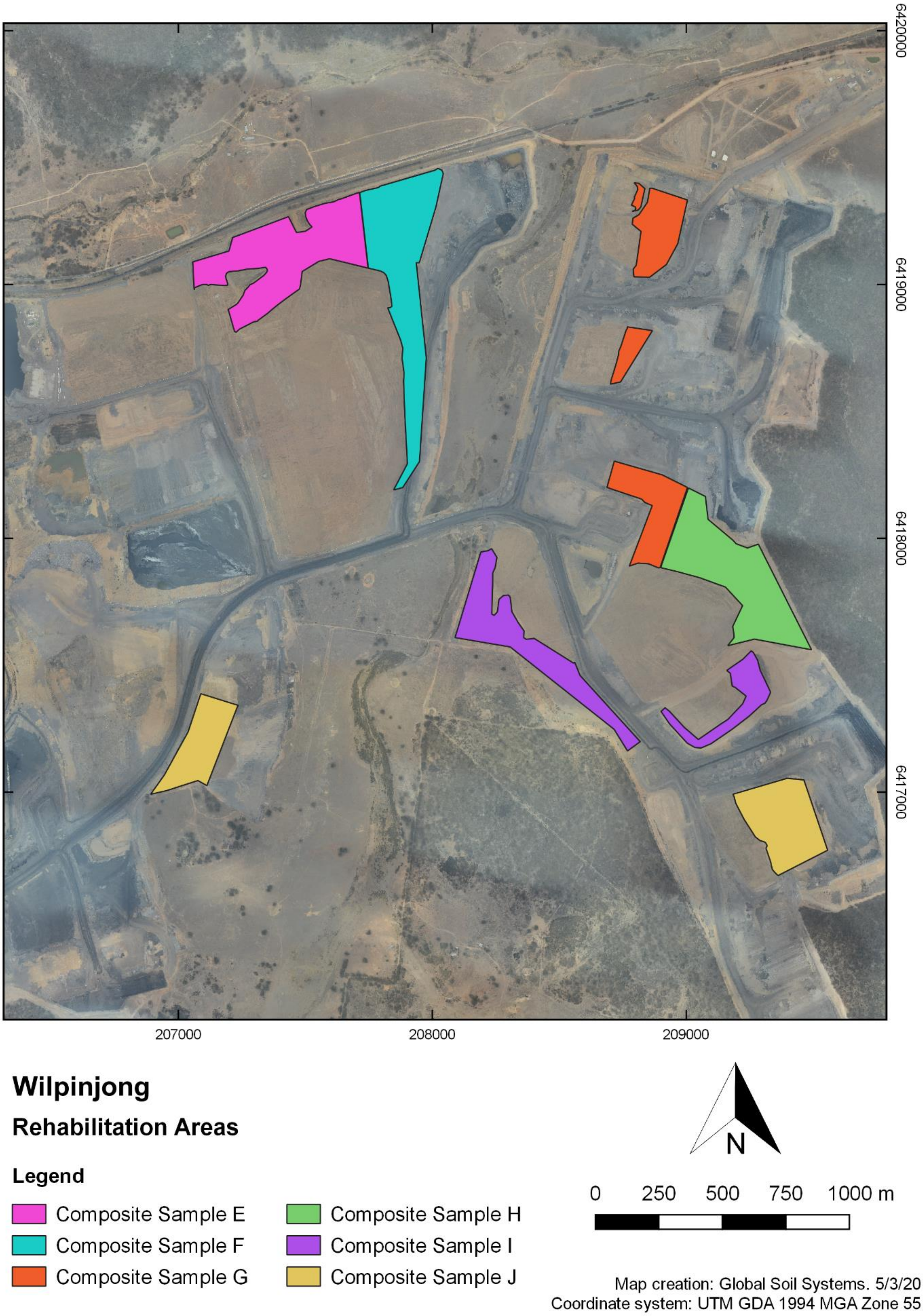
- Composite Sample A
- Composite Sample B
- Composite Sample C
- Composite Sample D

N

0 300 600 900 1200 m

Map creation: Global Soil Systems. 5/3/20
Coordinate system: UTM GDA 1994 MGA Zone 55

Figure 2 – Rehabilitation Areas (East)



3.0 Results

3.1 Composite Sample A

Overall summary of complete soil balance (cation, nutrient and biology) is 47%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 3.52 t/ha.

The soil analysis also determined that the soil pH (6) is within the desirable levels for the establishment of native vegetation.

Application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 3.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and mulch or green manure would be beneficial to help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 5.***

Table 1 – Composite Sample A – Cation Balance

Analysis Test	*pH* (1:5 Water)	*pH* (1:5 0.01M CaCl2)	*Electrical conductivity* µS/cm	*Total soluble salt* ppm
Composite Sample A	6	5.51	194	640.2
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample A	2.25	1.13	3.04	1.97
Desirable levels	3 - 4	1.5 - 2	4.73	1.09

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample A	0.32	0.35	2.72	1.6
Desirable levels	< 0.36	0.36		< 1.09

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample A	8.4	7.28	73	41.8
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample A	27.1	4.4	4.8	21.9
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 2 – Composite Sample A – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample A	774	301.2	94.07	41.9
Desirable levels	1202	179	< 115	22

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample A	5.88	175.11	42	2.41
Desirable levels	35	129	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample A	3.71	20	27	5.11
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample A	0.23	0.16	206	0.0589
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 3 – Composite Sample A – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
0	29	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0	1.3	0	0	2	0	0.3

Table 4 – Composite Sample A – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample A	1,000	180,000	100,000	280,000
Desirable levels	86,674			268,249
% of total active population	0.3			89.7
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample A	1000	30,000	100	**312,100**
Desirable levels	81,575	107,067	66,280	**509,845**
% of total active population	0.3	9.6	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 5 – Composite Sample A – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/Ha	2 litres/Ha	5 litres/Ha	2 litres/Ha	0	Beneficial

3.2 Composite Sample B

Overall summary of complete soil balance (cation, nutrient and biology) is 48%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 2.89 t/ha and lime is required at a rate of 0.75 t/ha.

The soil analysis also determined that the soil pH (5.6) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 8.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and liquefied humate would be beneficial to help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 10.***

Table 6 – Composite Sample B – Cation Balance

Analysis Test	*pH* (1:5 Water)	*pH* (1:5 0.01M CaCl2)	*Electrical conductivity* µS/cm	*Total soluble salt* ppm
Composite Sample B	5.6	5.1	173	570.9
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample B	1.74	0.87	2.14	1.66
Desirable levels	3 - 4	1.5 - 2	4.06	0.94

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample B	0.29	0.31	2.72	1.85
Desirable levels	< 0.31	0.31		< 0.94

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample B	7.12	6.25	68	34.2
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample B	26.6	4.6	5	29.6
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 7 – Composite Sample B – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample B	552	258	87.4	29.9
Desirable levels	1025	151	< 97	22

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample B	3.3	154.83	40.7	1.76
Desirable levels	35	108	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample B	2.98	26	18	3.97
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample B	0.2	0.15	148	0.0485
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 8 – Composite Sample B – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
0	32	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0.75	3	0	0	2	2	0.3

Table 9 – Composite Sample B – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample B	1,000	80,000	50,000	130,000
Desirable levels	80,336			155,946
% of total active population	0.6			71.8
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample B	10,000	40,000	100	**181,000**
Desirable levels	75,610	99,239	61,433	**472,565**
% of total active population	5.5	22.1	0.1	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 10 – Composite Sample B – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/Ha	5 litres/ha	2 litres/Ha	5 litres/ha	Beneficial

3.3 Composite Sample C

Overall summary of complete soil balance (cation, nutrient and biology) is 50%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 2.96 t/ha.

The soil analysis also determined that soil pH (6.3) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

Application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 13.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and Mulch/green manure would be beneficial to help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 15.***

Table 11 – Composite Sample C – Cation Balance

Analysis Test	*pH* (1:5 Water)	*pH* (1:5 0.01M CaCl2)	*Electrical conductivity* µS/cm	*Total soluble salt* ppm
Composite Sample C	6.3	5.79	190	627
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample C	2.59	1.3	3.48	1.81
Desirable levels	3 - 4	1.5 - 2	4.64	1.07

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample C	0.3	0.44	2.4	1.11
Desirable levels	< 0.36	0.36		< 1.07

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample C	8.43	7.14	76	48.8
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample C	25.4	4.2	6.2	15.5
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 12 – Composite Sample C – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample C	880	274.8	85.79	35.9
Desirable levels	1187	180	< 115	22

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample C	2.24	216.84	35.5	2.4
Desirable levels	35	129	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample C	4.75	19	23	4.95
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample C	0.28	0.17	129	0.0702
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 13 – Composite Sample C – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
0	33	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0	0	0	0	2	2	0.3

Table 14 – Composite Sample C – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample C	1,000	210,000	80,000	290,000
Desirable levels	85,836			166,622
% of total active population	0.3			85
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample C	40,000	10,000	100	**341,100**
Desirable levels	80,786	106,032	65,639	**504,915**
% of total active population	11.7	2.9	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 15 – Composite Sample C – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	5 litres/ha	2 litres/ha	5 litres/ha	Beneficial

3.4 Composite Sample D

Overall summary of complete soil balance (cation, nutrient and biology) is 45%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 0.97 t/ha. Lime is required at a rate of 0.68 t/ha.

The soil analysis also determined that soil pH (5.6) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 18.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and Mulch/green manure would be beneficial to help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed ***Table 20.***

Table 16 – Composite Sample D – Cation Balance

Analysis Test	*pH* (1:5 Water)	*pH* (1:5 0.01M CaCl2)	*Electrical conductivity* µS/cm	*Total soluble salt* ppm
Composite Sample D	5.6	4.95	173	570.9
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter* %	*Total organic carbon* %	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample D	1.15	0.58	0.7	0.59
Desirable levels	3 - 4	1.5 - 2	1.69	0.39

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample D	0.17	0.11	1.6	1.03
Desirable levels	< 0.13	0.13		< 0.39

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample D	3.17	2.6	63	27
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample D	22.7	6.6	4.2	39.5
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 17 – Composite Sample D – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample D	248	129	67.62	24.7
Desirable levels	518	79	< 50	22

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample D	13.3	75.27	43.6	1.15
Desirable levels	35	94	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample D	3.37	24	16	5
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample D	0.12	0.12	146	0.0353
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 18 – Composite Sample D – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
6	22	19	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0.75	1.6	0	0	2	2.5	0.3

Table 19 – Composite Sample D – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample D	1,000	160,000	30,000	190,000
Desirable levels	51,765			100,486
% of total active population	0.4			75.7
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample D	10,000	50,000	100	**251,100**
Desirable levels	48,720	63,945	39,585	**304,502**
% of total active population	4	19.9	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 20 – Composite Sample D – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	5 litres/ha	2 litres/ha	5 litres/ha	Beneficial

3.5 Composite Sample E

Overall summary of complete soil balance (cation, nutrient and biology) is 48%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 2.29 t/ha. Lime is required at a rate of 0.78 t/ha.

The soil analysis also determined that soil pH (6.1) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 23.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and liquefied humate would help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 25.***

Table 21 – Composite Sample E – Cation Balance

Analysis Test	*pH (1:5 Water)*	*pH (1:5 0.01M CaCl2)*	*Electrical conductivity µS/cm*	*Total soluble salt ppm*
Composite Sample E	6.1	5.63	450	1485
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium meq/100g of soil*	*Exchangeable magnesium meq/100g of soil*
Composite Sample E	3.15	1.58	4.17	1.92
Desirable levels	3 - 4	1.5 - 2	5.84	1.35

Analysis Test	*Exchangeable sodium meq/100g of soil*	*Exchangeable potassium meq/100g of soil*	*Exchangeable hydrogen meq/100g of soil*	*Adj. exchangeable hydrogen meq/100g of soil*
Composite Sample E	0.31	0.48	3.68	2.11
Desirable levels	< 0.45	0.45		< 1.35

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample E	10.56	8.99	74	46.4
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample E	21.4	3.5	5.3	23.4
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table22 – Composite Sample E – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample E	1280	352.8	110.17	145
Desirable levels	1722	256	< 164	21

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample E	3.92	285.09	77.6	2.85
Desirable levels	35	178	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample E	4.96	74	73	6.04
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample E	0.33	0.22	294	0.117
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 23 – Composite Sample E – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
0	31	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0	0	0	0	0	0	0.3

Table 24 – Composite Sample E – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample E	1,000	86,000	90,000	176,000
Desirable levels	96,323			186,980
% of total active population	0.5			88.4
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample E	2,000	20,000	100	**199,100**
Desirable levels	90,657	118,987	73,659	**566,605**
% of total active population	1	10	0.1	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 25 – Composite Sample E – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	10 litres/ha	2 litres/ha	5 litres/ha	

3.6 Composite Sample F

Overall summary of complete soil balance (cation, nutrient and biology) is 36%. This falls within the below average range of 20-60%.

The soil analysis determined that gypsum is required at a rate of 5.11 t/ha. Lime is required at a rate of 0.3 t/ha.

The soil analysis also determined that soil pH (5.7) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 28.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and liquefied humate would help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 30.***

Table 26 – Composite Sample F – Cation Balance

Analysis Test	*pH (1:5 Water)*	*pH (1:5 0.01M CaCl2)*	*Electrical conductivity µS/cm*	*Total soluble salt ppm*
Composite Sample F	5.7	5.23	512	1689.2
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium meq/100g of soil*	*Exchangeable magnesium meq/100g of soil*
Composite Sample F	2.82	1.41	2.66	2.23
Desirable levels	3 - 4	1.5 - 2	5.25	1.21

Analysis Test	*Exchangeable sodium meq/100g of soil*	*Exchangeable potassium meq/100g of soil*	*Exchangeable hydrogen meq/100g of soil*	*Adj. exchangeable hydrogen meq/100g of soil*
Composite Sample F	0.66	0.42	3.52	2.11
Desirable levels	< 0.40	0.4		< 1.21

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample F	9.49	8.08	74	32.9
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample F	27.6	8.2	5.2	26.1
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 27 – Composite Sample F – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample F	904	454.8	259.9	106
Desirable levels	1669	246	< 157	22

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample F	2.89	281.58	156	3.93
Desirable levels	35	176	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample F	4.82	26	36	6.99
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample F	0.4	0.29	216	0.103
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 28 – Composite Sample F – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
0	32	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0	0	0	0	2	0	0.3

Table 29 – Composite Sample F – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample F	1,000	100,000	70,000	170,000
Desirable levels	91,343			177,313
% of total active population	0.5			80.5
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample F	10,000	30,000	100	**211,000**
Desirable levels	85,970	112,836	69,851	**537,313**
% of total active population	4.7	14.2	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 30 – Composite Sample F – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	10 litres/ha	2 litres/ha	5 litres/ha	

3.7 Composite Sample G

Overall summary of complete soil balance (cation, nutrient and biology) is 50%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 1.98 t/ha. Lime is required at a rate of 0.65 t/ha.

The soil analysis also determined that soil pH (6.0) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 33.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and mulch would help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 35.***

Table 31 – Composite Sample G – Cation Balance

Analysis Test	*pH* (1:5 Water)	*pH* (1:5 0.01M CaCl2)	*Electrical conductivity* µS/cm	*Total soluble salt* ppm
Composite Sample G	6	5.46	217	716.1
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample G	3.68	1.84	2.96	1.51
Desirable levels	3 - 4	1.5 - 2	4.39	1.01

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample G	0.26	0.51	3.36	1.52
Desirable levels	< 0.28	0.34		< 1.01

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample G	8.6	6.76	67	43.8
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample G	22.3	3.9	7.5	22.5
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 32 – Composite Sample G – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample G	772	236.4	77.97	33.1
Desirable levels	1136	184	< 117	22

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample G	3.77	259.74	49.6	1.85
Desirable levels	35	131	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample G	4.11	91	144	3.75
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample G	0.28	0.23	139	0.113
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 33 – Composite Sample G – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
0	31	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0.75	0	0	0	0	0	0.3

Table 34 – Composite Sample G – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample G	1,000	110,000	70,000	180,000
Desirable levels	83,550			162,184
% of total active population	0.4			74.7
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample G	30,000	30,000	100	**241,100**
Desirable levels	78,635	103,208	63,891	**491,468**
% of total active population	12.4	12.4	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 35 – Composite Sample G – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	5 litres/ha	2 litres/ha		Beneficial

3.8 Composite Sample H

Overall summary of complete soil balance (cation, nutrient and biology) is 55%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 2.02 t/ha.

The soil analysis also determined that soil pH (5.9) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 38.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and mulch would help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 40.***

Table 36 – Composite Sample H – Cation Balance

Analysis Test	*pH* (1:5 Water)	*pH* (1:5 0.01M CaCl2)	*Electrical conductivity* µS/cm	*Total soluble salt* ppm
Composite Sample H	5.9	5.44	154	478.5
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample H	4.55	2.28	4.48	1.68
Desirable levels	3 - 4	1.5 - 2	5.09	1.18

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample H	0.17	0.42	3.36	1.09
Desirable levels	< 0.39	0.39		< 1.18

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample H	10.11	7.84	70	57.2
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample H	21.4	2.2	5.4	13.8
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 37 – Composite Sample H – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample H	1044	235.2	44.62	11.9
Desirable levels	1218	202	< 129	21

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample H	2.32	191.49	27.4	1.44
Desirable levels	35	140	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample H	3.28	91	68	3.12
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* ppm
Composite Sample H	0.29	0.31	108	0.0863
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 38 – Composite Sample H – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
14	33	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0.75	1.7	0	0	0	0	0.3

Table 39 – Composite Sample H – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample H	1,000	340,000	280,000	620,000
Desirable levels	89,948			174,604
% of total active population	0.1			84.3
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample H	4,000	110,000	100	**735,100**
Desirable levels	84,657	111,112	68,784	**529,104**
% of total active population	0.5	15	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 40 – Composite Sample H – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	10 litres/ha	2 litres/ha		Beneficial

3.9 Composite Sample I

Overall summary of complete soil balance (cation, nutrient and biology) is 51%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 1.68 t/ha. Lime is required at a rate of 0.53 t/ha.

The soil analysis also determined that soil pH (6.3) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 43.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and mulch would help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 45.***

Table 41 – Composite Sample I – Cation Balance

Analysis Test	*pH (1:5 Water)*	*pH (1:5 0.01M CaCl2)*	*Electrical conductivity µS/cm*	*Total soluble salt ppm*
Composite Sample I	6.3	5.79	261	861.3
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample I	3.37	1.69	4.4	1.71
Desirable levels	3 - 4	1.5 - 2	5.59	1.29

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample I	0.42	0.56	3.2	1.52
Desirable levels	< 0.43	0.43		< 1.29

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample I	10.29	8.61	74	51.1
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample I	19.9	4.9	6.5	17.6
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 42 – Composite Sample I – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample I	1144	267.6	125.35	20.3
Desirable levels	1460	224	< 143	21

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample I	4.92	281.58	54.6	2.43
Desirable levels	35	155	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample I	5.95	161	57	6.03
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample I	0.38	0.28	149	0.0953
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 43 – Composite Sample I – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
5	30	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0	0	0	0	0	0	0.3

Table 44 – Composite Sample I – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample I	1,000	500,000	310,000	810,000
Desirable levels	94,264			182,983
% of total active population	0.1			95.2
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample I	10,000	30,000	100	**851,000**
Desirable levels	88,719	116,444	72,084	**554,494**
% of total active population	1.2	3.5	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 45 – Composite Sample I – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	5 litres/ha	2 litres/ha		Beneficial

3.10 Composite Sample J

Overall summary of complete soil balance (cation, nutrient and biology) is 50%. This falls within the average range of 40-60%.

The soil analysis determined that gypsum is required at a rate of 3.2 t/ha. Lime is required at a rate of 0.1 t/ha.

The soil analysis also determined that soil pH (6.2) is within the desirable levels for the establishment of native vegetation (5.5 – 7.5).

The application of fertiliser would be beneficial for native trees, shrubs and grasses at rates listed in ***Table 48.***

Biological applications such as kelp extract, molasses/sugar, worm leachate, fish hydrolysate and mulch would help accelerate changes in soil structure and nutrient availability. Recommendations for rates of biological applications are listed in ***Table 50.***

Table 46 – Composite Sample J – Cation Balance

Analysis Test	*pH (1:5 Water)*	*pH (1:5 0.01M CaCl2)*	*Electrical conductivity* µS/cm	*Total soluble salt* ppm
Composite Sample I	6.2	5.71	123	405.9
Desirable levels	5.5 - 7.5		< 300	< 990

Analysis Test	*Total organic matter %*	*Total organic carbon %*	*Exchangeable calcium* meq/100g of soil	*Exchangeable magnesium* meq/100g of soil
Composite Sample I	2.59	1.3	4.44	2.18
Desirable levels	3 - 4	1.5 - 2	5.98	1.38

Analysis Test	*Exchangeable sodium* meq/100g of soil	*Exchangeable potassium* meq/100g of soil	*Exchangeable hydrogen* meq/100g of soil	*Adj. exchangeable hydrogen* meq/100g of soil
Composite Sample I	0.19	0.49	3.2	1.91
Desirable levels	< 0.46	0.28		< 1.38

Analysis Test	*Cation exchange capacity*	*Adjusted CEC*	*Base saturation percentage*	*Exchangeable calcium (% of adjusted CEC)*
Composite Sample I	10.5	9.21	72	48.2
Desirable levels				65 - 70

Analysis Test	*Exchangeable magnesium (% of adjusted CEC)*	*Exchangeable sodium (% of adjusted CEC)*	*Exchangeable potassium (% of adjusted CEC)*	*Adj. exchangeable hydrogen (% of adjusted CEC)*
Composite Sample I	23.7	2.1	5.3	20.7
Desirable levels	12 - 15	0.5 - 5	3 - 5	< 20

Table 47 – Composite Sample J – Nutrient Balance

Analysis Test	*Available calcium* ppm	*Available magnesium* ppm	*Available sodium* ppm	*Available nitrogen* ppm
Composite Sample I	1006	296.4	50.83	28.4
Desirable levels	1386	207	< 132	21

Analysis Test	*Available phosphorous* ppm	*Available potassium* ppm	*Available sulphur* ppm	*Available copper* ppm
Composite Sample I	1.62	218.79	19.6	1.98
Desirable levels	35	143	7 - 10	2

Analysis Test	*Available zinc* ppm	*Available iron* ppm	*Available manganese* ppm	*Available cobalt* ppm
Composite Sample I	2.59	32	26	3.2
Desirable levels	3 - 5	> 30	> 20	0.5 – 0.7

Analysis Test	*Available molybdenum* ppm	*Available boron* ppm	*Total phosphorus* ppm	*Total nitrogen* %
Composite Sample I	0.24	0.27	117	0.0606
Desirable levels	0.1 - 0.2	0.4 - 0.6		

Table 48 – Composite Sample J – Fertiliser Recommendations

Fertiliser recommendation for native trees (kg/ha)

Nitrogen	*Phosphorus*	*Potassium*	*Sulphur*	*Calcium*
0	33	0	0	0

Trace elements (kg/ha)

Copper	*Zinc*	*Cobalt*	*Molybdenum*	*Iron*	*Manganese*	*Boron*
0.75	3	0	0	2	0	0.3

Table 49 – Composite Sample J – Soil Biological Activity

Analysis Test	Active lactic acid bacteria cfu/g	Active fungi cfu/g	Cellulose utilisers cfu/g	Total active fungi cfu/g
Composite Sample I	1,000	90,000	110,000	200,000
Desirable levels	97,495			189,255
% of total active population	0.4			83
% Desirable	17			33

Analysis Test	Active yeast cfu/g	Active actinomycetes cfu/g	Active photosynthetic bacteria cfu/g	**Total active population cfu/g**
Composite Sample I	10,000	30,000	100	**241,100**
Desirable levels	91,760	120,435	74,555	**573,500**
% of total active population	4.1	12.4	0	
% Desirable	16	21	13	

cfu = colony forming unit per gram of soil

Table 50 – Composite Sample J – Soil Biological Management Recommendations

Kelp extract	*Molasses or sugar*	*Worm leachate*	*Fish hydrolysate*	*Liquefied humate*	*Mulch or green manure*
5 litres/ha	2 litres/ha	5 litres/ha	2 litres/ha		Beneficial

APPENDIX F

Proposed species list

White Box - Black Cypress Pine Shrubby Woodland

Species and Category
Dominant/Tall Trees
Angophora floribunda
Eucalyptus albens
Eucalyptus crebra
Eucalyptus dealbata
Eucalyptus dwyeri
Eucalyptus fibrosa
Eucalyptus macrorhyncha
Eucalyptus punctata
Eucalyptus rossii
Eucalyptus sparsifolia
Total - Dominant/Tall Trees
Required Total -Dominant/Tall Tree
Sub-Dominant/Small Trees
Acacia leariifolia
Acacia doratoxylon
Allocasuarina littoralis
Brachychiton populneus
Callitris endlicheri
Notelaea microcarpa
Total - Sub-Dominant/Small Trees
Requires Total - Sub-Dominant/Small Trees
Shrusbs - Acacias
Acacia buxifolia
Acacia caesiella
Acacia cheeli
Acacia decora
Acacia gladiiformis
Acacia gunni
Acacia implexa
Acacia ixiophylla
Acacia lanigera
Acacia penninervis
Acacia sertiformis
Acacia spectabilis
Acacia subulata
Total - Shrubs - Acacias
Required Total - Shrubs - Acacias
Shrubs - Non Acacias
Allocasuarina diminuta
Allocasuarina gymnanthera
Bossiaea rhombifolia
Bursaria spinosa
Callistemon pinifolius
Cassinia arcuata
Cassinia cunninghamii
Cassinia laevis
Cassinis quiquefaria
Daviesia acicularis
Daviesia genistifolia
Daviesia ulicifolia subsp. ulicifolia
Dodonaea boroniifolia
Dodonaea peduncularis
Dodonaea viscosa
Hakea dactyloides

Hardenbergia violacea
Jacksonia scoparia
Kunzea anbigua
Leptospermum sphaerocarpum
Myoporum montanum
Olearia elliptica
Ozothamnus diosmifolius
Pandorea pandorana
Podolobium foliolosa
Pultenaea ilicifolium
Pultenaea foliolosa
Pultenaea microphylla
Persoonia linearis
Total - Shrubs - Non Acacias
Required Total - Shrubs Non Acacias
Forbs and subshrubs
Ajuga australis
Calotis cunefolia
Calotis lappulacea
Chrysocephalum apiculatum
Desmodium brachypodum
Dyshonia spp
Einadia spp. mix
Enchyleana tomentosa
Gahnia aspera
Podolepis neglecta
Pomax umbellata
Poranthera corymbosa
Solanum brownii
Solanum cinereum
Spartothamnella juncea
Swainsona galegifolia
Vittadinia spp.
Wahlenbergia spp.
Total - Forbs and Sub-Shrubs
Required Total - Forbs and Sub-Shrubs
Native Grasses
Aristida jerichoensis
Aristida personata
Aristida ramosa
Arundinella nepalensis
Austrodanthonia spp.
Austrostipa scabra
Austrostipa verticillata
Bothriochloa decipiens
Bothriochloa macra
Chloris truncata
Cymbopogon refractus
Dichanthium sericeum
Dichelachne spp
Digitaria spp.
Elymus scaber
Eragrostis spp.
Microleana stipiodes
Panicum spp.
Paspalidium spp.
Themeda triandra
Total - Native Grasses
Required Total - Native Grasses

APPENDIX G

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