BMA

BHP Mitsubishi Alliance

Appendix A

Land Resources Assessment

Blackwater Mine - North Extension Project

Land Resources Assessment Report

BM Alliance Coal Operations

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SLR Project No.: 620.014601.00001

Client Reference No.: AU.015980

7 December 2023

Revision: 06

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
06	10 October 2023	S Krebs	A Koeman	A Koeman
01	12 October 2023	S Krebs	A Koeman	A Koeman
02	12 October 2023	S Krebs	A Koeman	A Koeman
03	1 November 2023	S Krebs	A Koeman	A Koeman
04	15 November 2023	S Krebs	A Koeman	A Koeman
05	30 November 2023	S Krebs	A Koeman	A Koeman
06	7 December 2023	S Krebs	A Koeman	A Koeman

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with BM Alliance Coal Operations (the Client or BMA). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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Acronyms and Abbreviations

%	Percent
ASRIS	Australian Soil Resource Information System
ASC	Australian Soil Classification
BoM	Bureau of Meteorology
BMA	BM Alliance Coal Operations Pty Ltd
BWM	Blackwater Mine
cm	centimetres
CEC	Cation exchange capacity
CHPP	Coal Handling and Preparation Plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
SDILGP	State Development, Infrastructure, Local Government and Planning
DNRM	Department of Natural Resources and Mines
DSITIA	Department of Science, Information Technology, Innovation and the Arts
EA	Environmental Authority
EAT	Emerson aggregate test
EC	Electrical conductivity
ECe	Electrical conductivity of a saturated extract
EP Act	*Environmental Protection Act 1994* (Qld)
ESC	Erosion and Sediment Controls
ES	Erosion hazard, subsoil erodibility
ESP	Exchangeable sodium percentage
GPS	Global Positioning System
Ha	hectares
km	Kilometre
m	meters
mm	millimeters
mbgl	Metres below ground level
mAHD	Metres Australian Height Datum
MIA	Mine Infrastructure Area
ML	Mining Lease
MLs	Mining Leases
Mtpa	Million tonnes per annum
NATA	National Association of Testing Authorities
NCST	National Committee on Soil and Terrain
NUMA	Non Use Mining Area
QLD	Queensland

pH	potential of hydrogen
PAA	Priority Agricultural Areas
PLA	Priority Living Area
PMLU	Post Mining Land Use
PRCP	Progressive Rehabilitation and Closure Plan
PSA	Particle size analysis
ROM	Run of Mine
RPI Act	*Regional Planning Interests Act 2014* (Qld)
SA	Surface Area
SCA	Strategic Cropping Area
SCL	Strategic Cropping Land
SEA	Strategic Environmental Area
SMU	Soil Map Units
SLR	SLR Consulting Australia Pty Ltd
TCP	Thermal Coal Plant

1.0 Introduction

1.1 Background and Overview of the Project

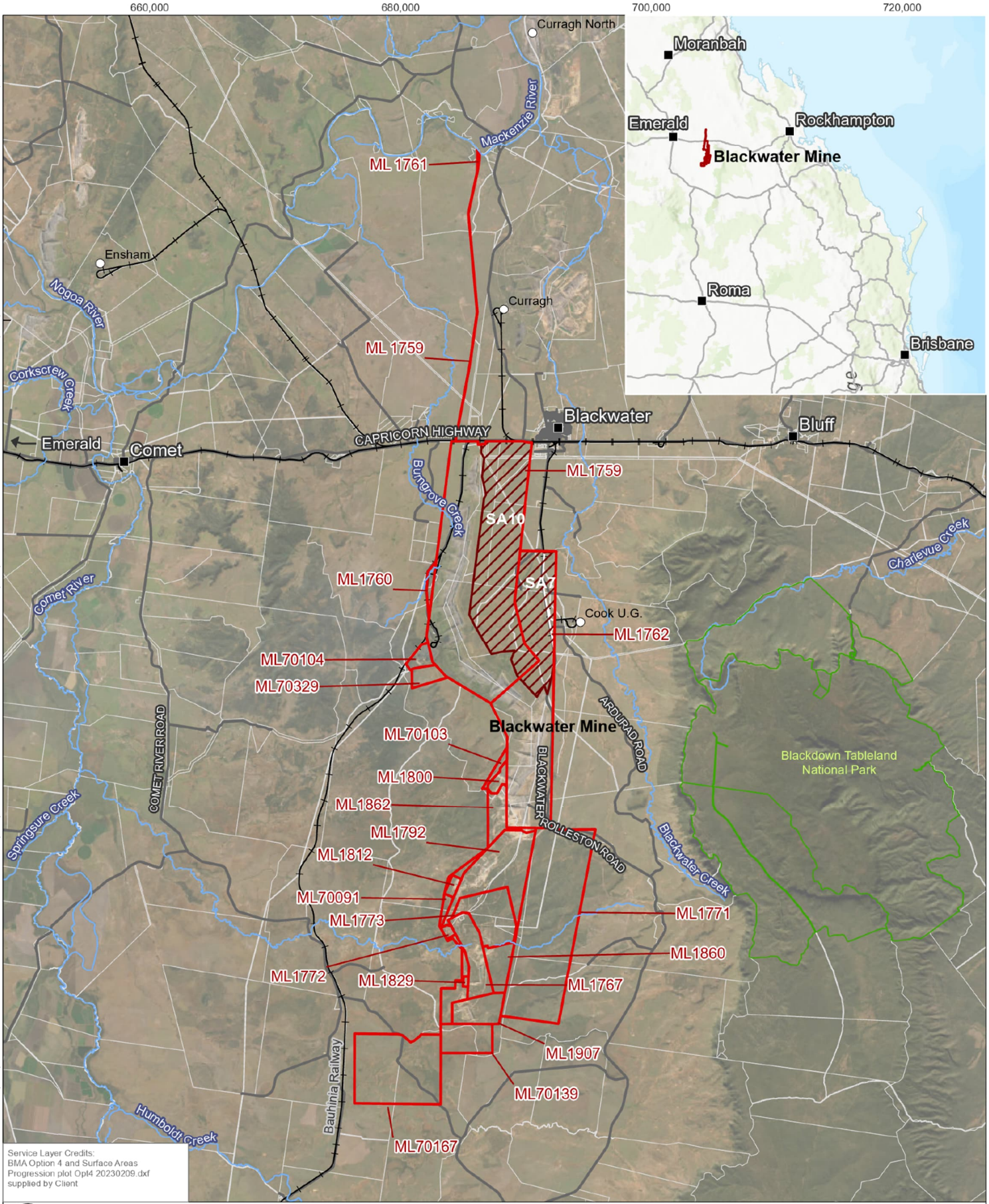
The Blackwater Mine (BWM) is located approximately 20 kilometres (km) south-west of Blackwater in the Bowen Basin, Queensland (**Figure 1-1**). BWM's Mining Leases (MLs) include ML1759, ML1760, ML1761, ML1762, ML1767, ML1771, ML1772, ML1773, ML1792, ML1800, ML1812, ML1829, ML1860, ML1862, ML1907, ML70091, ML70103, ML70104, ML70139, ML70167 and ML70329 (**Figure 1-1**).

The BWM has been in operation since 1967 and operates in accordance with, amongst other authorisations, Environmental Authority (EA) EPML00717813, granted under the *Environmental Protection Act 1994* (Qld) (EP Act), effective from 29 June 2023. The BWM produces up to 16 million tonnes per annum (Mtpa) of product coal.

BM Alliance Coal Operations Pty Ltd (BMA) seek relevant State and Federal approvals to extend the current mining operation through the BWM – North Extension Project (the Project). The Project would extend the mining area of the existing BWM to within Surface Area (SA)10 on ML1759 and SA7 on ML1762 (**Figure 1-1** and **Figure 1-2**) and increase BWM production to up to 17.6 Mtpa (product coal). Importantly, the Project should be viewed in the context that it is an extension and continuation of ongoing mining operations on a portion of the significantly larger BWM mining operation.

The key elements of the Project include, but are not limited to, the following:

- Vegetation clearing, the removal and stockpiling of topsoil material, drilling and blasting of overburden and interburden material.
- Removal of overburden and interburden material (dragline and truck and shovel/excavator methods) to uncover coal, which is placed as back fill in the mined-out pit voids (in-pit spoil dumps) as mining advances.
- Open cut mining (truck and shovel/excavator methods) of Run of Mine (ROM) coal from the coal measures in SA10 on ML1759 and SA7 on ML1762.
- Continued use of BWM infrastructure (e.g., Coal Handling and Preparation Plant (CHPP), Thermal Coal Plant (TCP), ROM and product stockpiles, train load-out, water management system and other supporting infrastructure).
- Continued disposal of rejects and tailings in accordance with the EA.
- Construction and operation of new or relocated infrastructure within SA10 on ML1759 and SA7 on ML1762 to facilitate and/or support the open cut mining extension such as back access roads, access tracks, water management infrastructure and powerlines, laydown areas and build pads.
- A new dragline crossing across Deep Creek.
- Ongoing exploration activities within ML1759 and ML1762.
- Progressive rehabilitation of the mine site.



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LEGEND

- City/Town
- Coal Mine
- Railway
- Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- National Park
- SA7/SA10 Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROJECT LOCATION

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FIGURE 1-1

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Surface Area SA7 on ML1762 and SA10 on ML1759 cover a total area of approximately 9,010 hectares (ha). The extent of the proposed Project open cut mining area and out of pit disturbance areas is approximately 3,761 ha (Figure 1-2). If approved, and subject to customer demand, the extension is projected to extend mining at the BWM to within SA7 on ML1762 and SA10 on ML1759 from 2025 to 2085.

1.2 Purpose

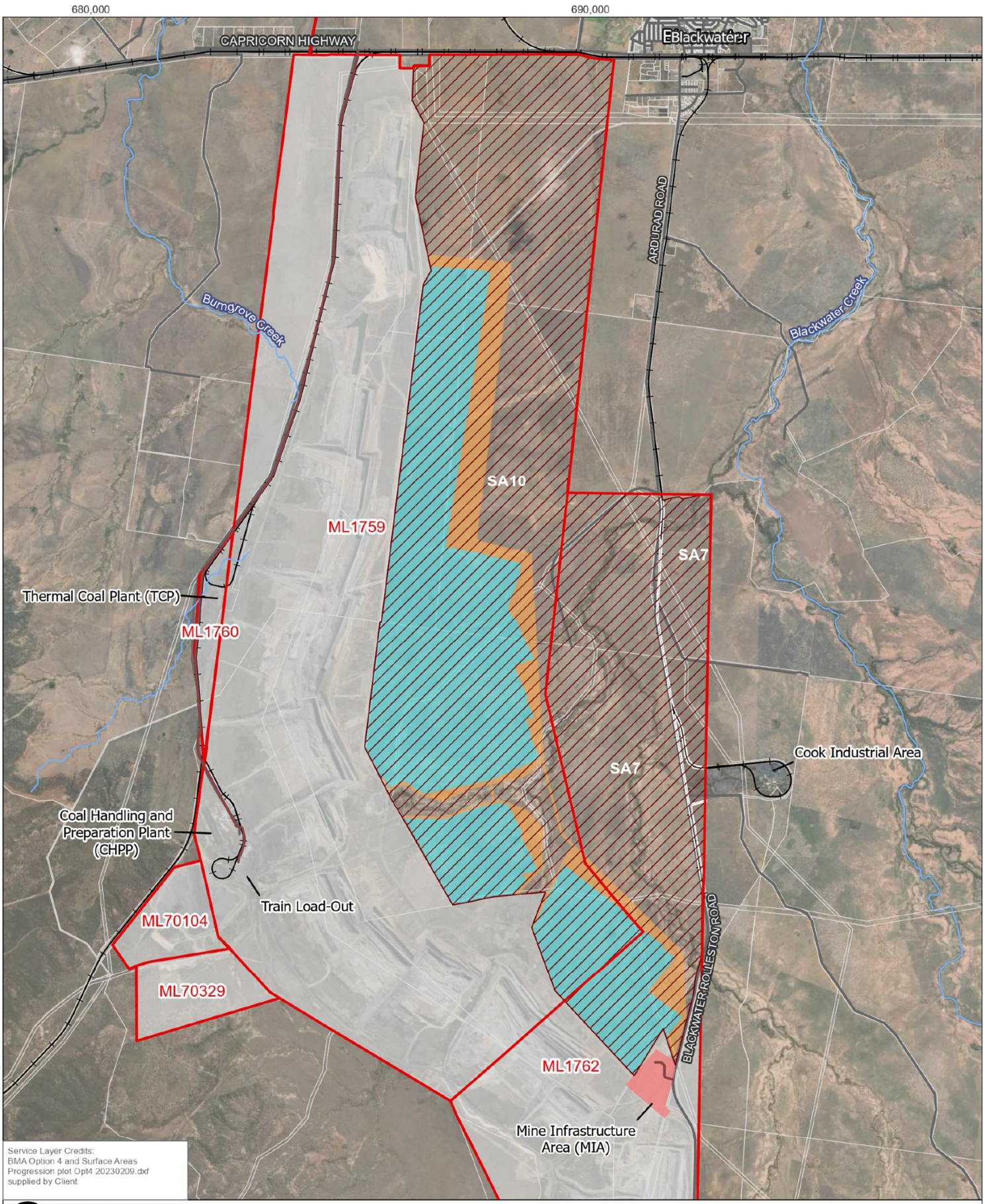
The purpose of this report is to provide an assessment of impacts to the soil and land resources within the Project. The soil and land resource assessment involved a soil survey and assessment to outline:

- Soil types.
- Soil resources available for rehabilitation (including a soil balance).
- Soil qualities (erosion risk, dispersion, and salinity risks).
- Soil and land resource assessment.
- Management and mitigation measures for handling soil resources during the mine extension and rehabilitation.

1.3 Relevant Guidelines and Standards

The following guideline and standards were used for the Land Resource Assessment:

- Department of Natural Resources and Mines (DNRM) and Department of Science, Information Technology, Innovation and the Arts (DSITIA), (2013), Regional Land Suitability Frameworks for Queensland.
- Isbell, R. F., (2021), The Australian Soil Classification Third Edition.
- National Committee on Soil and Terrain (NCST), (2008). Guidelines for Surveying Soil and Land Resources, 2nd edition, Australia.
- NCST, (2009), Australian Soil and Land Survey Field Handbook, 3rd edition. CSIRO Publishing.
- DSITIA & DNRM, (2015). Guidelines for agricultural land evaluation in Queensland (2nd edition).



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Coordinate System:	GDA2020 MGA Zone 55
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Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent
- SA7/SA10 Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROJECT OVERVIEW

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FIGURE 1-2

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2.0 Methodology

2.1 Desktop Review

A desktop assessment was undertaken to establish background information on the baseline soil and land resources within the Project. Various sources have been reviewed during the desktop assessment, including, but not limited to:

- Commonwealth Scientific and Industrial Research Organisation (CSIRO) land systems.
- Australian Soil Resource Information System (ASRIS).
- Terrain-based mapping images including contour information.
- Soil and Landscape Grid of Australia.
- Strategic Cropping Land (SCL) trigger mapping via Queensland Globe.

Geology mapping, vegetation mapping, satellite imagery and aerial photos were also used as inputs prior to undertaking the fieldwork component of the assessment.

2.2 Strategic Cropping Land

The *Regional Planning Interests Act 2014* (Qld) (RPI Act) identifies and protects areas of regional interest from inappropriate resource activity or regulated activity. Areas of regional interest identified in the RPI Act include Priority Agricultural Areas (PAA), Priority Living Area (PLA), Strategic Environmental Area (SEA) and Strategic Cropping Area (SCA). SCA consists of SCL as identified in the SCL trigger map. A PAA is an area deemed as highly productive agricultural land by the relevant regional council under a regional plan. The Project does not intercept any areas of regional interest.

2.3 Sampling Program and Assessment

2.3.1 Sampling Program

The field soil program was designed as an integrated free survey. An integrated free survey assumes that many land characteristics are interdependent and tend to occur in correlated sets (NCST, 2008). Survey points were irregularly located according to the survey teams' judgement to enable the delineation of soil boundaries. Soil boundaries can be abrupt or gradual, and catena and toposequences are used to aid the description of gradual variation.

Soil survey and mapping was undertaken to exceed a 1:125,000 survey intensity and included collection of the landform pattern and element information, soil profile data, and taxonomic parameters to distinguish soil types and delineations within the Project.

Three types of observations were used for the soil survey:

- Detailed sites, which are observations sites that allow for the identification of any physiographic factors or vegetation associations that characterise the site and associated map unit, along with the major pedological feature of the soil profile. Soil pits were excavated using a backhoe to a maximum depth of 1.2 meters below ground level (mbgl).
- Analysed sites, which are detailed sites from which soil samples are collected and sent to a National Association of Testing Authorities (NATA) accredited laboratory for analysis.
- Check sites, which are mapping observations examined in sufficient detail to allocate the site to a specific soil type and map unit.

43 detailed sites were assessed, with soil samples taken from each site and 37 check sites were assessed to confirm soil type and aid in soil mapping. This methodology produced a survey density of 1 site per 115 ha, which exceeds a 1:125,000 survey scale. The distribution of the field assessment sites is depicted in **Figure 2-1**.

2.3.2 Assessment

Soil profiles within the Project were assessed in accordance with the Australian Soil and Land Survey Field Handbook (NCST, 2009) soil classification procedures. Detailed soil profile descriptions were recorded covering the major parameters provided in **Table 2-1**.

Table 2-1 Field Assessment Parameters

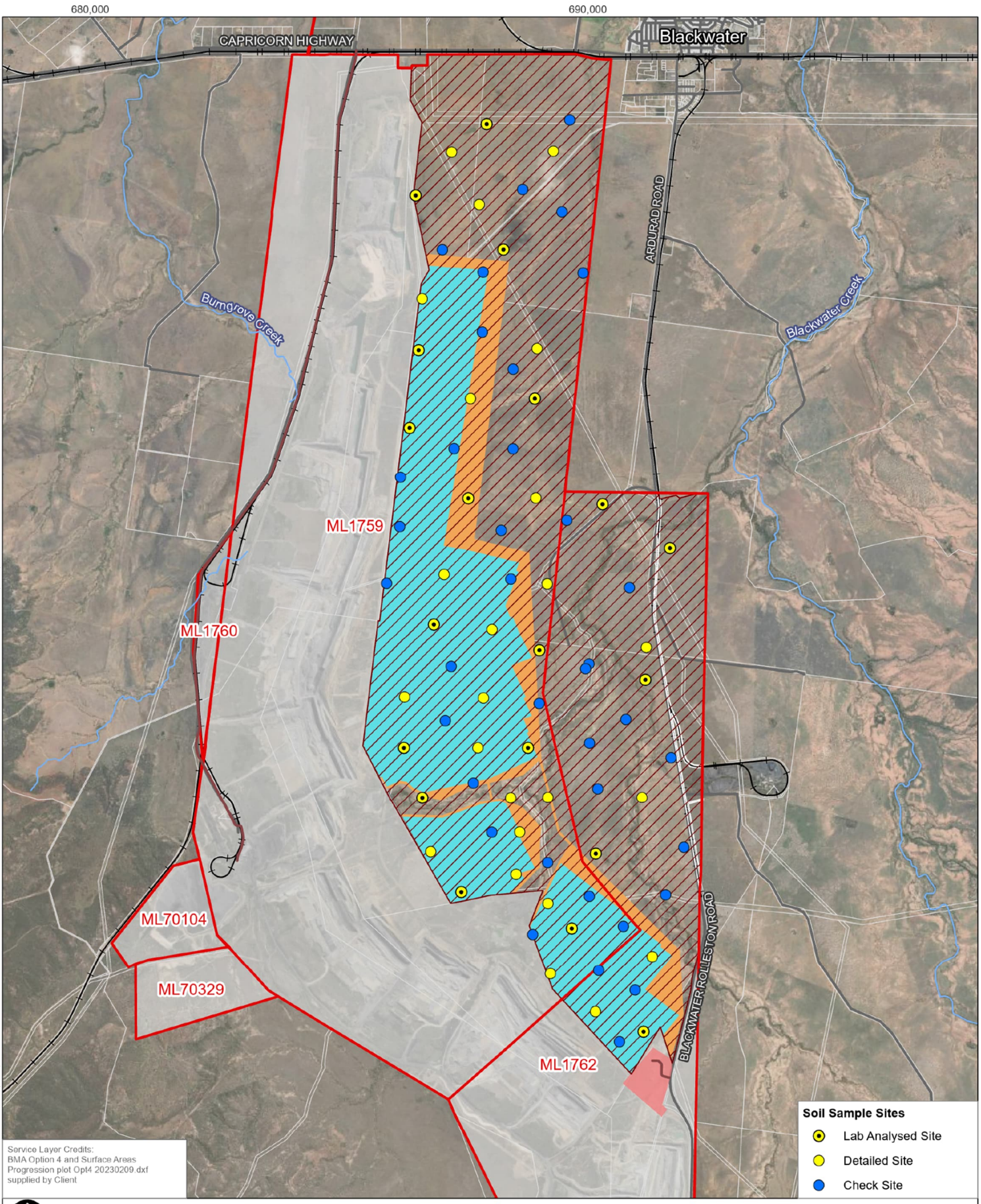
Detailed Field Assessment Parameters	
Horizon depth including distinctiveness and shape	Pan presence and form
Field texture grade	Permeability and drainage
Field colour (Munsell colour chart)	Field pH
Pedality structure, grade and consistence	Field moisture
Soil fabric and stickiness	Surface condition
Stones (abundance and size)	Landform pattern / element
Mottles (amount, size and distinctiveness)	Current land use and previous disturbance
Segregations (abundance, nature, form and size)	Vegetation

Soil profile logging was undertaken in the field using SLR soil data sheets, including Global Positioning System (GPS) recordings and photographs of the landforms and soil profiles. Soils were classified in accordance with The Australian Soil Classification (Isbell, 2021).

Full laboratory testing was undertaken for 20 of the detailed sites and typical sample depths were 0-10, 20-30, 50-60 and 90-100 centimetres (cm). Laboratory analysis was performed by Environmental Analysis Laboratory at the Southern Cross University Lismore, a laboratory with NATA accreditation for the analyses conducted. The soil testing suite included:

- pH (1:5 water).
- Electrical conductivity (EC).
- Cation exchange capacity (CEC).
- Exchangeable sodium percentage (ESP).
- Particle size analysis (PSA).
- Colour (Munsell).
- Emerson aggregate test (EAT).

Soil salinity in the laboratory analysed samples was determined through the measurement of the EC of 1:5 soil:water suspensions. These values were converted to the EC of a saturated extract (ECe) based on soil texture. Laboratory certificates of analysis are shown in **Appendix A**.



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BLACKWATER MINE - NORTH EXTENSION PROJECT

FIELD SAMPLING PLAN

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3.0 Existing Environment

3.1 Climate

The Bureau of Meteorology (BoM) operates the rainfall and evaporation gauges for the nearest meteorological station at Blackwater Water Treatment Plant (BoM Station 035290), located approximately 20 km north of the Project. The annual average rainfall (1995 – 2010) is 542 mm with most rain occurring between December and February. More recent information has been obtained from Blackwater Airport (BoM Station 035134), located approximately 28 km north of the Project for a period between July 2022 and August 2023.

The average monthly rainfall for Blackwater Water Treatment Plant is presented in **Table 3-1**,whilst the average monthly rainfall for Blackwater Airport is presented in **Table 3-2**.

3.2 Geology

The Project is situated in the northern region of the Bowen Basin, which is a north-south trending basin divided into broad morphotectonic zones. The Bowen Basin is characterised by gentle easterly dips and minor to moderate deformation on a relatively thin accumulation of sediments. The sediments and stratigraphic sequence were formed by the Permo-Triassic sediments of the Bowen Basin, which are overlain by a range of Tertiary and Quaternary sediments and alluvium. The Project occurs in the southern part of the basin, with the Moranbah and Rangal Coal Measures containing the deposit which is currently extracted by BWM as well as the future deposit for the Project.

3.3 Topography and Hydrology

The topographic elevations in and around the Project range from approximately 180 meters Australian Height Datum (mAHD) (northeast of the Project) to 230 mAHD (at the southern end of the extension) as depicted in **Figure 3-1**. Most of the Project is situated on gently undulating lowlands and plains with slopes of 0% to 5%.

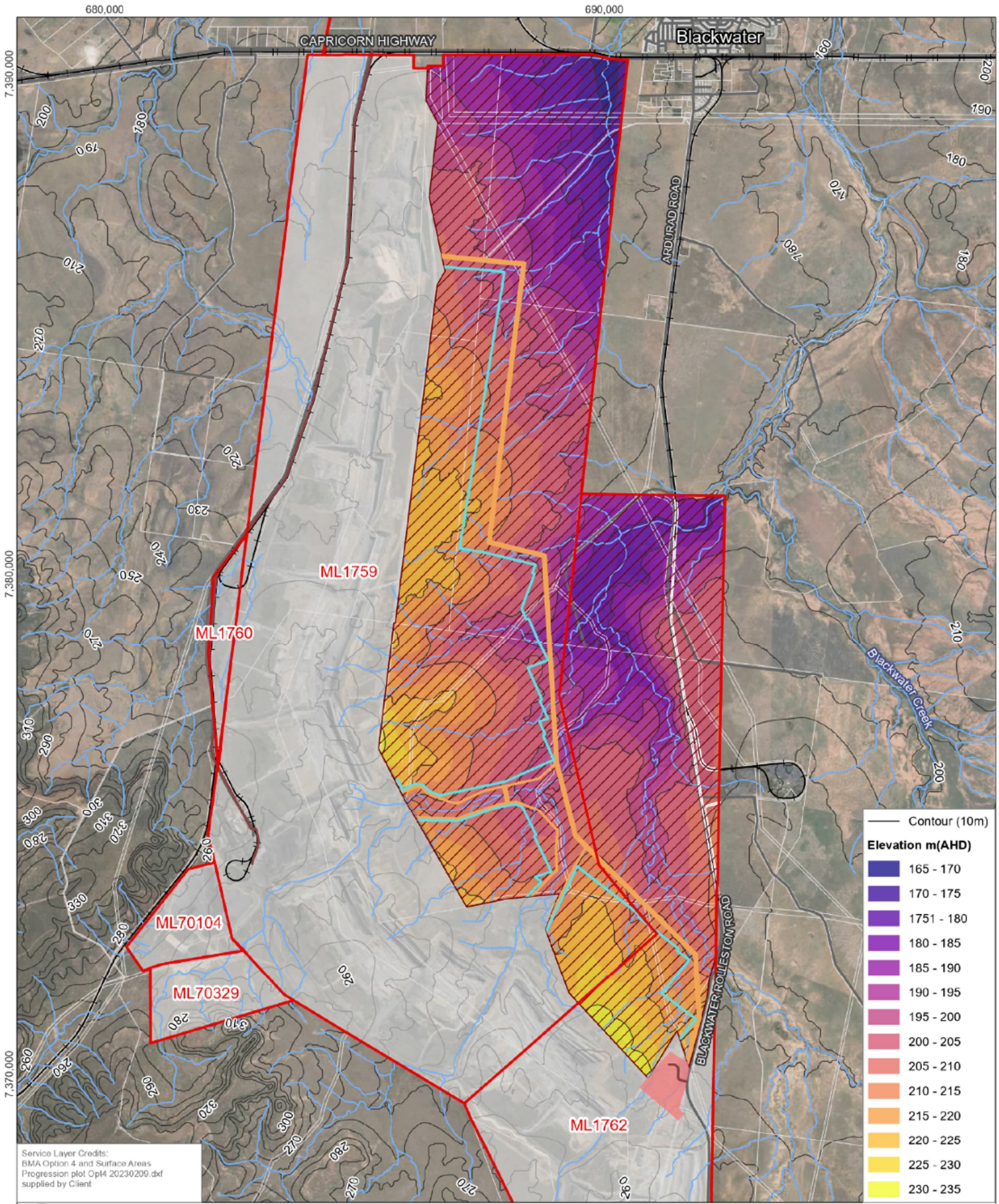
The Project lies within the Fitzroy Basin and Mackenzie River sub-basin. Watercourses within the Project are presented in **Figure 3-1**. Watercourses are ephemeral and include Sagittarius Creek and Taurus Creek, with tributaries including Two Mile Gully and Deep Creek. Taurus Creek intersects with Blackwater Creek east of the Project. Downstream of the Project, Blackwater Creek joins with the Mackenzie River. The Nogoa and Comet Rivers merge east of Emerald to form the Mackenzie River, which then joins the Fitzroy River further downstream to discharge into the Coral Sea south-east of Rockhampton, near Port Alma.

Table 3-1 Average Monthly Rainfall for Blackwater Water Treatment Plant (1995 to 01 March 2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean Rainfall (mm)	68.5	78.8	30.5	28.6	21.4	42.1	15.1	25.9	19.3	66.0	66.3	79.5	542.0

Table 3-2 Average Monthly Rainfall for Blackwater Airport (July 2022 – August 2023)

	Jul-22	Aug-22	Sept-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Annual
Mean Rainfall (mm)	75.6	33.6	68.8	160.4	63.4	66.6	136	2.2	2	0	0	0.2	62.6	0	671.4



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LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

TOPOGRAPHY AND HYDROLOGY

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FIGURE 3-1

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3.4 Vegetation and Land-Use

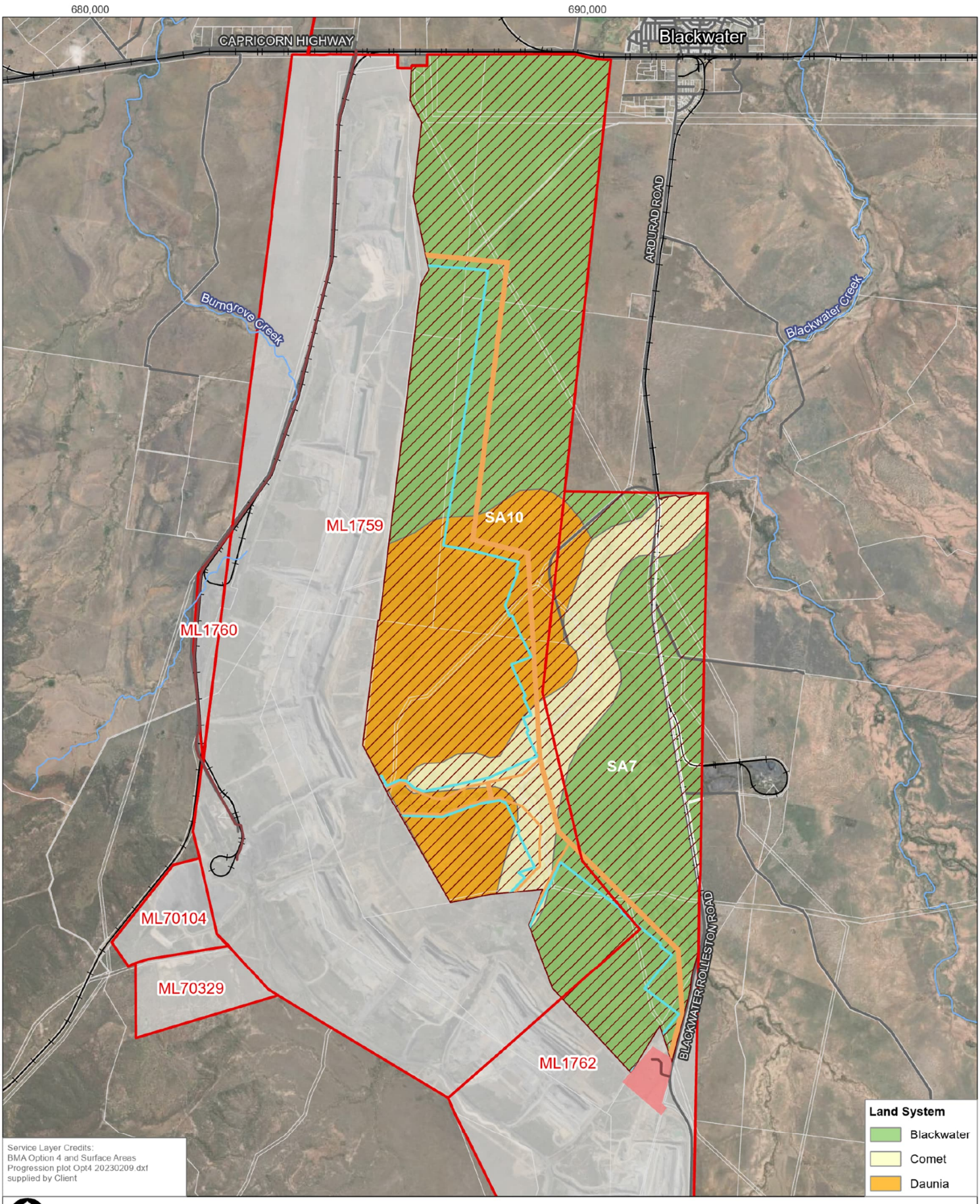
Based on a terrestrial ecology study (EMM, 2023), the Project is highly modified from historic vegetation clearing, cattle grazing, weed encroachment and fragmentation whilst being subject to ongoing direct and indirect effects of the operation of BWM. The vegetation within the Project is largely regrowth brigalow and eucalypt woodland communities. The areas of non-remnant vegetation are now largely dominated by introduced Buffel Grass and have been raked of woody debris and rocks and continue to be grazed by livestock.

3.5 Land Systems

Three land systems occur within the Project; the Daunia, Blackwater and Comet. These are dominated by lowlands with brigalow and cracking clay soils on weathered and fresh Permian shales and lithic sandstone. The Project covered by each Land System and a brief description of attributes is presented in **Table 3-3** and depicted in **Figure 3-2**. The Land System mapping indicates Vertosols would comprise the majority soil type within the Project.

Table 3-3 Land Systems in the Project

Land System	Land System Description
Blackwater	Brigalow plains and cracking clay soils on weathered Tertiary clay and older rocks along the central axis of the Project.
Daunia	Lowlands with brigalow and cracking clay soils on weathered and fresh Permian shales and lithic sandstone in the north and centre.
Comet	Alluvial plains with brigalow and cracking clay soils, often flooded, along major streams.



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LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

LAND SYSTEMS

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FIGURE 3-2

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4.0 Soil Survey Results

4.1 Soil Classification and Description

The soils assessment and subsequent laboratory analysis indicated a total of three (3) dominant and four (4) sub-dominant soil orders within the Project. The dominant soil types within the Project are a Self-Mulching Black-Brown Vertosols, Eutrophic Red Dermosols and Eutrophic Black-Brown Dermosols and are summarised in **Section 4.1.1** and **Section 4.1.2**. Detailed profile descriptions are presented in **Appendix B** and check site descriptions are presented in **Appendix C**.

4.1.1 Vertosols

These are soils with the following:

- A clay field texture of 35% or more clay throughout the solum except for a thin, surface crusty horizons 0.03 m or less thick.
- When dry, open cracks occur at some time in most years. These are at least 5 mm wide and extend upward to the surface or to the base of any plough layer, peaty horizon, self-mulching horizon, or thin, surface crusty horizon.
- Slickensides and/or lenticular peds occur at some depth in the solum.

Self-Mulching Black-Brown Vertosols were identified as the dominant soil type.

The Vertosols within the Project generally consisted of brown to black light to heavy clay A horizons (topsoil) with moderate structure, overlying a medium to heavy medium clay B2 horizon with strong subangular blocky structure. The topsoil showed moderately alkaline, non-sodic and non-saline properties. The B2 horizon generally showed strongly alkaline, sodic to strongly sodic and slightly to moderately saline properties.

4.1.2 Dermosols

These are soils other than Vertosols, Hydrosols, Calcarosols and Ferrosols which:

- Have B2 horizons with a moderate or strong structure throughout the major part of the horizon.
- Do not have clear or abrupt textural B horizons.

The Dermosols were further classified into the following dominant soil types:

- Eutrophic Black-Brown Dermosols.
- Eutrophic Red Dermosols.

The Dermosols within the Project generally consisted of very dark brown to dark reddish-brown clay loam to light clay A horizons (topsoil) with moderate structure, overlying a typically light clay B2 horizon with strong subangular blocky structure. The topsoil showed neutral, non-sodic and non-saline properties, whilst the B2 horizon generally showed strongly alkaline, strongly sodic and moderately saline properties.

4.2 Soil Map Units

Within the Project, a total of four (4) Soil Map Units (SMU) were identified based on the dominant Australian Soil Classification (ASC) soil types and the SMUs are presented in **Figure 4-1.** The dominant and sub-dominant soil types per SMU are shown in **Table 4-1** and field investigation sites associated with each SMU are presented in **Table 4-2** and presented in **Figure 4-2**. A summary of the SMUs is included in **Sections 4.2.1** to **4.2.4**.

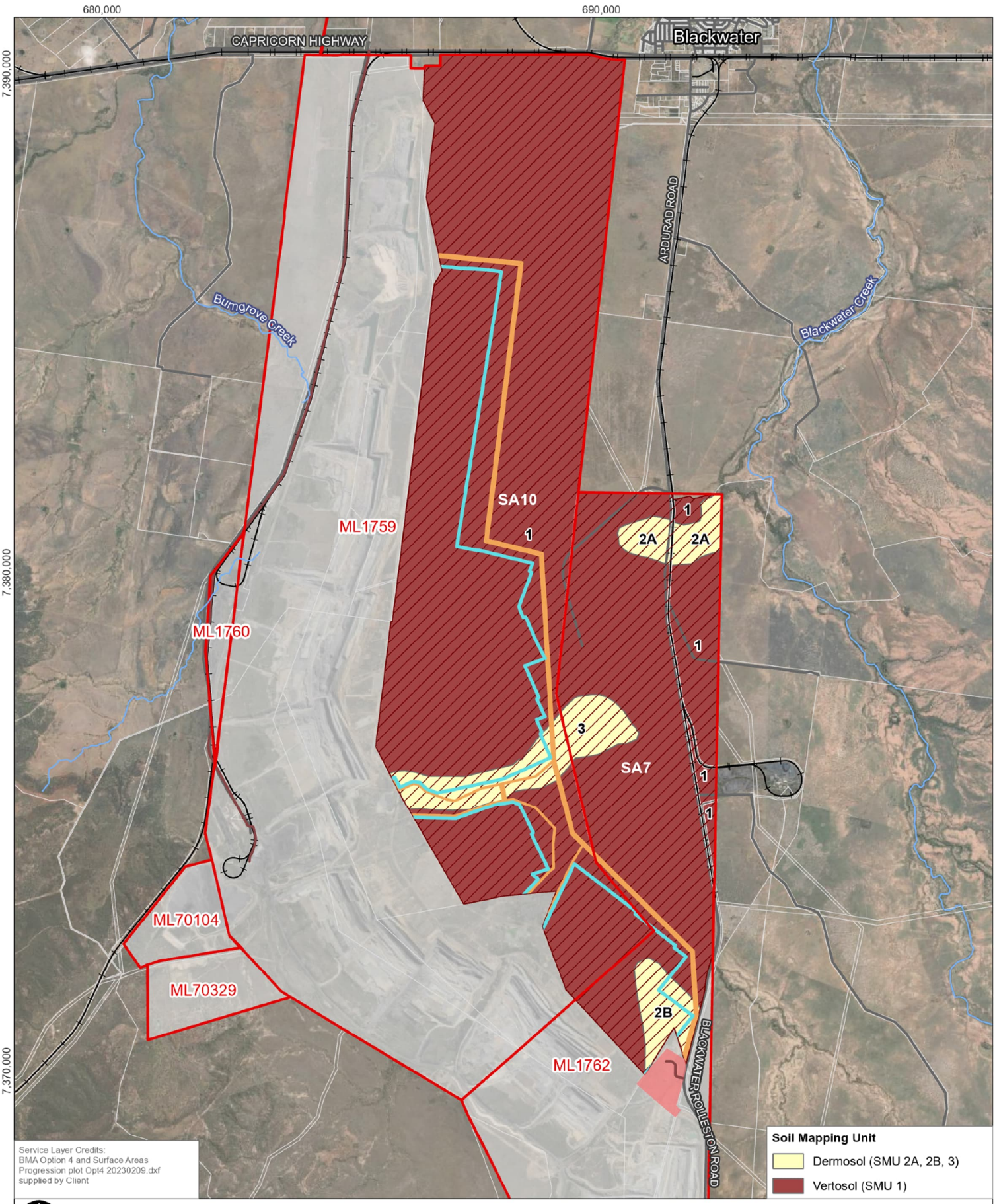
Table 4-1 SMU Soil Types and Areas

Soil Map Unit	Dominant Soil Type	Sub-Dominant Soil Types
1	Self-Mulching Black-Brown Vertosols	Dermosols, Sodosols
2A	Eutrophic Red Dermosols	Nil
2B		
3	Eutrophic Black-Brown Dermosols	Chromosols

The detailed and check sites per SMU are summarised in **Table 4-2** and depicted in **Figure 4-2,** with ASC soil types also presented.

Table 4-2 Field Investigation Sites

SMU	ASC Soil Type	Detailed Site	Check Site
1	Self-Mulching Black-Brown Vertosols	B02-B11, B13-B19, B21-B27, B29-B43	C01-C21, C23-C29, C31-C37
2A	Eutrophic Red Dermosols	B28	-
2B	Eutrophic Red Dermosols	B01	C30
3	Eutrophic Black-Brown Dermosols	B12, B20	C22, C35
Total Observations		**43**	**37**



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	29-Nov-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

SOIL MAP UNITS AND DISTURBANCE AREAS

SLR

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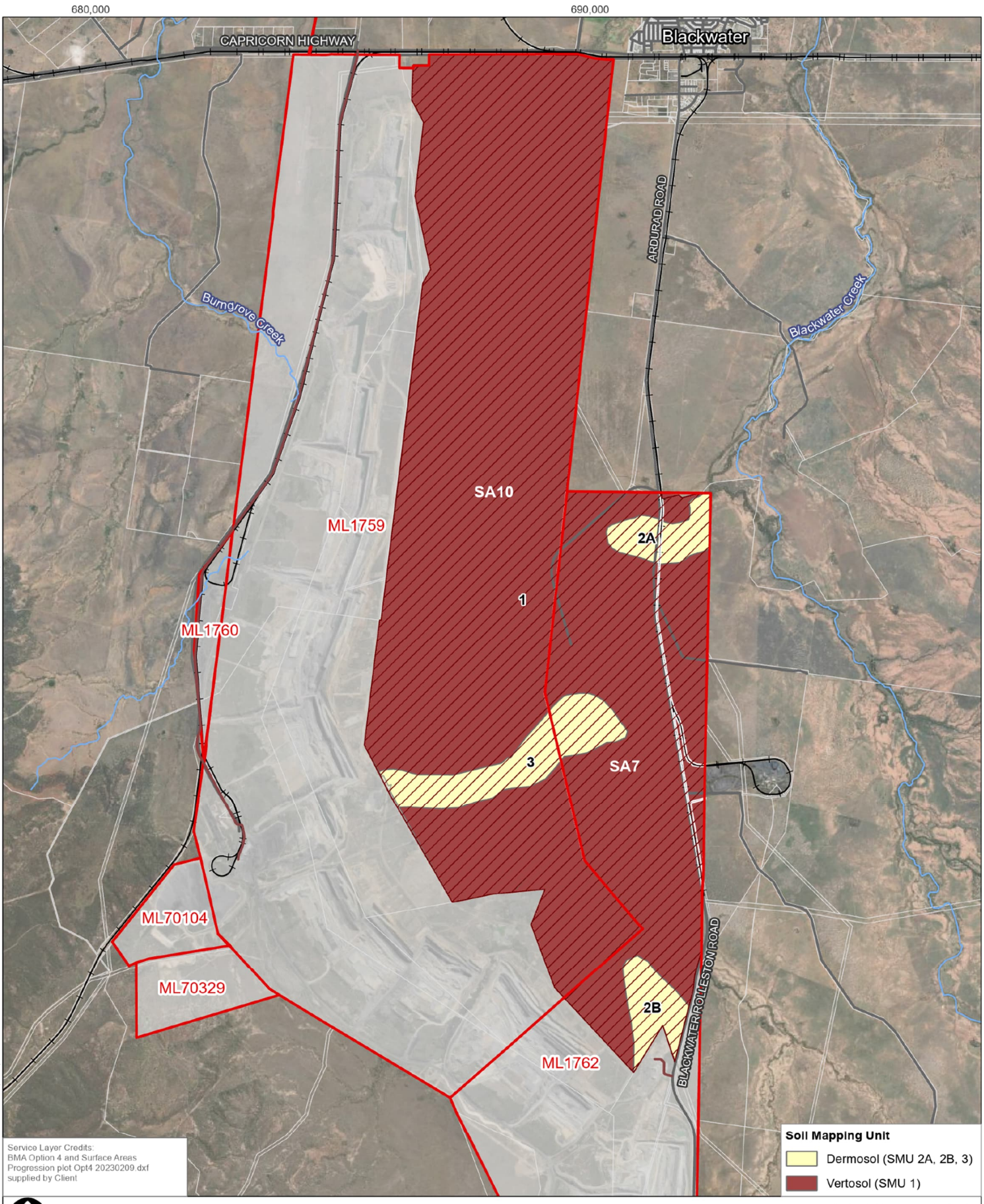
FIGURE 4-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_LR_F04_1_Soil Map Units and Disturbance Areas



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	29-Nov-2023
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LEGEND

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BLACKWATER MINE - NORTH EXTENSION PROJECT

SOIL MAP UNITS

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FIGURE 4-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_LR_F04_2_Soil Map Units

4.2.1 Soil Map Unit 1

4.2.1.1 Description

The SMU 1 dominant soil types were Black and Brown Self-Mulching Vertosols and sub-dominant soil types included Dermosols and Sodosols.

4.2.1.2 Location

SMU 1 is located across the majority of the site.

4.2.1.3 Land-Use

At the time of the field assessment, the land use within SMU 1 was cattle grazing.

4.2.1.4 Management Considerations

The topsoil within SMU 1 is suitable for stripping and reuse using standard Erosion and Sediment Controls (ESC). The subsoil generally exhibits strong alkalinity, high sodicity and moderate salinity.

If the subsoil is exposed and not managed, in addition to severe agricultural productivity limitations, impacts may include:

- Erosion hazards including tunnel erosion.
- Impeded soil infiltration and permeability.
- Slumping failure of batters.
- Soil dispersion leading to soil structure breakdown, increased run-off and increased turbidity run-off.

4.2.2 Soil Map Unit 2A

4.2.2.1 Description

The SMU 2A dominant soil type was Eutrophic Red Dermosols.

4.2.2.2 Location

SMU 2A is located in the eastern portion of the Project.

4.2.2.3 Land-Use

At the time of the field assessment, the land use within SMU 2A was cattle grazing.

4.2.2.4 Management Considerations

The topsoil within SMU 2A is suitable for stripping and reuse using standard ESC. The subsoil generally exhibits very strong alkalinity, high sodicity and moderate salinity.

If the subsoil is exposed and not managed, in addition to severe agricultural productivity limitations, impacts may include:

- Erosion hazards including tunnel erosion.
- Impeded soil infiltration and permeability.
- Slumping failure of batters.
- Soil dispersion leading to soil structure breakdown, increased run-off and increased turbidity run-off.

4.2.3 Soil Map Unit 2B

4.2.3.1 Description

The SMU 2B dominant soil type was Eutrophic Red Dermosols.

4.2.3.2 Location

SMU 2B is located in the southern portion of the Project.

4.2.3.3 Land-Use

At the time of the field assessment, the land use within SMU 2B was cattle grazing.

4.2.3.4 Management Considerations

The topsoil with SMU 2B is suitable for stripping and reuse using standard ESC. The subsoil generally exhibits very strong alkalinity, sodicity and moderate salinity. If the subsoil is exposed and not managed, in addition to severe agricultural productivity limitations, impacts may include:

- Erosion hazards including tunnel erosion.
- Impeded soil infiltration and permeability.
- Slumping failure of batters.
- Soil dispersion leading to soil structure breakdown, increased run-off and increased turbidity run-off.

4.2.4 Soil Map Unit 3

4.2.4.1 Description

The SMU 3 dominant soil type was Eutrophic Black-Brown Dermosols and subdominant soil types included Chromosols.

4.2.4.2 Location

SMU 3 is located in the western and central portion.

4.2.4.3 Land-Use

At the time of the field assessment, the land use within SMU 3 was cattle grazing.

4.2.4.4 Management Considerations

The topsoil within SMU 3 is suitable for stripping and reuse using standard ESC. The subsoil generally exhibits very strong alkalinity, sodicity and moderate salinity.

If the subsoil is exposed and not managed, in addition to severe agricultural productivity limitations, impacts may include:

- Erosion hazards including tunnel erosion.
- Impeded soil infiltration and permeability.
- Slumping failure of batters.
- Soil dispersion leading to soil structure breakdown, increased run-off and increased turbidity run-off.

4.3 Soil Resources and Erosion Potential

4.3.1 Soil Resource Summary

Based on the soil survey results, topsoil resources available in the Project are summarised in **Table 4-3**. It is noted that these soil resources are presented for informative purposes.

Table 4-3 Available Soil Resource Summary

Topsoil Map Unit	ASC Soil Type	Hectares	Topsoil Depth (m)	Topsoil Volume (m^3)
1	Self-Mulching Black-Brown Vertosol	8,275	0.1	8,275,000
2A	Eutrophic Red Dermosol	167	0.1	167,000
2B	Eutrophic Red Dermosol	168	0.2	336,000
3	Eutrophic Black-Brown Dermosol	400	0.1	400,000
Topsoil Volume Available				**9,178,000**

4.3.2 Erosion Potential

An Emerson Aggregate Test (EAT) semi-quantitatively classifies the coherence of soil aggregates in water to provide an indication of dispersive properties and susceptibility to erosion. The ratings are based on a hierarchical class system where a rating of 1 being the most dispersive and 8 being non-dispersive. Approximately 30% of the analysed sites have topsoil with negligible potential for dispersion, having an EAT rating of 4. The remaining 70% analysed topsoil sites have EAT ratings of 2 and 3, which indicates a moderately high to high potential for dispersion. Approximately 95% of subsoil samples have EAT ratings of 2 and 3, indicating a moderately high to high potential for dispersion. Only 5% or one (1) analysed site has subsoil with a negligible dispersion potential of EAT 4. Full EAT results are presented in **Appendix D**.

5.0 Soil and Land Resource Impact Assessment

The soil and land resource impact assessment takes into consideration land suitability, agricultural land, grazing suitability and land capability assessments.

As per current practice at BWM, mining for the Project will continue to the east and the mined-out void areas to the west will be progressively back-filled and rehabilitated. Final voids will remain at the conclusion of mining in some of the pits. In addition to the void, the relief and slope of the rehabilitated area (created by backfilling the pits) will increase compared to pre-mining. This rehabilitated area is located west of the final void area and east of the western boundary of the Project. The final conceptual landform is depicted in **Figure 5-1**.

The conceptual post-mining land use depicted in **Figure 5-2** includes indicative areas for:

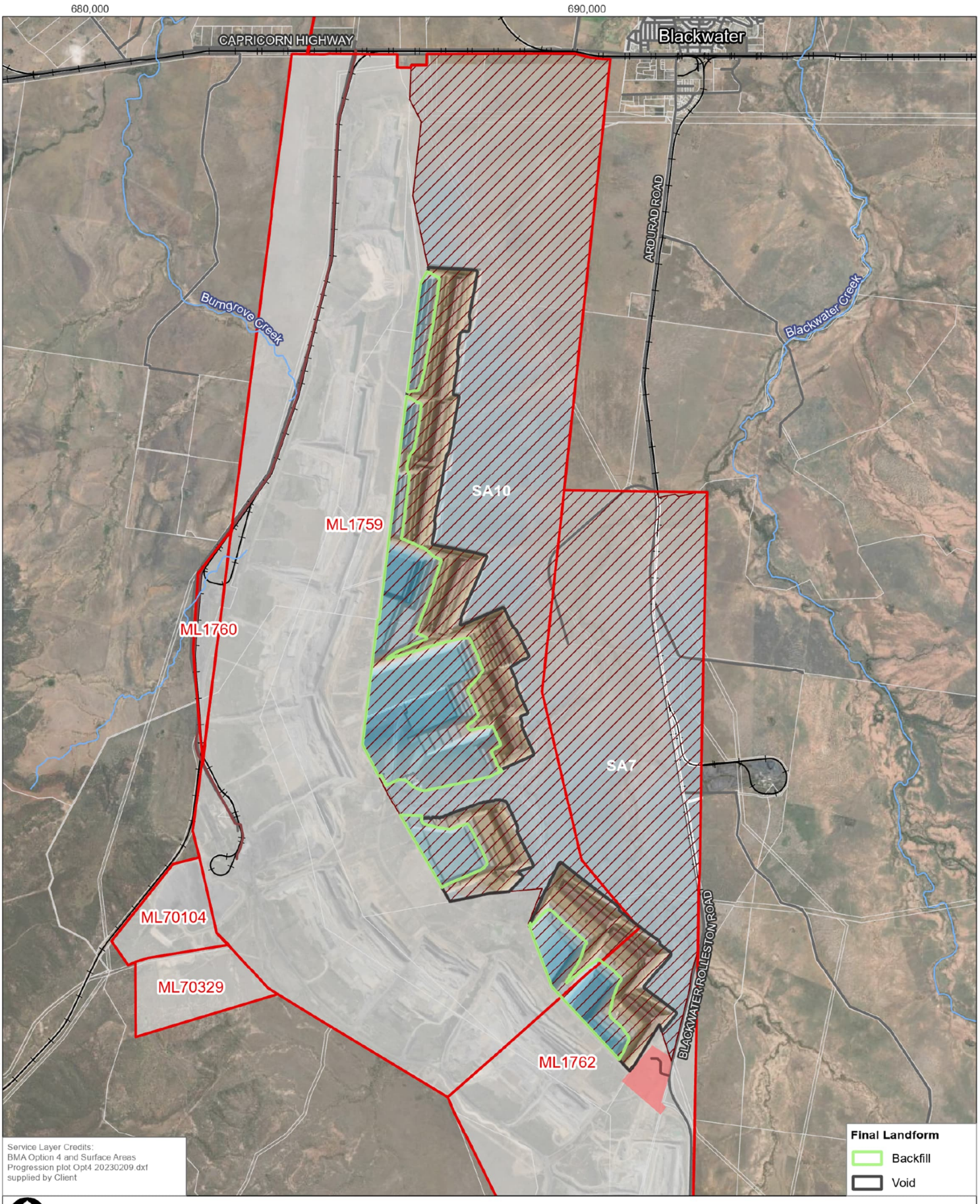
- Cattle grazing.
- Woodland habitat.
- Non-Use Management Area (NUMA).
- Land outside the indicative project footprint (which may include areas of cattle grazing, woodland habitat, water storage or watercourses).

5.1 Land Suitability Methodology

The information required for the land suitability assessment was collected during the desktop assessment and verified on the ground during the field survey and laboratory testing program. The land suitability classification was applied across the Project in accordance with the Regional Land Suitability Frameworks for Queensland (DSITI & DNRM, 2013), in particular Section 10 Suitability Framework for the Inland Fitzroy and Southern Burdekin Area and the Guidelines for Agricultural Land Evaluation in Queensland, 2nd Edition (DSITI & DNRM, 2015). This framework uses the biophysical features of the land and soil to derive detailed ratings tables for a range of land and soil hazards. The scheme consists of eight (8) limitations that classify the land based on severity against the suitability subclasses for various land management options. The eight (8) limitations associated with the biophysical features that are assessed by the framework are:

- Water erosion (E).
- Erosion hazard, subsoil erodibility (Es).
- Soil water availability (M).
- Narrow moisture range (Pm).
- Surface condition (Ps).
- Rockiness (R).
- Microrelief (Tm).
- Wetness (W).

The suitability framework provides the detail for assessing which cropping and cattle grazing activities are suitable for individual mapped areas of land or soil. Each hazard was assessed against set criteria tables, as described in the framework, with each hazard ranked from 1 (most suitable) through to 5 (least suitable) with the overall ranking of the land determined by its most significant limitation, as described in **Table 5-1**.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	29-Nov-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

BLACKWATER MINE - NORTH EXTENSION PROJECT

CONCEPTUAL FINAL LANDFORM

SLR

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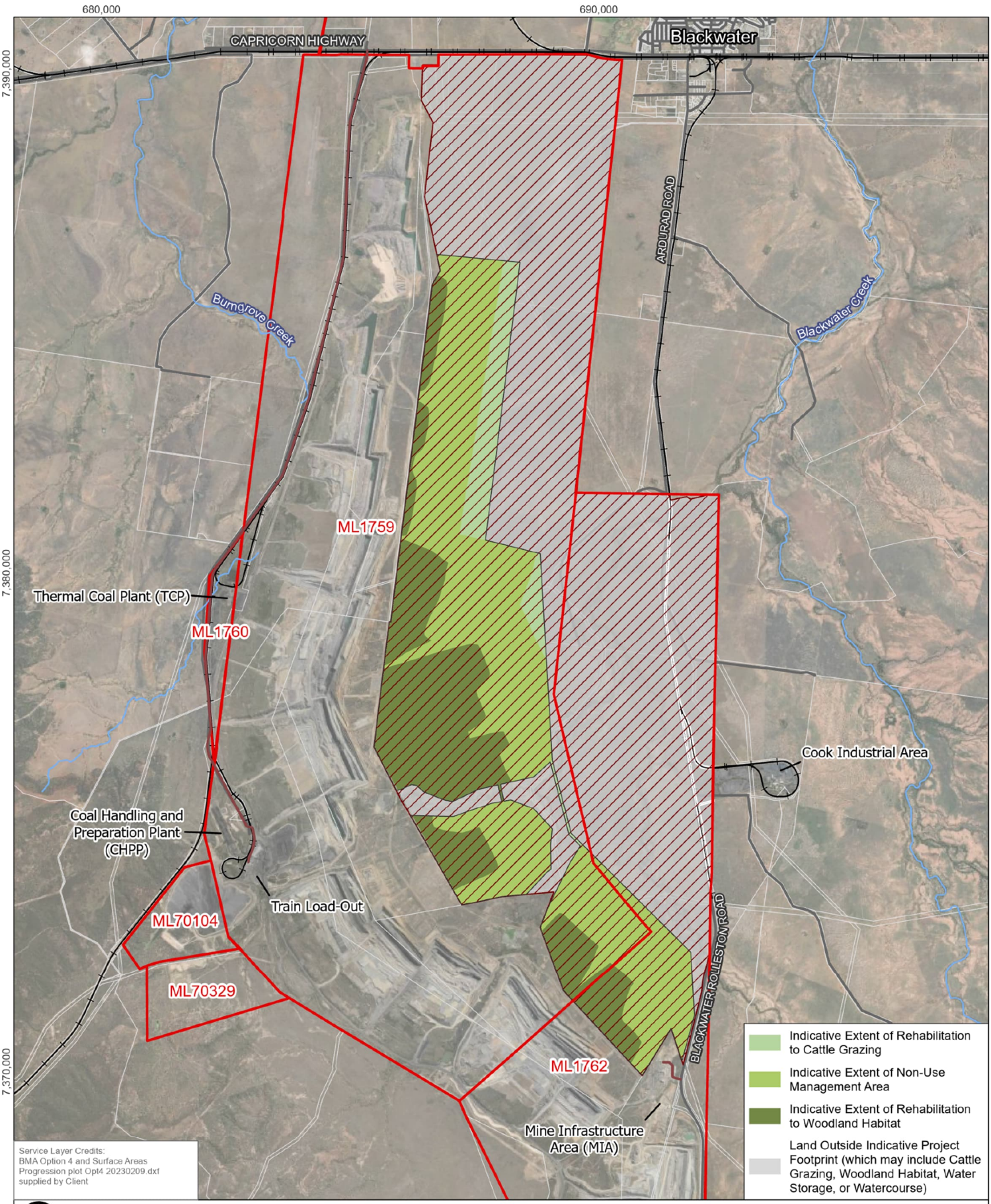
FIGURE 5-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_LR_F05_1_Conceptual Final Landform



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	29-Nov-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Indicative Project Footprint

BLACKWATER MINE - NORTH EXTENSION PROJECT

INDICATIVE FINAL LAND USE

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FIGURE 5-2

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Table 5-1 Land Suitability Class

Class	Description
1	Suitable land with negligible limitations and is highly productive requiring only simple management practices.
2	Suitable land with minor limitations which either reduce production or require more than simple management practices to sustain the use.
3	Suitable land with moderate limitations. Land which is moderately suited to a proposed use but which requires significant inputs to ensure sustainable use.
4	Marginal land with severe limitations which make it doubtful whether the inputs required to achieve and maintain production outweigh the benefits in the long term.
5	Unsuitable land with extreme limitations that precludes its use.

5.2 Land Suitability Results

5.2.1 Pre-Mining

The land suitability assessment has rated SMU 1, which covers the majority of the Project, as Class 4 for cropping and Class 3 for grazing, with the main limitations being soil wetness (W) and soil water availability (M). SMUs 2A, 2B and 3 are rated as Class 5 for cropping and Class 4 for grazing, with the same limitations as SMU 1. Results for the pre-mining Land Suitability Assessment are shown in **Figure 5-3** and the detailed land suitability assessment is presented in **Appendix E.**

5.2.2 Post-Mining

Land suitability (cropping and grazing) classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes some Class 4 and 5 cropping and Class 3 and 4 grazing areas located in the eastern portion of the Project**.** Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet the Rehabilitation Requirements included in Table E1 as per their assigned Post Mining Land Use (PMLU). The PMLU within the disturbance areas will have the following implications to the pre-mining land suitability classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining land suitability classes.
- The PMLU areas to be rehabilitated to woodland habitat will present additional limitations (e.g. steeper slopes and increased rockiness) to the land, which will reduce the land suitability class to marginal land with severe limitations (Class 4) or unsuitable land (Class 5).

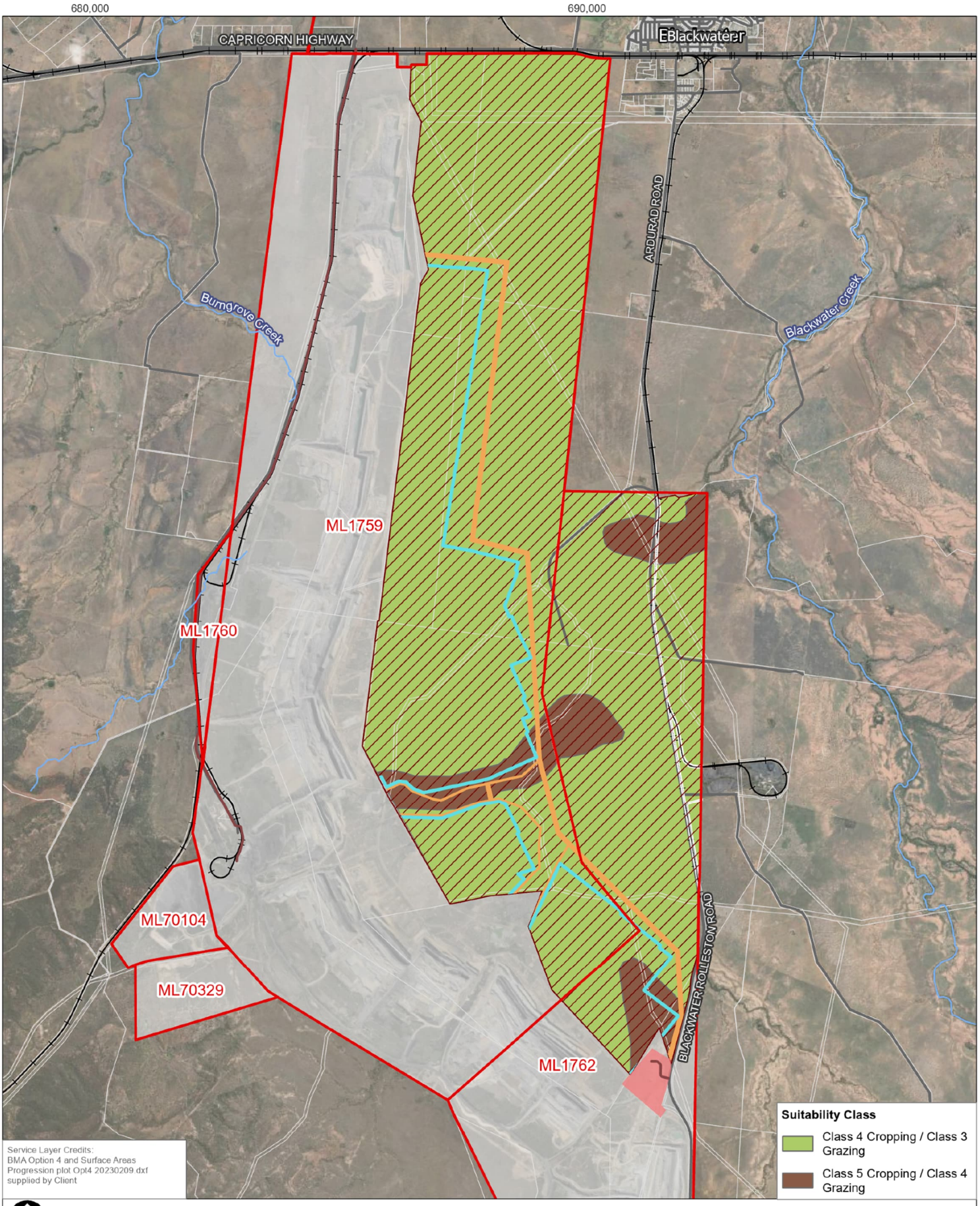
680,000
690,000
7,390,000
7,380,000
7,370,000
CAPRICORN HIGHWAY
Blackwater
ARDURAD ROAD
Burngrove Creek
Blackwater Creek
ML1759
ML1760
ML70104
ML70329
ML1762
BLACKWATER ROLLESTON ROAD
Suitability Class
Class 4 Cropping / Class 3 Grazing
Class 5 Cropping / Class 4 Grazing
Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client
0 1 2 km
Coordinate System: GDA2020 MGA Zone 55
Scale: 1:100,000 at A4
Project Number: 620.014601
Date Drawn: 29-Nov-2023
Drawn by: NT
LEGEND
Road
Railway
Mine Acces Road
Watercourse
BWM Mining Lease
BWM North Extension Project Area
Cadastre
Existing Blackwater Mine
Existing Mine Infrastructure Area
Indicative Project Footprint
Proposed Out of Pit Disturbance
Proposed Pit Extent
BLACKWATER MINE - NORTH EXTENSION PROJECT
LAND SUITABILITY CLASS PRE-MINING
SLR
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FIGURE 5-3
Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_LR_F05_3_Land Suitability Class Pre-Mining

5.3 Agricultural Land Class Assessment

Agricultural Land Classification in Queensland follows a simple hierarchical scheme that is applicable across the state. It allows the presentation of interpreted land evaluation data to indicate the location and extent of agricultural land that can be used sustainably for a wide range of land uses with minimal land degradation. Provision is also made to highlight areas that may be suitable for one specific crop considered important in a particular area. Three broad classes of agricultural land (Class A to Class C) and one non-agricultural land class (Class D) are identified in the Agricultural Land Class system (DSITI & DNRM, 2015) presented in **Table 5-2**:

Table 5-2 Agricultural Land Classes

Class	Description
A	Crop land – Land that is suitable for current and potential crops with limitations to production which range from none to moderate levels.
A1	Suitable for a wide range of current and potential broadacre and horticultural crops.
A2	Suitable for a wide range of current and potential horticultural crops only.
B	Limited crop land – Land that is marginal for current and potential crops due to severe limitations; and suitable for pastures. Engineering and/or agronomic improvements may be required before the land is considered suitable for cropping.
C	Pasture land – Land that is suitable only for improved or native pastures due to limitations which preclude continuous cultivation for crop production; but some areas may tolerate a short period of ground disturbance for pasture establishment.
C1	Suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils.
C2	Suitable for grazing native pastures, with or without the introduction of pasture, and with lower fertility soils than C1.
C3	Suitable for light grazing of native pastures in accessible areas, and includes steep land more suited to forestry or catchment protection
D	Non-agricultural land – Land not suitable for agricultural uses due to extreme limitations. This may be undisturbed land with significant habitat, conservation and/or catchment values or land that may be unsuitable because of very steep slopes, shallow soils, rock outcrop or poor drainage.

5.4 Agricultural Land Class Results

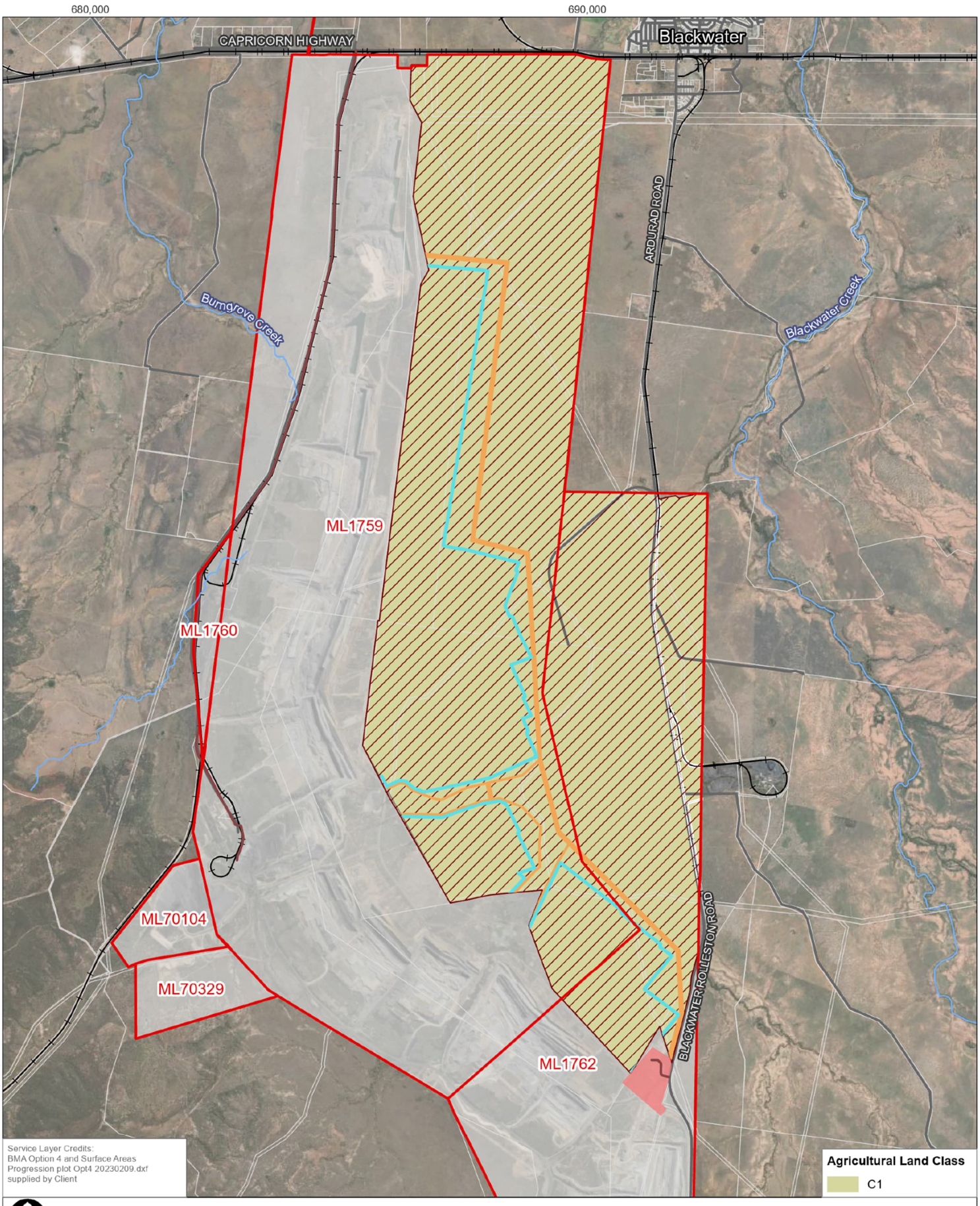
5.4.1 Pre-Mining

The agricultural Land Assessment indicates the Project, consisting of SMU 1, 2A, 2B & 3, is rated as Class C1, pastureland, suitable for grazing improved and native pastures. Results for the pre-mining agricultural land assessment are presented in **Figure 5-4**.

5.4.2 Post-Mining

Agricultural land classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes some Class C1 located in the eastern portion of the Project. Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet the Rehabilitation Requirements included in Table E1 as per their assigned PMLU. The PMLU within the disturbance areas will have the following implications to the pre-mining land suitability classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining agricultural land classes.
- The PMLU areas to be rehabilitated to woodland habitat will present additional limitations (e.g., steeper slopes and increased rockiness) to that land, which will result in a Class C3 or Class D agricultural land class classification.



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Coordinate System:	GDA2020 MGA Zone 55
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LEGEND

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Indicative Project Footprint

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BLACKWATER MINE - NORTH EXTENSION PROJECT

AGRICULTURAL LAND CLASSES PRE-MINING

SLR

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FIGURE 5-4

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_LR_F05_4_Agricultural Land Classes Pre-Mining

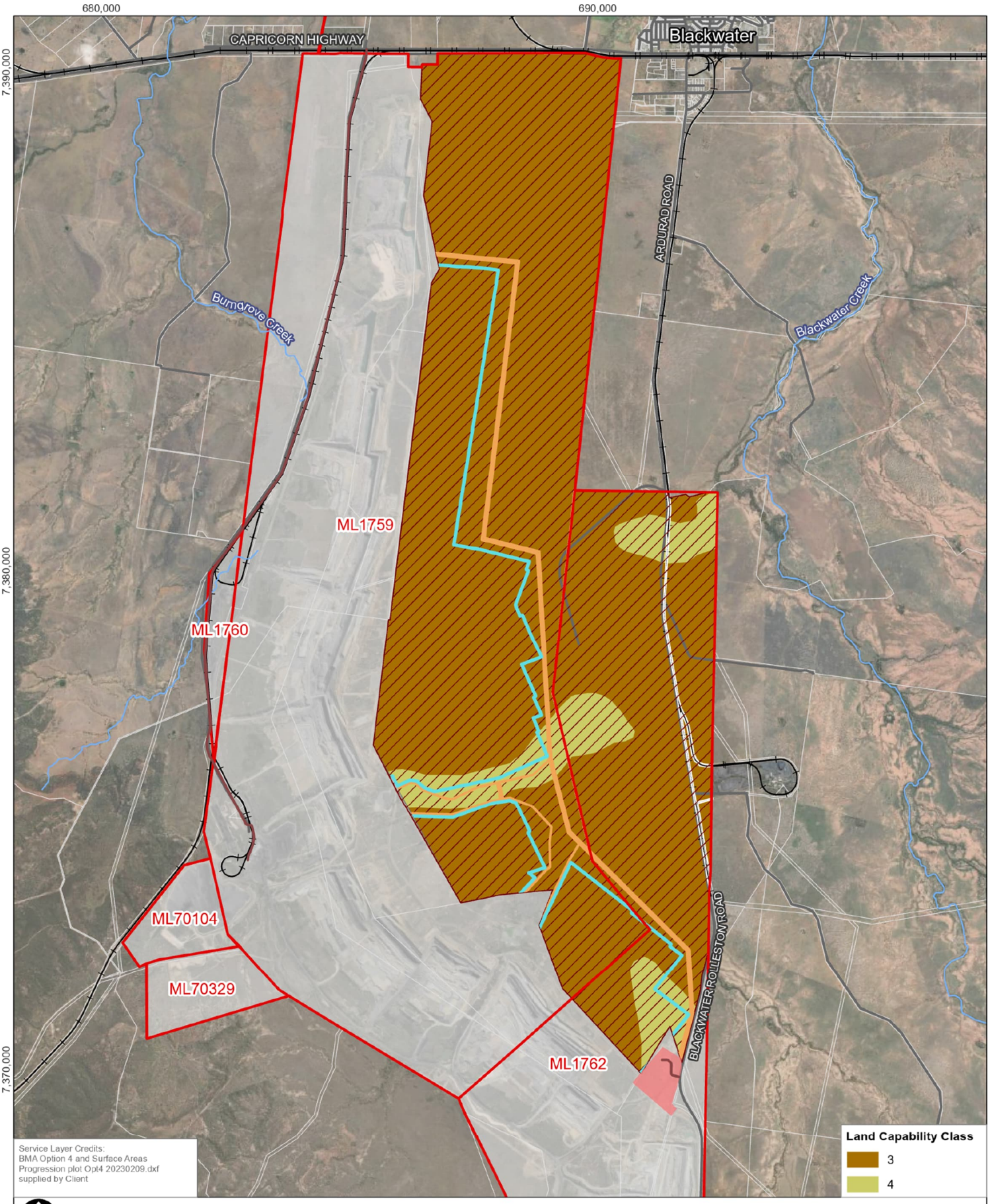
5.5 Land Capability Assessment

Land capability classification evaluates the potential of land for broadly defined land uses, e.g., cropping, pastoral, non-agricultural. In Queensland, it is generally only used for broad scale assessment of land.

The system uses eight classes, described in **Table 5-3**, with limitations and hazards to agricultural and pastoral use becoming progressively greater from Class I to Class VIII, accompanied by a decreasing adaptability and choice of use. Lower-numbered classes (Classes I to III) are suited to more intense uses while higher-numbered classes are suited only to low-intensity agricultural use or conservation. Class VIII is unsuited to either cultivation or grazing.

Table 5-3 Land Capability Classes

Class	Description
I	Land suitable for all agricultural and pastoral uses
II	Land suitable for all agricultural uses but with slight restrictions for cultivation
III	Land suitable for all agricultural uses but with moderate restrictions for cultivation
IV	Land primarily suited to pastoral use but which may be safely used for occasional cultivation with careful management
V	Land that in all other characteristics would be arable but has limitations that make cultivation impractical and/or uneconomic
VI	Land that is not suitable for cultivation but is well suited to pastoral use
VII	Land that is not suitable for cultivation but on which pastoral use is possible only with careful management
VIII	Land that has such severe limitations that it is unsuited for either cultivation or grazing



Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client

0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
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Drawn by:	NT

LEGEND

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Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

LAND CAPABILITY CLASSES PRE-MINING

SLR

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FIGURE 5-5

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_LR_F05_5_Land Capability Classes Pre-Mining

5.6 Land Capability Results

5.6.1 Pre-Mining

The Land capability assessment indicates SMU 1 is rated as Class III land suitable for all agricultural uses but with moderate restrictions for cultivation. The main limitations of the Class III area are wetness, soil salinity/sodicity and landscape complexity. The balance of the Project is rated as Class IV, which is land primarily suited to pastoral use but may be safely used for occasional cultivation with careful management. The main limitations of the Class IV area are soil water availability, soil salinity/sodicity and landscape complexity. Results for the pre-mining land capability assessment are presented in **Figure 5-4** and the detailed Land capability assessment is provided in **Appendix E.**

5.6.2 Post-Mining

Land capability classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes some Class III and Class IV areas located in the eastern portion of the Project. Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet the Rehabilitation Requirements included in Table E1 as per their assigned PMLU. The PMLU within the disturbance areas will have the following implications to the pre-mining land suitability classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining land capability classes.
- The PMLU areas to be rehabilitated to woodland habitat will present additional limitations (e.g., steeper slopes and increased rockiness) to that land, which will result in a Class VII or Class VIII land capability classification.

5.7 Grazing Suitability Assessment

As part of the rehabilitation requirements of the EA, a grazing suitability assessment is required. The information required for applying the Queensland land suitability classification for cattle grazing specifically to the assessment of open-cut coal mine rehabilitation in Queensland's Bowen Basin was collected during the desktop assessment and verified on the ground during the field survey and laboratory testing program. The land suitability classification was applied across the Project in accordance with a rule-set for land suitability assessment of sustainable beef cattle grazing on land rehabilitated after open-cut mining in the Bowen Basin, Queensland draft (Short, 2013), of which the Guidelines for Agricultural Land Evaluation in Queensland, 2nd Edition *(*DSITI & DNRM, 2015*)* forms the basis*.* This framework and the typical soil and land features of grazing systems in the Bowen Basin derive detailed ratings tables for a range of land and soil hazards. The scheme consists of 11 limitations for cattle grazing in coal mine rehabilitation and have been selected based upon:

- The target post-mining land use of sustainable cattle grazing.
- The regional scale of application across the Bowen Basin.
- Diagnostic attributes that can be readily correlated to mapping units at potential mapping scales of 1:50,000 and larger.

The 11 limitations and land-use associated with the biophysical features assessed by the framework are:

- Water availability (M) – adequate water storage in the soil profile to maintain plant growth.
- Nutrient supply – adequate nutrient supply (Nd) and soil pH is suitable for plant growth and does not cause nutrient toxicities or deficiencies (Nr).
- Soil physical factors, surface condition (Ps) – ease of seed germination and establishment.
- Salinity (Sa) – low level of soluble salts in the soil profile.
- Rockiness (R) – minimal impact from gravel, stone and rock at the soil surface.
- Topography* – accessible slope gradients (Ts) and accessible surface micro-relief (Tm).
- Water erosion (E) – minimal soil loss and land degradation.
- Subsoil erosion (ES) – minimal soil loss and land degradation.
- Potentially acid forming materials (D) – minimal environmental and agronomic impacts from low pH drainage.

*Note: These limitations are to do with restrictions to safe and efficient access by vehicles and stock (cattle and horses).

The suitability framework provides the detail for assessing which cattle grazing activities are suitable and for what grazing system for individual mapped areas of land or soil. Each hazard was assessed against set criteria tables, as described in the framework, with each hazard ranked from 1 (most suitable) through to 5 (unsuitable) with the overall ranking of the land determined by its most significant limitation, as described in **Table 5-4.**

Table 5-4 Land Suitability Class for Cattle Grazing on Rehabilitation

Class	Suitability	Grazing System	Description
1	Suitable	Fattening/ finishing	Rehabilitation capable of attaining maximum grazing productivity, i.e., production of young, finished, grass fed, export quality cattle in most seasons.
2	Suitable	Growing	Rehabilitation on which younger cattle perform well but may be difficult to finish at a young age, depending on seasonal conditions.
3	Suitable	Breeding	Rehabilitation able to carry breeding stock all year round depending on seasons.
4	Unsuitable	Sometimes	Rehabilitation that is unsuitable most of the time but may be grazed in better seasons for short periods in conjunction with other country.
5	Unsuitable	Never	Rehabilitation that is not suitable for cattle grazing.

5.8 Grazing Suitability Results

5.8.1 Pre-Mining

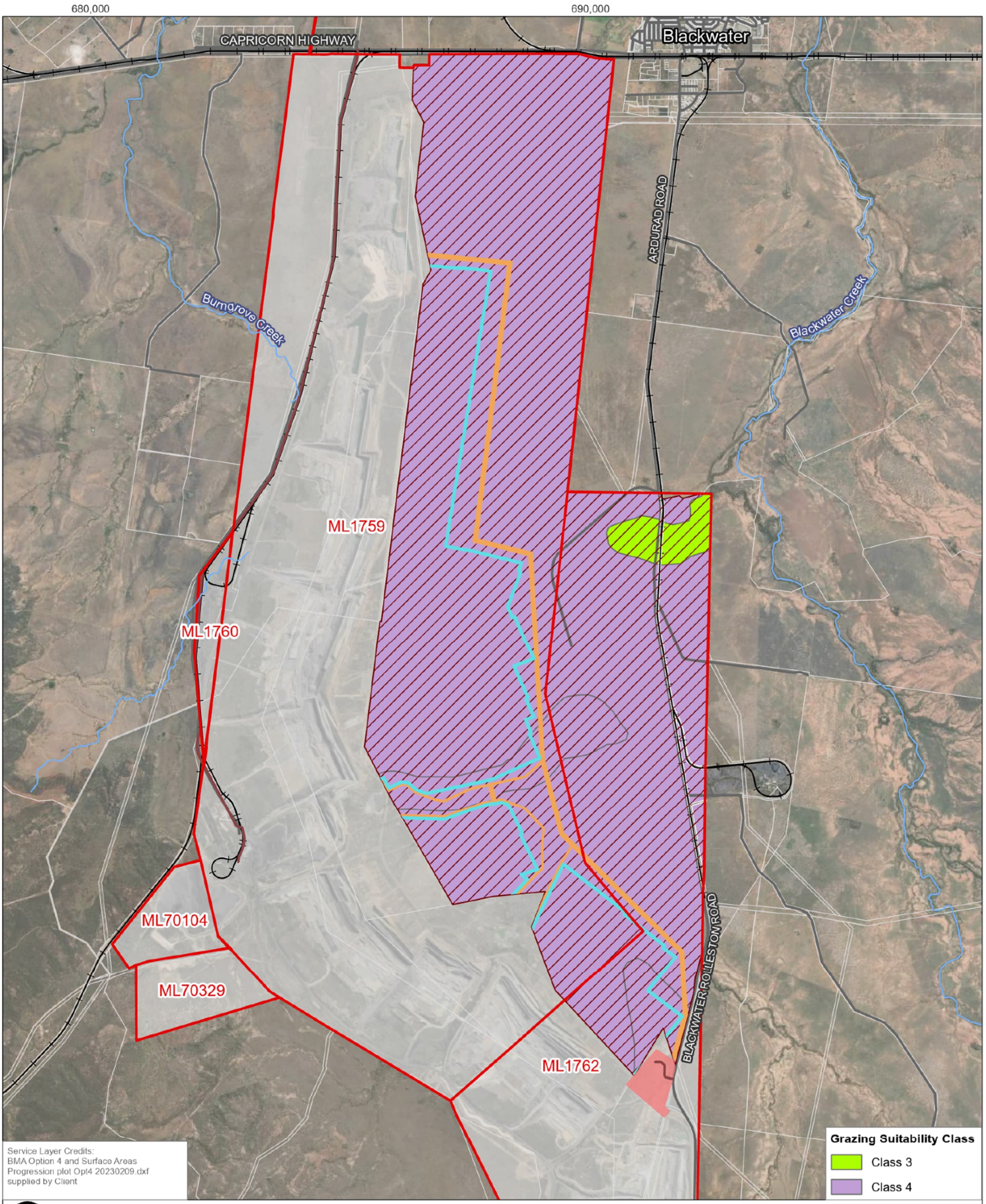
The grazing suitability assessment indicates SMU 1 is rated as Class 4, with the main limitations being soil water availability (m), nutrient supply (Nr), soil physical factors and subsoil erosion (Es). SMU2A is rated as Class 3 with the main limitations of soil water availability and salinity. The balance of the Project made up of SMU2B and SMU3 are rated as Class 4, with the main limitations of soil water availability (m) and soil physical factors (p). Results for the pre-mining Grazing Suitability Assessment are shown in **Figure 5-6** and the detailed grazing suitability assessment is presented in **Appendix E.**

5.8.2 Post-Mining

Grazing suitability classes for areas not scheduled for the proposed mining activity disturbances are likely to remain the same. This includes the Class 3 and some Class 4 areas located in the eastern portion of the Project.

Areas scheduled for the proposed mining activity disturbances will be managed and rehabilitated to meet the Rehabilitation Requirements included in Table E1 as per their assigned PMLU. The PMLU within the disturbance areas will have the following implications to the pre-mining grazing suitability classes:

- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining grazing suitability.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	29-Nov-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

GRAZING SUITABILITY PRE-MINING

SLR

DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

FIGURE 5-6

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_LR_F05_6_Grazing Suitability Pre-Mining

6.0 Rehabilitation

6.1 Rehabilitation Goals

The BWM PRCP is yet to be developed. BWM has a transitional notice for the PRCP and once developed, submitted, and approved, the PRCP will guide the long-term rehabilitation and closure strategy for BWM. The BWM PRCP is due to be submitted in November 2024.

In accordance with the conditions of the BWM Environmental Authority (EPML00717813), all areas significantly disturbed by mining activities will be rehabilitated in accordance with Table E1 of the EA. Table E1 outlines objectives, indicators and acceptance criteria for rehabilitation relating to goals for creating land that is:

- Safe to humans and wildlife.
- Non-polluting.
- Stable.
- Able to sustain an agreed post-mining land use.

The stability of the post-mine landform will be achieved by applying sound rehabilitation practices. Landforms will be established following mining, using soils capable of supporting vegetation communities adapted to the local environment. The rehabilitation practices are designed to stabilise the landform, protect downstream water quality, and aid a sustainable outcome for the Project area.

6.2 Rehabilitation Methodology

Rehabilitation of the Project will be in accordance with the BWM rehabilitation commitments as per the upcoming PRCP and the BWM EA.

6.2.1 Soil and Material Balances

Soils for rehabilitation are salvaged and made available for reuse in establishing a soil profile on the post-mining landform. Volume calculations and soil balance will be determined to inform post-mining requirements for soil depths. The estimated volume of suitable soil throughout the Project is summarised in **Section 4.3.1** and an includes 9,178,000 m^3 of topsoil (as shown in **Table 4-3**). The soil survey and laboratory results were used to determine depth of soil material suitable for recovery and reuse as material in rehabilitation. Factors requiring management considerations include sodicity, salinity and alkalinity.

6.2.2 Soil Sourcing and Substitution

Suitable topsoil will be stripped for use in later rehabilitation. The topsoil will either be stockpiled until suitable re-contoured areas are available, or directly returned across areas to be rehabilitated. The results of the land resources assessment identified that the topsoil resources are adequate for the rehabilitation of the disturbed areas.

Where practicable, soil will be stripped in a slightly moist condition and not be stripped in either an excessively dry or wet condition to prevent pulverisation of the natural soil aggregates or damage of the resource through compaction by equipment.

To reduce soil degradation during stripping operations preference will be given to using equipment which can grade or push soil into windrows such as graders or dozers for later collection by conventional truck and shovel techniques. This will minimise compaction impacts of heavy equipment that is often necessary for economical transport of soil material. These techniques are examples of preferential, less aggressive soil handling systems which may be adopted.

6.2.3 Soil Placement and Management

All soils removed will be placed in designated stockpile areas or returned to areas available for immediate rehabilitation. Freshly stripped and placed topsoil retains seed, micro-organisms and nutrients than stockpiled soil and vegetation establishment is generally improved by the direct return of topsoil and is considered 'best practice' topsoil management. Where long term storage stockpiles be proposed, accurate records are required indicating stockpile volumes and locations. Soil stockpiles within work areas could be used as long-term batters or bunds to facilitate noise amelioration, visual screening and surface water diversion where required.

The following management and mitigation strategies and/or the BWM Topsoil Management Procedure (where applicable) is to be implemented to reduce degradation during stockpiling operations.

- Locations of stockpiles will be recorded using GPS along with data relating to the soil type and volume. An inventory of available soil is maintained and updated regularly to ensure adequate topsoil will be available for planned rehabilitation activities.
- The surface of soil stockpiles will be left in as coarsely structured condition where practicable to promote rainfall infiltration and minimise erosion prior to cover vegetation becoming established.
- Soil types with significantly different properties should be stockpiled separately.
- Storage time will be minimised, where possible. If long term stockpiling is planned, stockpiles should be seeded with an annual cover crop.
- Growth media including topsoil will be spread to depths according to target requirements.
- Where possible, suitable growth media will be re-spread directly onto rehabilitation areas. Growth media will be treated with fertiliser and seeded in one consecutive operation, reducing the potential for compaction and topsoil loss to wind and water erosion.

Stockpiles are not disturbed until required for rehabilitation, weed management, erosion control or for seeding and fertilising purposes. Ameliorants are applied post-spreading of soil resources on rehabilitation areas.

6.2.4 Vegetation Establishment

6.2.4.1 Timing

Revegetation operations will consider both the season and timing of potential germination during the drier months. The preferred seeding timing for woodland habitat is expected to be in September/early October or April/May when there is sufficient soil moisture in the profile.

6.2.4.2 Revegetation

Revegetation methods for all types of disturbed land within the Project will normally consist of the following:

- Respreading of freshly stripped or stockpiled topsoil .
- Contour ripping.
- Application of appropriate fertiliser and ameliorants for plant establishment, after soil chemical analysis, if required.
- Seeding with the appropriate seed mix.

Contour ripping is used as an erosion control measure immediately after surface preparation and before revegetation. A seed mix containing pasture grass and/or local native shrub and tree species is used to establish a sustainable vegetation cover suitable for the post mining land use.

6.2.5 Erosion and Sediment Control

The principal objectives of erosion and sediment control for rehabilitation areas are to:

- Minimise erosion and sedimentation from all active and rehabilitated areas, thereby minimising sediment ingress into surrounding surface waters.
- Segregate contact water (surface run-off from disturbed catchments e.g., active areas of disturbance, stockpiles and rehabilitated areas until stabilised) from clean water (surface run-off from catchments that are undisturbed or relatively undisturbed by Project-related activities and rehabilitated catchments) and maximise the retention time of contact water so that any discharge from the disturbance area is in line with the EA.
- Avoid the potential for runoff and incorporate suitable erosion and sediment control measures in accordance with the BWM ESC Plan.
- Manage surface flows upstream of any surface disturbance during Project works so that rehabilitation activities are not affected by excessive run-on water.
- Establish sustainable long-term surface water management features following rehabilitation of the site, including implementation of an effective revegetation and maintenance program.
- Monitor the effectiveness of erosion and sediment controls and maintain, in accordance with the requirements of the BWM ESC Plan.
- Land disturbance will be restricted to that necessary for the Project.
- Disturbance will be controlled using the BWM Permit to Disturb process and in accordance with the EA.
- All available topsoil will be salvaged for use in rehabilitation, where practicable.
- Erosion from topsoil stockpiles will be managed in accordance with the BWM ESC Plan which requires stockpile sites to be located outside the limits of drainage lines, with controls to prevent mobilising stockpiled material and capture sediment.
- Topsoil stockpiles will be managed in accordance with the BWM Topsoil Management Procedure.
- Stormwater and runoff from catchments directly upstream of the Project will be diverted away from the site during Project works.
- Vehicles to utilise maintained tracks and roads.

Table 6-1 summarises the risks associated with surface disturbance and the associated erosion and sediment control measures which can be applied.

Table 6-1 Erosion Causes and Control – Soil Disturbance Activities

Area	Control Measure
Cleared Land	Restrict clearing to areas essential for the Project works. Windrow vegetation debris along the contour. Minimise length of time soil is exposed. Divert run-off from undisturbed areas away from the Project works. Direct run-off from cleared areas to be dealt with as outlined in the BWM ESC Plan.
Rehabilitation	Install drainage control works as outlined in the BWM ESC Plan. Spread topsoil or appropriate growth media, rip on the contour and seed with appropriate seed mix.
Infrastructure	Vehicles to utilise maintained tracks and roads. Sediment will be controlled as outlined in the BWM ESC Plan. Rehabilitate disturbed areas around work sites as soon as practicable after becoming available.

7.0 Land Resources Mitigation Measures

Potential impacts to land resources and rehabilitation have been considered, and include the following:

- Impacts to land due to disturbance from mining activities (and changes to land use.
- Soil loss due to wind or water erosion.
- Reduction in soil quality and fertility including nutrient loss.
- Inability to achieve post-mine land uses.
- Contamination of land due to leaks or spills from plant, storage facilities or infrastructure and/or transport of contaminated soil or water and introduction into previously uncontaminated areas.

The following general mitigation strategies are to be implemented by the Project to minimise the extent and severity of land disturbance and constraints on rehabilitation, thus mitigating risks that could result in environmental impacts:

- Clearing will occur within the area approved via the BWM's Permit to Disturb process.
- Appropriate storage and management of hydrocarbons and hazardous materials within the MIA to prevent contamination of land e.g., bunding.
- Disturbance to be undertaken in consideration of water flows that could affect land resources during early mining activities.
- Topsoil will be stripped prior to mining and direct re-spread is the preferred method to minimise topsoil handling and reduce damage to soil structure and propagules.
- Topsoil that is not directly re-spread will be stockpiled for re-use in rehabilitation.
- Appropriate surface water management measures are to be implemented including clean water diversions, and use of in-pit sumps and sediment dams to capture mine affected runoff and stormwater as outlined in the Water Management Plan.
- Monitoring and maintenance of rehabilitation until post-mining land use criteria and relinquishment have been achieved.

8.0 Conclusion

The objective of the Soil and Land Resource Assessment was to identify the soil types, qualities and resources available for rehabilitation and conduct an impact assessment. This was to determine the impacts on existing soils and recommend practical and reasonable mitigation measures.

In line with this approach, four (4) Soil Map Units (SMU) were identified in the assessment, comprising the following:

- SMU 1A Self-Mulching Brown-Black Vertosol.
- SMU 2A Eutrophic Red Dermosol.
- SMU 2B Eutrophic Red Dermosol.
- SMU 3 Eutrophic Red-Brown Dermosol.

The land suitability assessment indicates:

- SMU 1A are rated as Class 4 (marginal land with severe limitations) for cropping and Class 3 (suitable land with moderate limitations) for grazing, with the main limitations being soil wetness (w) and soil water availability (m).
- SMU 2A, 2B and 3 is rated as Class 5 (unsuitable land) for cropping and Class 4 (marginal land with severe limitations) for grazing, with the main limitations being soil wetness (w) and soil water availability (m).
- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining land suitability classes.
- The PMLU area to be rehabilitated to woodland habitat will present additional limitations to the land, which will reduce the land suitability class to marginal land with severe limitations (Class 4) or unsuitable land (Class 5).

The agricultural land assessment indicates:

- SMU 1, 2A, 2B and 3 are rated as Agricultural Land Class C1, pasture land suitable for grazing both native and improved pasture species.
- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining agricultural land classes.
- The PMLU areas to be rehabilitated to woodland habitat will present additional limitations to that land, which will result in a Class C3 or Class D agricultural land class classification.

The land capability assessment indicates:

- SMU 1 is rated as Class III land that is suitable for all agricultural uses but with moderate restrictions for cultivation.
- SMU 2A, 2B and 3 are rated as Class IV, land primarily suited to pastoral use but which may be safely used for occasional cultivation with careful management.
- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining land capability classes.
- The PMLU area to be rehabilitated to woodland habitat will present additional limitations to that land, which will result in a Class VII or Class VIII land capability classification.

The grazing land suitability assessment indicates:

- SMU 1, 2B and 3 is rated as Class 4 and is noted as land that is unsuitable for high intensity grazing, however, may be utilised in above average seasonal rainfall conditions.
- SMU 2A is rated as Class 3 (167 ha) and is noted as land that is suitable to carry breeding stock all your round depending on seasons.
- The PMLU areas to be rehabilitated to cattle grazing will likely retain the pre-mining grazing suitability.
- The PMLU area to be rehabilitated to woodland habitat will present additional limitation to that land, which will result in unsuitable (Class 4 or 5) grazing suitability.

9.0 References

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Appendix A Laboratory Certificates of Analysis

Land Resources Assessment Report

BM Alliance Coal Operations

SLR Project No.: 620.014601.00001

7 December 2023

Environmental Analysis Laboratory

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 11/11/2020. Lab Job No.K0498
Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
		Sample ID:	B01	B01	B01	B01	B05
		Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/1	K0498/2	K0498/3	K0498/4	K0498/5
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.79	7.68	9.03	9.19	8.20
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.151	0.125	0.402	0.609	0.128
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	11	11	22	13	29
	Exchangeable Calcium (kg/ha)		4,771	5,078	10,006	6,021	13,106
	Exchangeable Calcium (mg/kg)		2,130	2,267	4,467	2,688	5,851
	Exchangeable Magnesium (cmol+/kg)		2.1	2.7	9.3	1.8	6.8
	Exchangeable Magnesium (kg/ha)		580	738	2,540	496	1,848
	Exchangeable Magnesium (mg/kg)		259	330	1,134	221	825
	Exchangeable Potassium (cmol+/kg)		0.55	0.21	0.27	<0.12	1.0
	Exchangeable Potassium (kg/ha)		485	188	235	<112	919
	Exchangeable Potassium (mg/kg)		216	84	105	<50	410
	Exchangeable Sodium (cmol+/kg)		0.40	1.1	4.5	1.3	0.37
	Exchangeable Sodium (kg/ha)		208	580	2,302	644	188
	Exchangeable Sodium (mg/kg)		93	259	1,028	288	84
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.02	0.02	0.01
	Exchangeable Aluminium (kg/ha)		2.3	2.4	3.0	3.1	2.5
	Exchangeable Aluminium (mg/kg)		1.0	1.1	1.4	1.4	1.1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	14	15	36	17	37
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	77	74	61	81	78
	Magnesium (%)		16	18	26	11	18
	Potassium (%)		4.0	1.4	0.74	0.30	2.8
	Sodium - ESP (%)		2.9	7.3	12	7.6	0.98
	Aluminium (%)		0.08	0.08	0.04	0.09	0.03
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	5.0	4.2	2.4	7.4	4.3
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5 YR 3/4 Dark Reddish Brown	5 YR 3/4 Dark Reddish Brown	7.5 YR 3/4 Dark Brown	5 YR 3/4 Dark Reddish Brown	7.5 YR 2.5/2 Very Dark Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

		Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	Sample ID:	B01	B01	B01	B01	B05
	Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
	Client:	BMA	BMA	BMA	BMA	BMA
Parameter	Method reference	K0498/1	K0498/2	K0498/3	K0498/4	K0498/5

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
13. ** NATA accreditation does not cover the performance of this service.
14. Analysis conducted between sample arrival date and reporting date.
15. This report is not to be reproduced except in full. Results only relate to the item tested.
16. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal).
17. This report issued 2/12/2020 replaces the original report issued on 30/11/2020.

NATA WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

Quality Checked: Kris Saville
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			Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
		Sample ID:	B05	B05	B05	B07	B07
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/6	K0498/7	K0498/8	K0498/9	K0498/10
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.91	9.03	8.97	7.89	8.79
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.159	0.298	0.688	0.102	0.076
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	39	36	28	15	18
	Exchangeable Calcium (kg/ha)		17,563	15,968	12,411	6,713	8,234
	Exchangeable Calcium (mg/kg)		7,841	7,129	5,541	2,997	3,676
	Exchangeable Magnesium (cmol+/kg)		9.3	13	12	6.0	6.7
	Exchangeable Magnesium (kg/ha)		2,526	3,474	3,147	1,640	1,813
	Exchangeable Magnesium (mg/kg)		1,128	1,551	1,405	732	809
	Exchangeable Potassium (cmol+/kg)		0.47	0.48	0.34	0.36	0.20
	Exchangeable Potassium (kg/ha)		414	424	301	312	172
	Exchangeable Potassium (mg/kg)		185	189	134	139	77
	Exchangeable Sodium (cmol+/kg)		1.7	4.2	5.8	0.55	1.6
	Exchangeable Sodium (kg/ha)		858	2,157	2,965	282	803
	Exchangeable Sodium (mg/kg)		383	963	1,324	126	359
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		2.4	1.5	1.3	1.9	1.6
	Exchangeable Aluminium (mg/kg)		1.1	<1	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	51	53	45	22	27
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	77	67	61	68	69
	Magnesium (%)		18	24	26	28	25
	Potassium (%)		0.94	0.91	0.76	1.6	0.73
	Sodium - ESP (%)		3.3	7.9	13	2.5	5.8
	Aluminium (%)		0.02	0.01	0.01	0.04	0.03
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	4.2	2.8	2.4	2.5	2.8
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 2/1 Black	5 YR 2.5/1 Black	7.5 YR 3/4 Dark Brown	5 YR 3/3 Dark Reddish Brown	10 YR 3/3 Dark Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 11/11/2020. Lab Job No.K0498
Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
		Sample ID:	B05	B05	B05	B07	B07
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/6	K0498/7	K0498/8	K0498/9	K0498/10

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium,
    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

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			Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
		Sample ID:	B07	B07	B09	B09	B09
		Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/11	K0498/12	K0498/13	K0498/14	K0498/15
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	9.25	9.21	8.56	9.00	9.02
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.423	0.875	0.109	0.266	0.522
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	23	19	29	26	25
	Exchangeable Calcium (kg/ha)		10,279	8,747	12,824	11,686	11,103
	Exchangeable Calcium (mg/kg)		4,589	3,905	5,725	5,217	4,957
	Exchangeable Magnesium (cmol+/kg)		8.6	10	11	11	13
	Exchangeable Magnesium (kg/ha)		2,336	2,791	3,046	3,024	3,404
	Exchangeable Magnesium (mg/kg)		1,043	1,246	1,360	1,350	1,520
	Exchangeable Potassium (cmol+/kg)		0.17	0.21	0.68	0.42	0.42
	Exchangeable Potassium (kg/ha)		152	187	596	370	368
	Exchangeable Potassium (mg/kg)		68	84	266	165	164
	Exchangeable Sodium (cmol+/kg)		4.7	8.2	1.2	4.1	7.1
	Exchangeable Sodium (kg/ha)		2,434	4,237	610	2,134	3,670
	Exchangeable Sodium (mg/kg)		1,087	1,892	272	953	1,639
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		1.5	1.3	1.8	1.7	1.9
	Exchangeable Aluminium (mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	36	38	42	42	45
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	63	51	69	62	55
	Magnesium (%)		24	27	27	27	28
	Potassium (%)		0.48	0.56	1.6	1.0	0.94
	Sodium - ESP (%)		13	22	2.8	9.9	16
	Aluminium (%)		0.02	0.02	0.02	0.02	0.02
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.7	1.9	2.6	2.3	2.0
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 3/4 Dark Brown	7.5 YR 4/6 Strong Brown	5 YR 2.5/2 Dark Reddish Brown	7.5 YR 3/2 Dark Brown	7.5 YR 3/1 Very Dark Gray
	Mottles Munsell Colour		..	..	..	..	..
			..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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		Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
	Sample ID:	B07	B07	B09	B09	B09
	Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
	Client:	BMA	BMA	BMA	BMA	BMA
	Parameter / Method reference	K0498/11	K0498/12	K0498/13	K0498/14	K0498/15

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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			Sample 16	Sample 17	Sample 18	Sample 19	Sample 20
		Sample ID:	B09	B10	B10	B10	B10
		Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/16	K0498/17	K0498/18	K0498/19	K0498/20
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.81	8.53	8.57	8.68	6.15
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.889	0.155	0.258	0.797	1.058
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	29	23	23	19	11
	Exchangeable Calcium (kg/ha)		13,007	10,398	10,288	8,704	5,069
	Exchangeable Calcium (mg/kg)		5,807	4,642	4,593	3,886	2,263
	Exchangeable Magnesium (cmol+/kg)		14	9.3	10.0	11	10
	Exchangeable Magnesium (kg/ha)		3,740	2,520	2,712	3,035	2,770
	Exchangeable Magnesium (mg/kg)		1,670	1,125	1,211	1,355	1,237
	Exchangeable Potassium (cmol+/kg)		0.49	0.60	0.56	0.42	0.33
	Exchangeable Potassium (kg/ha)		431	528	488	367	291
	Exchangeable Potassium (mg/kg)		192	236	218	164	130
	Exchangeable Sodium (cmol+/kg)		9.8	1.4	2.7	8.0	10
	Exchangeable Sodium (kg/ha)		5,055	707	1,380	4,129	5,256
	Exchangeable Sodium (mg/kg)		2,257	316	616	1,844	2,347
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	0.01	0.01	0.01	0.16
	Exchangeable Aluminium (kg/ha)		1.6	2.4	2.6	2.5	32
	Exchangeable Aluminium (mg/kg)		<1	1.1	1.2	1.1	14
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	0.03
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	53	34	36	39	32
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	55	67	63	50	35
	Magnesium (%)		26	27	28	29	32
	Potassium (%)		0.93	1.8	1.5	1.1	1.0
	Sodium - ESP (%)		19	4.0	7.4	21	32
	Aluminium (%)		0.02	0.03	0.04	0.03	0.50
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.10
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.1	2.5	2.3	1.7	1.1
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 3/1 Very Dark Gray	7.5 YR 3/3 Dark Brown	5 YR 3/3 Dark Reddish Brown	7.5 YR 3/4 Dark Brown	7.5 YR 3/4 Dark Brown
	Mottles Munsell Colour		..	..	..	..	..
			..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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		Sample 16	Sample 17	Sample 18	Sample 19	Sample 20
	Sample ID:	B09	B10	B10	B10	B10
	Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
	Client:	BMA	BMA	BMA	BMA	BMA
	Parameter / Method reference	K0498/16	K0498/17	K0498/18	K0498/19	K0498/20

Notes:

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			Sample 21	Sample 22	Sample 23	Sample 24	Sample 25
		Sample ID:	B12	B12	B12	B12	B17
		Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/21	K0498/22	K0498/23	K0498/24	K0498/25
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.87	7.04	8.28	8.89	7.51
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.046	0.042	0.130	0.498	0.078
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	8.7	8.6	11	14	16
	Exchangeable Calcium (kg/ha)		3,922	3,875	5,078	6,077	7,176
	Exchangeable Calcium (mg/kg)		1,751	1,730	2,267	2,713	3,204
	Exchangeable Magnesium (cmol+/kg)		4.4	4.4	6.6	8.3	10
	Exchangeable Magnesium (kg/ha)		1,196	1,208	1,789	2,249	2,755
	Exchangeable Magnesium (mg/kg)		534	539	799	1,004	1,230
	Exchangeable Potassium (cmol+/kg)		0.45	0.40	0.53	0.63	0.69
	Exchangeable Potassium (kg/ha)		392	351	460	549	603
	Exchangeable Potassium (mg/kg)		175	157	205	245	269
	Exchangeable Sodium (cmol+/kg)		0.64	0.57	0.91	2.7	1.5
	Exchangeable Sodium (kg/ha)		330	295	471	1,403	782
	Exchangeable Sodium (mg/kg)		147	132	210	627	349
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.01	0.01
	Exchangeable Aluminium (kg/ha)		2.7	2.3	2.2	2.1	2.3
	Exchangeable Aluminium (mg/kg)		1.2	1.0	1.0	<1	1.0
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	14	14	19	25	28
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	61	61	59	54	56
	Magnesium (%)		31	32	34	33	36
	Potassium (%)		3.1	2.9	2.7	2.5	2.4
	Sodium - ESP (%)		4.5	4.1	4.7	11	5.4
	Aluminium (%)		0.09	0.08	0.06	0.04	0.04
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.0	1.9	1.7	1.6	1.6
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 2.5/3 Very Dark Brown	7.5 YR 2.5/2 Very Dark Brown	7.5 YR 3/4 Dark Brown	7.5 YR 3/4 Dark Brown	10 YR 3/3 Dark Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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			Sample 21	Sample 22	Sample 23	Sample 24	Sample 25
		Sample ID:	B12	B12	B12	B12	B17
		Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/21	K0498/22	K0498/23	K0498/24	K0498/25

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			Sample 26	Sample 27	Sample 28	Sample 29	Sample 30
		Sample ID:	B17	B17	B17	B20	B20
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/26	K0498/27	K0498/28	K0498/29	K0498/30
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.44	8.83	8.24	7.39	8.64
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.145	0.779	1.025	0.047	0.096
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	19	18	13	9.7	16
	Exchangeable Calcium (kg/ha)		8,747	7,900	5,723	4,365	7,000
	Exchangeable Calcium (mg/kg)		3,905	3,527	2,555	1,949	3,125
	Exchangeable Magnesium (cmol+/kg)		11	11	13	1.3	3.6
	Exchangeable Magnesium (kg/ha)		2,894	2,988	3,561	365	988
	Exchangeable Magnesium (mg/kg)		1,292	1,334	1,590	163	441
	Exchangeable Potassium (cmol+/kg)		0.38	0.33	0.36	0.90	0.45
	Exchangeable Potassium (kg/ha)		331	292	314	789	397
	Exchangeable Potassium (mg/kg)		148	130	140	352	177
	Exchangeable Sodium (cmol+/kg)		3.7	8.3	11	0.18	0.14
	Exchangeable Sodium (kg/ha)		1,881	4,257	5,771	92	74
	Exchangeable Sodium (mg/kg)		840	1,901	2,577	41	33
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	0.01
	Exchangeable Aluminium (kg/ha)		1.4	1.5	1.3	1.7	2.1
	Exchangeable Aluminium (mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	34	37	37	12	20
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	57	47	34	80	79
	Magnesium (%)		31	30	35	11	18
	Potassium (%)		1.1	0.90	0.96	7.4	2.3
	Sodium - ESP (%)		11	22	30	1.5	0.72
	Aluminium (%)		0.02	0.02	0.02	0.07	0.05
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.8	1.6	0.97	7.3	4.3
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5 YR 2.5/1 Black	7.5 YR 2.5/2 Very Dark Brown	7.5 YR 3/4 Dark Brown	7.5 YR 2.5/2 Very Dark Brown	5 YR 3/4 Dark Reddish Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 11/11/2020. Lab Job No.K0498
Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 26	Sample 27	Sample 28	Sample 29	Sample 30
		Sample ID:	B17	B17	B17	B20	B20
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/26	K0498/27	K0498/28	K0498/29	K0498/30

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium,
    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample 31	Sample 32	Sample 33	Sample 34	Sample 35
		Sample ID:	B20	B20	B21	B21	B21
		Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/31	K0498/32	K0498/33	K0498/34	K0498/35
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.79	9.21	7.83	8.81	9.25
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.100	0.150	0.067	0.050	0.131
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	13	20	5.4	7.6	6.8
	Exchangeable Calcium (kg/ha)		5,931	9,000	2,443	3,413	3,039
	Exchangeable Calcium (mg/kg)		2,648	4,018	1,091	1,524	1,357
	Exchangeable Magnesium (cmol+/kg)		4.8	7.5	0.91	6.3	7.7
	Exchangeable Magnesium (kg/ha)		1,310	2,046	248	1,704	2,095
	Exchangeable Magnesium (mg/kg)		585	913	111	761	935
	Exchangeable Potassium (cmol+/kg)		0.37	0.38	0.38	0.33	0.37
	Exchangeable Potassium (kg/ha)		320	332	333	289	320
	Exchangeable Potassium (mg/kg)		143	148	149	129	143
	Exchangeable Sodium (cmol+/kg)		0.24	0.82	<0.065	0.98	2.1
	Exchangeable Sodium (kg/ha)		124	420	<33	502	1,082
	Exchangeable Sodium (mg/kg)		55	188	<15	224	483
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	<0.01	0.01	0.01	0.01
	Exchangeable Aluminium (kg/ha)		2.2	1.6	2.3	2.9	2.3
	Exchangeable Aluminium (mg/kg)		<1	<1	1.0	1.3	1.0
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	19	29	6.8	15	17
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	71	70	80	50	40
	Magnesium (%)		26	26	13	41	45
	Potassium (%)		2.0	1.3	5.6	2.2	2.2
	Sodium - ESP (%)		1.3	2.8	0.52	6.4	12
	Aluminium (%)		0.06	0.03	0.17	0.10	0.07
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.7	2.7	6.0	1.2	0.88
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5 YR 4/6 Yellowish Red	7.5 YR 4/6 Strong Brown	7.5 YR 3/4 Dark Brown	7.5 YR 4/4 Brown	7.5 YR 3/3 Dark Brown
	Mottles Munsell Colour		..	..	..	..	7.5 YR 5/6
	Degree of Mottling (%)		..	..	..	..	Strong Brown 40

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10 Kings Road NEW LAMBTON NSW 2305

			Sample 31	Sample 32	Sample 33	Sample 34	Sample 35
		Sample ID:	B20	B20	B21	B21	B21
		Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/31	K0498/32	K0498/33	K0498/34	K0498/35

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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			Sample 36	Sample 37	Sample 38	Sample 39	Sample 40
		Sample ID:	B21	B23	B23	B23	B23
		Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/36	K0498/37	K0498/38	K0498/39	K0498/40
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	9.25	8.62	8.69	9.13	9.11
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.731	0.110	0.091	0.568	0.911
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	20	26	26	25	26
	Exchangeable Calcium (kg/ha)		8,870	11,704	11,558	11,148	11,858
	Exchangeable Calcium (mg/kg)		3,960	5,225	5,160	4,977	5,294
	Exchangeable Magnesium (cmol+/kg)		9.0	4.2	6.4	10.0	11
	Exchangeable Magnesium (kg/ha)		2,464	1,155	1,731	2,710	2,961
	Exchangeable Magnesium (mg/kg)		1,100	516	773	1,210	1,322
	Exchangeable Potassium (cmol+/kg)		0.35	0.46	0.28	0.26	0.26
	Exchangeable Potassium (kg/ha)		310	404	245	230	230
	Exchangeable Potassium (mg/kg)		138	180	109	103	103
	Exchangeable Sodium (cmol+/kg)		5.8	0.28	1.5	8.1	11
	Exchangeable Sodium (kg/ha)		2,978	143	761	4,159	5,599
	Exchangeable Sodium (mg/kg)		1,330	64	340	1,857	2,500
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	0.01	0.01	<0.01	0.01
	Exchangeable Aluminium (kg/ha)		1.7	2.2	2.3	1.8	2.0
	Exchangeable Aluminium (mg/kg)		<1	<1	1.0	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	35	31	34	43	48
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	57	84	76	58	55
	Magnesium (%)		26	14	19	23	22
	Potassium (%)		1.0	1.5	0.83	0.61	0.54
	Sodium - ESP (%)		17	0.90	4.4	19	22
	Aluminium (%)		0.02	0.03	0.03	0.02	0.02
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.2	6.1	4.0	2.5	2.4
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 4/4 Brown	7.5 YR 3/2 Dark Brown	7.5 YR 3/1 Very Dark Gray	10 YR 4/3 Brown	10 YR 3/3 Dark Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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10 Kings Road NEW LAMBTON NSW 2305

		Sample 36	Sample 37	Sample 38	Sample 39	Sample 40
	Sample ID:	B21	B23	B23	B23	B23
	Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
	Client:	BMA	BMA	BMA	BMA	BMA
Parameter	Method reference	K0498/36	K0498/37	K0498/38	K0498/39	K0498/40

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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11. Conversions to kg/ha = mg/kg x 2.24
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			Sample 41	Sample 42	Sample 43	Sample 44	Sample 45
		Sample ID:	B25	B25	B25	B25	B28
		Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/41	K0498/42	K0498/43	K0498/44	K0498/45
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.26	6.80	8.06	9.13	7.39
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.117	0.087	0.189	0.147	0.043
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	19	23	28	20	12
	Exchangeable Calcium (kg/ha)		8,747	10,227	12,714	9,157	5,259
	Exchangeable Calcium (mg/kg)		3,905	4,566	5,676	4,088	2,348
	Exchangeable Magnesium (cmol+/kg)		6.7	7.9	8.3	5.7	2.4
	Exchangeable Magnesium (kg/ha)		1,830	2,141	2,260	1,549	656
	Exchangeable Magnesium (mg/kg)		817	956	1,009	692	293
	Exchangeable Potassium (cmol+/kg)		0.56	0.37	0.36	0.18	0.32
	Exchangeable Potassium (kg/ha)		490	323	314	154	284
	Exchangeable Potassium (mg/kg)		219	144	140	69	127
	Exchangeable Sodium (cmol+/kg)		0.42	0.62	0.91	1.2	0.10
	Exchangeable Sodium (kg/ha)		218	320	471	614	52
	Exchangeable Sodium (mg/kg)		98	143	210	274	23
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.02	0.01	0.01	0.01
	Exchangeable Aluminium (kg/ha)		2.2	3.1	2.8	2.2	2.7
	Exchangeable Aluminium (mg/kg)		<1	1.4	1.2	<1	1.2
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	27	32	38	27	15
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	72	72	75	74	80
	Magnesium (%)		25	25	22	21	17
	Potassium (%)		2.1	1.2	0.95	0.64	2.2
	Sodium - ESP (%)		1.6	2.0	2.4	4.3	0.69
	Aluminium (%)		0.04	0.05	0.04	0.04	0.09
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.9	2.9	3.4	3.6	4.9
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 3/3 Dark Brown	7.5 YR 3/3 Dark Brown	10 YR 4/2 Dark Grayish Brown	5 YR 3/3 Dark Reddish Brown	5 YR 3/3 Dark Reddish Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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			Sample 41	Sample 42	Sample 43	Sample 44	Sample 45
		Sample ID:	B25	B25	B25	B25	B28
		Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/41	K0498/42	K0498/43	K0498/44	K0498/45

Notes:

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			Sample 46	Sample 47	Sample 48	Sample 49	Sample 50
		Sample ID:	B28	B28	B28	B29	B29
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/46	K0498/47	K0498/48	K0498/49	K0498/50
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.58	9.21	9.54	8.77	9.18
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.069	0.214	0.544	0.162	0.211
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	11	8.9	18	28	29
	Exchangeable Calcium (kg/ha)		5,091	3,996	8,184	12,626	13,216
	Exchangeable Calcium (mg/kg)		2,273	1,784	3,654	5,637	5,900
	Exchangeable Magnesium (cmol+/kg)		5.6	6.4	8.7	9.7	12
	Exchangeable Magnesium (kg/ha)		1,521	1,744	2,370	2,641	3,299
	Exchangeable Magnesium (mg/kg)		679	779	1,058	1,179	1,473
	Exchangeable Potassium (cmol+/kg)		0.26	0.21	0.26	0.37	0.32
	Exchangeable Potassium (kg/ha)		227	184	226	322	277
	Exchangeable Potassium (mg/kg)		101	82	101	144	124
	Exchangeable Sodium (cmol+/kg)		1.5	2.4	4.5	1.6	2.9
	Exchangeable Sodium (kg/ha)		759	1,225	2,342	836	1,494
	Exchangeable Sodium (mg/kg)		339	547	1,046	373	667
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.01	<0.01	0.01	0.01
	Exchangeable Aluminium (kg/ha)		3.5	2.7	1.5	2.6	2.3
	Exchangeable Aluminium (mg/kg)		1.5	1.2	<1	1.2	1.0
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	19	18	32	40	45
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	61	50	57	71	66
	Magnesium (%)		30	36	27	24	27
	Potassium (%)		1.4	1.2	0.81	0.92	0.71
	Sodium - ESP (%)		7.9	13	14	4.1	6.5
	Aluminium (%)		0.09	0.08	0.02	0.03	0.03
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.0	1.4	2.1	2.9	2.4
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5 YR 3/3 Dark Reddish Brown	5 YR 3/4 Dark Reddish Brown	7.5 YR 4/4 Brown	7.5 YR 2.5/2 Very Dark Brown	10 YR 3/2 Very Dark Grayish Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 11/11/2020. Lab Job No.K0498
Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 46	Sample 47	Sample 48	Sample 49	Sample 50
		Sample ID:	B28	B28	B28	B29	B29
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/46	K0498/47	K0498/48	K0498/49	K0498/50

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium,
    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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Quality Checked: Kris Saville
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			Sample 51	Sample 52	Sample 53	Sample 54	Sample 55
		Sample ID:	B29	B29	B31	B31	B31
		Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/51	K0498/52	K0498/53	K0498/54	K0498/55
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	9.03	7.43	8.30	9.02	8.89
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.765	1.271	0.089	0.211	0.673
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	20	13	22	22	19
	Exchangeable Calcium (kg/ha)		9,049	5,723	9,717	9,820	8,695
	Exchangeable Calcium (mg/kg)		4,040	2,555	4,338	4,384	3,882
	Exchangeable Magnesium (cmol+/kg)		12	15	9.0	8.1	11
	Exchangeable Magnesium (kg/ha)		3,400	4,029	2,455	2,206	2,885
	Exchangeable Magnesium (mg/kg)		1,518	1,799	1,096	985	1,288
	Exchangeable Potassium (cmol+/kg)		0.28	0.29	0.45	0.31	0.34
	Exchangeable Potassium (kg/ha)		244	253	391	273	295
	Exchangeable Potassium (mg/kg)		109	113	174	122	132
	Exchangeable Sodium (cmol+/kg)		7.9	13	0.97	2.6	6.7
	Exchangeable Sodium (kg/ha)		4,062	6,441	501	1,315	3,446
	Exchangeable Sodium (mg/kg)		1,814	2,876	224	587	1,539
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.02	0.01	0.01
	Exchangeable Aluminium (kg/ha)		2.6	2.5	3.1	3.0	2.9
	Exchangeable Aluminium (mg/kg)		1.2	1.1	1.4	1.3	1.3
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	41	40	32	33	37
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	49	32	67	67	52
	Magnesium (%)		31	37	28	25	29
	Potassium (%)		0.68	0.71	1.4	0.95	0.91
	Sodium - ESP (%)		19	31	3.0	7.8	18
	Aluminium (%)		0.03	0.03	0.05	0.05	0.04
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.6	0.86	2.4	2.7	1.8
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5 YR 3/2 Dark Reddish Brown	5 YR 4/4 Reddish Brown 10%	7.5 YR 3/3 Dark Brown	7.5 YR 4/3 Brown	5 YR 3/3 Dark Reddish Brown
	Mottles Munsell Colour		..	5 YR 3/1 Very Dark Gray	..	..	..
	Degree of Mottling (%)		..	10	..	..	..

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Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 51	Sample 52	Sample 53	Sample 54	Sample 55
		Sample ID:	B29	B29	B31	B31	B31
		Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/51	K0498/52	K0498/53	K0498/54	K0498/55

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium,
    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample 56	Sample 57	Sample 58	Sample 59	Sample 60
		Sample ID:	B31	B32	B32	B32	B32
		Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/56	K0498/57	K0498/58	K0498/59	K0498/60
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.20	7.25	7.55	9.12	9.11
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.128	0.039	0.041	0.819	1.064
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	12	10	11	23	15
	Exchangeable Calcium (kg/ha)		5,492	4,553	5,010	10,342	6,914
	Exchangeable Calcium (mg/kg)		2,452	2,033	2,237	4,617	3,087
	Exchangeable Magnesium (cmol+/kg)		11	5.3	5.1	11	9.6
	Exchangeable Magnesium (kg/ha)		2,986	1,431	1,394	3,055	2,602
	Exchangeable Magnesium (mg/kg)		1,333	639	623	1,364	1,162
	Exchangeable Potassium (cmol+/kg)		0.26	0.85	0.31	0.20	0.20
	Exchangeable Potassium (kg/ha)		232	744	271	176	172
	Exchangeable Potassium (mg/kg)		104	332	121	79	77
	Exchangeable Sodium (cmol+/kg)		12	0.44	0.76	6.4	7.3
	Exchangeable Sodium (kg/ha)		6,018	227	394	3,276	3,764
	Exchangeable Sodium (mg/kg)		2,687	101	176	1,463	1,681
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.02	0.02	0.02	0.01
	Exchangeable Aluminium (kg/ha)		2.8	3.9	3.8	3.7	2.8
	Exchangeable Aluminium (mg/kg)		1.3	1.7	1.7	1.6	1.3
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	35	17	17	41	32
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	35	61	64	56	47
	Magnesium (%)		31	31	29	27	29
	Potassium (%)		0.75	5.1	1.8	0.49	0.60
	Sodium - ESP (%)		33	2.6	4.4	16	23
	Aluminium (%)		0.04	0.11	0.11	0.04	0.04
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.1	1.9	2.2	2.1	1.6
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 4/4 Brown	5 YR 3/3 Dark Reddish Brown	5 YR 4/4 Reddish Brown	7.5 YR 4/6 Strong Brown	5 YR 5/4 Reddish Brown
	Mottles Munsell Colour		10 YR 4/1 Dark Gray	..	..	..	5 YR 6/8 Reddish Yellow
	Degree of Mottling (%)		2	..	..	..	20

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

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Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 56	Sample 57	Sample 58	Sample 59	Sample 60
		Sample ID:	B31	B32	B32	B32	B32
		Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/56	K0498/57	K0498/58	K0498/59	K0498/60

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium,
    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample 61	Sample 62	Sample 63	Sample 64	Sample 65
		Sample ID:	B34	B34	B34	B34	B36
		Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/61	K0498/62	K0498/63	K0498/64	K0498/65
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.99	8.80	8.51	8.13	7.31
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.173	0.211	1.512	1.745	0.058
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	36	31	18	16	13
	Exchangeable Calcium (kg/ha)		16,045	13,784	8,214	7,194	5,649
	Exchangeable Calcium (mg/kg)		7,163	6,154	3,667	3,212	2,522
	Exchangeable Magnesium (cmol+/kg)		10.0	7.1	13	13	4.8
	Exchangeable Magnesium (kg/ha)		2,712	1,930	3,481	3,416	1,320
	Exchangeable Magnesium (mg/kg)		1,211	861	1,554	1,525	589
	Exchangeable Potassium (cmol+/kg)		0.53	0.42	0.41	0.42	0.29
	Exchangeable Potassium (kg/ha)		466	372	358	370	255
	Exchangeable Potassium (mg/kg)		208	166	160	165	114
	Exchangeable Sodium (cmol+/kg)		2.2	2.3	12	13	0.91
	Exchangeable Sodium (kg/ha)		1,140	1,183	6,305	6,844	467
	Exchangeable Sodium (mg/kg)		509	528	2,815	3,056	209
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.02	<0.01	<0.01	0.01
	Exchangeable Aluminium (kg/ha)		2.9	3.5	1.3	1.4	2.2
	Exchangeable Aluminium (mg/kg)		1.3	1.6	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	48	41	44	42	19
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	74	76	42	38	68
	Magnesium (%)		21	17	29	30	26
	Potassium (%)		1.1	1.0	0.94	1.00	1.6
	Sodium - ESP (%)		4.6	5.7	28	31	4.9
	Aluminium (%)		0.03	0.04	0.01	0.02	0.06
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.6	4.3	1.4	1.3	2.6
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 3/2 Very Dark Grayish Brown	7.5 YR 3/1 Very Dark Gray	7.5 YR 2.5/2 Very Dark Brown	5 YR 3/2 Dark Reddish Brown	7.5 YR 3/4 Dark Brown
	Mottles Munsell Colour		..	..	..	7.5 YR 4/6 Strong Brown	..
	Degree of Mottling (%)		..	..	..	40	..

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10 Kings Road NEW LAMBTON NSW 2305

			Sample 61	Sample 62	Sample 63	Sample 64	Sample 65
		Sample ID:	B34	B34	B34	B34	B36
		Crop:	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/61	K0498/62	K0498/63	K0498/64	K0498/65

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
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    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample 66	Sample 67	Sample 68	Sample 69	Sample 70
		Sample ID:	B36	B36	B36	B38	B38
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/66	K0498/67	K0498/68	K0498/69	K0498/70
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.78	9.29	9.38	8.98	9.19
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.178	0.528	0.749	0.178	0.344
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	25	24	23	32	29
	Exchangeable Calcium (kg/ha)		11,105	10,908	10,272	14,246	13,045
	Exchangeable Calcium (mg/kg)		4,958	4,870	4,586	6,360	5,824
	Exchangeable Magnesium (cmol+/kg)		8.4	12	10.0	6.3	7.5
	Exchangeable Magnesium (kg/ha)		2,287	3,214	2,719	1,724	2,034
	Exchangeable Magnesium (mg/kg)		1,021	1,435	1,214	770	908
	Exchangeable Potassium (cmol+/kg)		0.32	0.29	0.20	0.46	0.31
	Exchangeable Potassium (kg/ha)		280	251	174	406	268
	Exchangeable Potassium (mg/kg)		125	112	78	181	120
	Exchangeable Sodium (cmol+/kg)		2.0	7.4	8.2	2.1	4.8
	Exchangeable Sodium (kg/ha)		1,026	3,791	4,217	1,103	2,454
	Exchangeable Sodium (mg/kg)		458	1,693	1,883	493	1,096
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		2.2	1.9	1.4	2.0	1.9
	Exchangeable Aluminium (mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	35	44	41	41	42
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	70	56	55	78	70
	Magnesium (%)		24	27	24	16	18
	Potassium (%)		0.90	0.65	0.48	1.1	0.74
	Sodium - ESP (%)		5.6	17	20	5.3	11
	Aluminium (%)		0.03	0.02	0.02	0.02	0.02
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.9	2.1	2.3	5.0	3.9
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 3/3 Dark Brown	10 YR 3/3 Dark Brown	10 YR 5/4 Yellowish Brown	7.5 YR 3/4 Dark Brown	7.5 YR 3/4 Dark Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 11/11/2020. Lab Job No.K0498
Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 66	Sample 67	Sample 68	Sample 69	Sample 70
		Sample ID:	B36	B36	B36	B38	B38
		Crop:	0.20-0.30	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/66	K0498/67	K0498/68	K0498/69	K0498/70

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium,
    122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

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10 Kings Road NEW LAMBTON NSW 2305

			Sample 71	Sample 72	Sample 73	Sample 74	Sample 75
		Sample ID:	B38	B38	B40	B40	B40
		Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/71	K0498/72	K0498/73	K0498/74	K0498/75
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	9.17	9.19	8.68	8.96	9.02
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.976	1.225	0.130	0.812	0.892
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	24	22	24	24	23
	Exchangeable Calcium (kg/ha)		10,908	9,923	10,637	10,926	10,272
	Exchangeable Calcium (mg/kg)		4,870	4,430	4,749	4,878	4,586
	Exchangeable Magnesium (cmol+/kg)		8.3	8.7	7.2	12	12
	Exchangeable Magnesium (kg/ha)		2,260	2,365	1,969	3,322	3,348
	Exchangeable Magnesium (mg/kg)		1,009	1,056	879	1,483	1,495
	Exchangeable Potassium (cmol+/kg)		0.28	0.24	0.60	0.36	0.34
	Exchangeable Potassium (kg/ha)		244	211	522	316	301
	Exchangeable Potassium (mg/kg)		109	94	233	141	134
	Exchangeable Sodium (cmol+/kg)		9.1	11	0.68	8.3	9.5
	Exchangeable Sodium (kg/ha)		4,674	5,919	348	4,284	4,893
	Exchangeable Sodium (mg/kg)		2,087	2,643	155	1,913	2,185
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		1.9	1.5	1.9	1.8	1.7
	Exchangeable Aluminium (mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	42	43	32	45	45
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	58	52	74	54	51
	Magnesium (%)		20	20	22	27	27
	Potassium (%)		0.66	0.57	1.9	0.80	0.76
	Sodium - ESP (%)		22	27	2.1	18	21
	Aluminium (%)		0.02	0.02	0.03	0.02	0.02
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.9	2.5	3.3	2.0	1.9
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 4/4 Dark Yellowish Brown	7.5 YR 3/4 Dark Brown	7.5 YR 3/2 Dark Brown	10 YR 4/2 Dark Grayish Brown	10 YR 3/2 Very Dark Grayish Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 11/11/2020. Lab Job No.K0498
Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

			Sample 71	Sample 72	Sample 73	Sample 74	Sample 75
		Sample ID:	B38	B38	B40	B40	B40
		Crop:	0.50-0.60	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/71	K0498/72	K0498/73	K0498/74	K0498/75

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
   Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
10. Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium,
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11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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Agricultural Co-Ordinator KS

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10 Kings Road NEW LAMBTON NSW 2305

			Sample 76	Sample 77	Sample 78	Sample 79	Sample 80
		Sample ID:	B40	B42	B42	B42	B42
		Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
		Client:	BMA	BMA	BMA	BMA	BMA
	Parameter	Method reference	K0498/76	K0498/77	K0498/78	K0498/79	K0498/80
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.58	8.93	9.23	9.38	9.45
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.197	0.077	0.178	0.921	1.124
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	14	21	17	23	17
	Exchangeable Calcium (kg/ha)		6,247	9,392	7,844	10,115	7,499
	Exchangeable Calcium (mg/kg)		2,789	4,193	3,502	4,516	3,348
	Exchangeable Magnesium (cmol+/kg)		12	8.2	6.6	9.2	9.6
	Exchangeable Magnesium (kg/ha)		3,286	2,243	1,793	2,513	2,609
	Exchangeable Magnesium (mg/kg)		1,467	1,001	801	1,122	1,165
	Exchangeable Potassium (cmol+/kg)		0.34	0.37	0.27	0.19	0.17
	Exchangeable Potassium (kg/ha)		299	324	237	165	150
	Exchangeable Potassium (mg/kg)		134	145	106	74	67
	Exchangeable Sodium (cmol+/kg)		11	2.6	2.5	9.7	11
	Exchangeable Sodium (kg/ha)		5,711	1,319	1,286	5,003	5,693
	Exchangeable Sodium (mg/kg)		2,550	589	574	2,234	2,542
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	<0.01	0.01	<0.01	<0.01	0.01
	Exchangeable Aluminium (kg/ha)		1.6	2.2	1.6	1.7	2.0
	Exchangeable Aluminium (mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	37	32	27	42	38
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	37	65	65	54	45
	Magnesium (%)		32	26	25	22	26
	Potassium (%)		0.91	1.2	1.0	0.45	0.46
	Sodium - ESP (%)		30	8.0	9.3	23	29
	Aluminium (%)		0.02	0.03	0.03	0.02	0.03
	Hydrogen (%)		0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.2	2.5	2.7	2.4	1.7
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 5/6 Strong Brown	7.5 YR 3/2 Dark Brown	10 YR 3/3 Dark Brown	10 YR 3/3 Dark Brown	10 YR 3/3 Dark Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

80 samples supplied by SLR Consulting Australia Pty Ltd on 11/11/2020. Lab Job No.K0498
Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

		Sample 76	Sample 77	Sample 78	Sample 79	Sample 80
	Sample ID:	B40	B42	B42	B42	B42
	Crop:	0.90-1.0	0.0-0.10	0.20-0.30	0.50-0.60	0.90-1.0
	Client:	BMA	BMA	BMA	BMA	BMA
Parameter	Method reference	K0498/76	K0498/77	K0498/78	K0498/79	K0498/80

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013,
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9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil res
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11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimat
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			Sample ID:	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
			Crop:				
			Client:	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
	Parameter		**Method reference**	**Indicative guidelines - refer to Notes 6 and 8**			
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	*6.5*	*6.5*	*6.3*	*6.3*
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	*0.200*	*0.150*	*0.120*	*0.100*
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	*15.6*	*10.8*	*5.0*	*1.9*
		(kg/ha)		*7000*	*4816*	*2240*	*840*
		(mg/kg)		*3125*	*2150*	*1000*	*375*
	Exchangeable Magnesium	**(cmol$_+$/kg)**		*2.4*	*1.7*	*1.2*	*0.60*
		(kg/ha)		*650*	*448*	*325*	*168*
		(mg/kg)		*290*	*200*	*145*	*75*
	Exchangeable Potassium	**(cmol$_+$/kg)**		*0.60*	*0.50*	*0.40*	*0.30*
		(kg/ha)		*526*	*426*	*336*	*224*
		(mg/kg)		*235*	*190*	*150*	*100*
	Exchangeable Sodium	**(cmol$_+$/kg)**		*0.3*	*0.26*	*0.22*	*0.11*
		(kg/ha)		*155*	*134*	*113*	*57*
		(mg/kg)		*69*	*60*	*51*	*25*
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		*121*	*101*	*73*	*30*
		(mg/kg)		*54*	*45*	*32*	*14*
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		*13*	*11*	*8*	*3*
		(mg/kg)		*6*	*5*	*4*	*2*
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	*20.1*	*14.3*	*7.8*	*3.3*
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	*77.6*	*75.7*	*65.6*	*57.4*
	Magnesium (%)			*11.9*	*11.9*	*15.7*	*18.1*
	Potassium (%)			*3.0*	*3.5*	*5.2*	*9.1*
	Sodium - ESP (%)			*1.5*	*1.8*	*2.9*	*3.3*
	Aluminium (%)			*6.0*	*7.1*	*10.5*	*12.1*
	Hydrogen (%)						
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	*6.5*	*6.4*	*4.2*	*3.2*
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification			..	
	Mottles Munsell Colour					..	
	Degree of Mottling (%)					..	

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AGRICULTURAL SOIL ANALYSIS RE-ISSUED REPORT

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Analysis requested by Murray Fraser. Your Job: SLR 620.13452.20000 Blackwater
10 Kings Road NEW LAMBTON NSW 2305

	Sample ID:	***Heavy Soil***	***Medium Soil***	***Light Soil***	***Sandy Soil***
	Crop:				
	Client:	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
	Parameter	**Method reference**	**Indicative guidelines - refer to Notes 6 and 8**		
Notes:					

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11. Conversions to kg/ha = mg/kg x 2.24
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Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

80 soil samples supplied by SLR Consulting Australia pty Ltd on 11 November, 2020 - Lab Job No. K0498
Analysis requested by Murray Fraser
10 Kings Road NEW LAMBTON NSW 2305

SAMPLE ID	DEPTH INTERVAL (m)	Lab Code	EMERSON AGGREGATE CLASS	WET MUNSELL COLOUR		MOISTURE CONTENT (% of water in air-dry sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	GRAVEL > 4.75 mm (% of total oven-dry equivalent)	GRAVEL 2.00-4.75 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
B01	**0.0-0.10**	K0498/1	3	5 YR 3/4	Dark Reddish Brown	3.4%	0.3%	0.0%	0.3%	15.3%	46.0%	10.6%	28.0%	100.0%
B01	**0.20-0.30**	K0498/2	3	5 YR 3/4	Dark Reddish Brown	9.0%	0.2%	0.0%	0.2%	14.6%	33.8%	15.2%	36.1%	100.0%
B01	**0.50-0.60**	K0498/3	2	7.5 YR 3/4	Dark Brown	11.6%	3.5%	0.0%	3.5%	12.5%	19.3%	25.8%	38.9%	100.0%
B01	**0.90-1.0**	K0498/4	2	5 YR 3/4	Dark Reddish Brown	11.1%	45.1%	39.9%	5.3%	9.6%	12.1%	7.4%	25.7%	100.0%
B05	**0.0-0.10**	K0498/5	4	7.5 YR 2.5/2	Very Dark Brown	7.7%	0.8%	0.0%	0.8%	9.0%	24.7%	19.1%	46.3%	100.0%
B05	**0.20-0.30**	K0498/6	4	10 YR 2/1	Black	11.5%	0.1%	0.0%	0.1%	7.2%	15.5%	12.6%	64.5%	100.0%
B05	**0.50-0.60**	K0498/7	4	5 YR 2.5/1	Black	12.7%	1.3%	0.0%	1.3%	5.3%	10.4%	15.1%	67.9%	100.0%
B05	**0.90-1.0**	K0498/8	4	7.5 YR 3/4	Dark Brown	8.2%	8.3%	1.2%	7.1%	13.2%	23.4%	17.3%	37.8%	100.0%
B07	**0.0-0.10**	K0498/9	4	5 YR 3/3	Dark Reddish Brown	5.1%	1.7%	0.2%	1.5%	25.5%	27.4%	8.5%	37.0%	100.0%
B07	**0.20-0.30**	K0498/10	3	10 YR 3/3	Dark Brown	7.2%	0.7%	0.0%	0.7%	26.7%	11.4%	5.8%	55.4%	100.0%
B07	**0.50-0.60**	K0498/11	3	7.5 YR 3/4	Dark Brown	7.5%	2.1%	0.8%	1.3%	22.4%	20.0%	11.3%	44.2%	100.0%
B07	**0.90-1.0**	K0498/12	2	7.5 YR 4/6	Strong Brown	8.4%	0.2%	0.0%	0.2%	18.4%	23.1%	10.3%	48.0%	100.0%
B09	**0.0-0.10**	K0498/13	4	5 YR 2.5/2	Dark Reddish Brown	8.0%	1.2%	0.0%	1.2%	4.6%	14.4%	71.5%	8.2%	100.0%
B09	**0.20-0.30**	K0498/14	3	7.5 YR 3/2	Dark Brown	11.5%	2.0%	0.9%	1.1%	3.8%	9.9%	18.2%	66.0%	100.0%
B09	**0.50-0.60**	K0498/15	2	7.5 YR 3/1	Very Dark Gray	12.5%	5.0%	0.8%	4.2%	3.4%	6.6%	16.8%	68.2%	100.0%
B09	**0.90-1.0**	K0498/16	3	7.5 YR 3/1	Very Dark Gray	13.0%	7.0%	2.4%	4.7%	2.8%	6.9%	17.4%	65.9%	100.0%
B10	**0.0-0.10**	K0498/17	3	7.5 YR 3/3	Dark Brown	6.8%	0.0%	0.0%	0.0%	2.4%	27.9%	18.0%	51.7%	100.0%
B10	**0.20-0.30**	K0498/18	3	5 YR 3/3	Dark Reddish Brown	8.7%	0.0%	0.0%	0.0%	1.6%	15.5%	19.0%	64.0%	100.0%
B10	**0.50-0.60**	K0498/19	3	7.5 YR 3/4	Dark Brown	11.6%	0.0%	0.0%	0.0%	2.0%	15.5%	16.7%	65.7%	100.0%
B10	**0.90-1.0**	K0498/20	2	7.5 YR 3/4	Dark Brown	10.7%	0.0%	0.0%	0.0%	2.8%	25.6%	29.0%	42.6%	100.0%
B12	**0.0-0.10**	K0498/21	3	7.5 YR 2.5/3	Very Dark Brown	2.2%	0.0%	0.0%	0.0%	18.8%	50.8%	12.1%	18.3%	100.0%
B12	**0.20-0.30**	K0498/22	3	7.5 YR 2.5/2	Very Dark Brown	4.9%	0.1%	0.0%	0.1%	12.5%	48.1%	6.0%	33.2%	100.0%
B12	**0.50-0.60**	K0498/23	3	7.5 YR 3/4	Dark Brown	6.1%	0.0%	0.0%	0.0%	9.7%	44.4%	9.7%	36.2%	100.0%
B12	**0.90-1.0**	K0498/24	2	7.5 YR 3/4	Dark Brown	6.9%	0.3%	0.0%	0.3%	11.6%	41.2%	11.4%	35.6%	100.0%
B17	**0.0-0.10**	K0498/25	2	10 YR 3/3	Dark Brown	5.1%	0.6%	0.0%	0.6%	2.9%	22.8%	22.2%	51.5%	100.0%
B17	**0.20-0.30**	K0498/26	2	5 YR 2.5/1	Black	8.8%	0.0%	0.0%	0.0%	2.1%	18.5%	20.0%	59.4%	100.0%
B17	**0.50-0.60**	K0498/27	2	7.5 YR 2.5/2	Very Dark Brown	10.8%	0.0%	0.0%	0.0%	3.2%	24.6%	18.7%	53.4%	100.0%
B17	**0.90-1.0**	K0498/28	2	7.5 YR 3/4	Dark Brown	12.7%	0.3%	0.0%	0.3%	1.9%	15.9%	25.1%	56.9%	100.0%
B20	**0.0-0.10**	K0498/29	3	7.5 YR 2.5/2	Very Dark Brown	2.9%	2.4%	1.3%	1.1%	33.0%	41.9%	6.4%	16.2%	100.0%
B20	**0.20-0.30**	K0498/30	2	5 YR 3/4	Dark Reddish Brown	6.8%	2.0%	0.0%	2.0%	26.8%	26.6%	6.8%	37.8%	100.0%
B20	**0.50-0.60**	K0498/31	4	5 YR 4/6	Yellowish Red	5.5%	1.6%	0.0%	1.6%	29.6%	35.3%	2.5%	30.9%	100.0%
B20	**0.90-1.0**	K0498/32	2	7.5 YR 4/6	Strong Brown	4.8%	31.0%	25.1%	5.9%	19.5%	23.7%	4.6%	21.1%	100.0%
B21	**0.0-0.10**	K0498/33	3	7.5 YR 3/4	Dark Brown	7.4%	2.7%	0.0%	2.7%	56.0%	29.0%	3.4%	8.9%	100.0%
B21	**0.20-0.30**	K0498/34	2	7.5 YR 4/4	Brown	7.3%	2.1%	0.0%	2.1%	35.5%	20.9%	2.0%	39.6%	100.0%
B21	**0.50-0.60**	K0498/35	2	7.5 YR 3/3 with 40% 7.5 YR 5/6	Dark Brown with 40% Strong Brown	6.3%	1.9%	0.0%	1.9%	36.6%	21.3%	3.4%	36.7%	100.0%
B21	**0.90-1.0**	K0498/36	2	7.5 YR 4/4	Brown	5.7%	5.8%	1.4%	4.4%	29.2%	19.0%	11.3%	34.7%	100.0%
B23	**0.0-0.10**	K0498/37	4	7.5 YR 3/2	Dark Brown	10.6%	19.1%	12.7%	6.4%	8.1%	18.9%	12.3%	41.6%	100.0%
B23	**0.20-0.30**	K0498/38	3	7.5 YR 3/1	Very Dark Gray	11.1%	2.4%	0.0%	2.4%	6.6%	18.8%	13.8%	58.4%	100.0%
B23	**0.50-0.60**	K0498/39	3	10 YR 4/3	Brown	12.5%	6.6%	0.5%	6.0%	8.8%	18.2%	10.7%	55.7%	100.0%
B23	**0.90-1.0**	K0498/40	3	10 YR 3/3	Dark Brown	12.3%	10.8%	0.0%	10.8%	8.6%	12.9%	10.4%	57.3%	100.0%

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Graham Lancaster (Nata signatory)
Laboratory Manager

SAMPLE ID	DEPTH INTERVAL (m)	Lab Code	EMERSON AGGREGATE CLASS	WET MUNSELL COLOUR		MOISTURE CONTENT (% of water in air-dry sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	GRAVEL > 4.75 mm (% of total oven-dry equivalent)	GRAVEL 2.00-4.75 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
B25	**0.0-0.10**	K0498/41	3	7.5 YR 3/3	Dark Brown	5.9%	0.0%	0.0%	0.0%	2.4%	27.8%	12.9%	56.9%	100.0%
B25	**0.20-0.30**	K0498/42	4	7.5 YR 3/3	Dark Brown	10.6%	0.0%	0.0%	0.0%	2.2%	23.1%	15.8%	58.9%	100.0%
B25	**0.50-0.60**	K0498/43	4	10 YR 4/2	Dark Grayish Brown	10.8%	2.8%	0.8%	1.9%	3.7%	23.9%	18.1%	51.6%	100.0%
B25	**0.90-1.0**	K0498/44	4	5 YR 3/3	Dark Reddish Brown	6.9%	4.6%	0.8%	3.8%	21.2%	28.0%	21.3%	24.9%	100.0%
B28	**0.0-0.10**	K0498/45	3	5 YR 3/3	Dark Reddish Brown	3.1%	0.0%	0.0%	0.0%	33.2%	32.8%	11.9%	22.0%	100.0%
B28	**0.20-0.30**	K0498/46	2	5 YR 3/3	Dark Reddish Brown	7.2%	0.2%	0.0%	0.2%	26.4%	20.6%	11.1%	41.7%	100.0%
B28	**0.50-0.60**	K0498/47	2	5 YR 3/4	Dark Reddish Brown	7.0%	0.4%	0.0%	0.4%	31.2%	24.4%	8.9%	35.1%	100.0%
B28	**0.90-1.0**	K0498/48	2	7.5 YR 4/4	Brown	5.6%	0.5%	0.0%	0.5%	37.3%	22.7%	10.9%	28.7%	100.0%
B29	**0.0-0.10**	K0498/49	4	7.5 YR 2.5/2	Very Dark Brown	9.3%	0.0%	0.0%	0.0%	6.5%	29.1%	14.2%	50.2%	100.0%
B29	**0.20-0.30**	K0498/50	3	10 YR 3/2	Very Dark Grayish Brown	11.8%	0.5%	0.0%	0.5%	4.9%	18.6%	15.2%	60.8%	100.0%
B29	**0.50-0.60**	K0498/51	2	5 YR 3/2	Dark Reddish Brown	12.6%	1.4%	0.0%	1.4%	4.9%	18.4%	16.3%	59.0%	100.0%
B29	**0.90-1.0**	K0498/52	2	5 YR 4/4 with 10% 5 YR 3/1	Reddish Brown with 10% Very Dark Gray	14.3%	0.0%	0.0%	0.0%	2.0%	16.6%	16.6%	64.8%	100.0%
B31	**0.0-0.10**	K0498/53	4	7.5 YR 3/3	Dark Brown	7.2%	0.0%	0.0%	0.0%	4.4%	32.1%	16.1%	47.4%	100.0%
B31	**0.20-0.30**	K0498/54	3	7.5 YR 4/3	Brown	11.0%	0.5%	0.0%	0.5%	3.7%	21.7%	15.5%	58.6%	100.0%
B31	**0.50-0.60**	K0498/55	2	5 YR 3/3	Dark Reddish Brown	11.2%	2.4%	0.0%	2.4%	4.3%	18.0%	17.6%	57.7%	100.0%
B31	**0.90-1.0**	K0498/56	2	7.5 YR 4/4 with 2% 10 YR 4/1	Brown with 2% Dark Gray	12.7%	0.1%	0.0%	0.1%	4.2%	20.4%	22.4%	53.0%	100.0%
B32	**0.0-0.10**	K0498/57	2	5 YR 3/3	Dark Reddish Brown	3.7%	0.1%	0.0%	0.1%	3.4%	38.5%	16.9%	41.1%	100.0%
B32	**0.20-0.30**	K0498/58	3	5 YR 4/4	Reddish Brown	8.0%	0.0%	0.0%	0.0%	4.0%	36.2%	15.4%	44.5%	100.0%
B32	**0.50-0.60**	K0498/59	3	7.5 YR 4/6	Strong Brown	10.7%	0.8%	0.0%	0.8%	5.5%	23.2%	16.0%	54.4%	100.0%
B32	**0.90-1.0**	K0498/60	3	5 YR 5/4 with 20% 5 YR 6/8	Reddish Brown with 20% Reddish Yellow	8.9%	1.5%	0.0%	1.5%	5.1%	37.5%	14.5%	41.3%	100.0%
B34	**0.0-0.10**	K0498/61	3	10 YR 3/2	Very Dark Grayish Brown	12.2%	0.2%	0.0%	0.2%	6.0%	14.2%	14.2%	65.3%	100.0%
B34	**0.20-0.30**	K0498/62	3	7.5 YR 3/1	Very Dark Gray	13.5%	0.3%	0.0%	0.3%	4.9%	12.2%	13.4%	69.2%	100.0%
B34	**0.50-0.60**	K0498/63	3	7.5 YR 2.5/2	Very Dark Brown	13.5%	0.9%	0.0%	0.9%	6.7%	9.6%	14.8%	68.0%	100.0%
B34	**0.90-1.0**	K0498/64	3	5 YR 3/2 with 40% 7.5 YR 4/6	Dark Reddish Brown with 40% Strong Brown	15.2%	0.9%	0.0%	0.9%	4.6%	10.0%	15.5%	69.0%	100.0%
B36	**0.0-0.10**	K0498/65	3	7.5 YR 3/4	Dark Brown	5.8%	0.0%	0.0%	0.0%	4.2%	50.2%	14.7%	30.8%	100.0%
B36	**0.20-0.30**	K0498/66	3	10 YR 3/3	Dark Brown	10.9%	0.1%	0.0%	0.1%	4.4%	31.4%	8.9%	55.1%	100.0%
B36	**0.50-0.60**	K0498/67	2	10 YR 3/3	Dark Brown	13.7%	1.5%	0.0%	1.5%	5.7%	23.3%	8.0%	61.6%	100.0%
B36	**0.90-1.0**	K0498/68	2	10 YR 5/4	Yellowish Brown	9.7%	2.1%	0.0%	2.1%	8.2%	31.4%	17.1%	41.2%	100.0%
B38	**0.0-0.10**	K0498/69	2	7.5 YR 3/4	Dark Brown	8.1%	0.3%	0.0%	0.3%	4.0%	32.0%	14.9%	48.8%	100.0%
B38	**0.20-0.30**	K0498/70	2	7.5 YR 3/4	Dark Brown	11.3%	0.7%	0.0%	0.7%	4.6%	25.6%	12.7%	56.5%	100.0%
B38	**0.50-0.60**	K0498/71	3	10 YR 4/4	Dark Yellowish Brown	10.8%	1.7%	0.0%	1.7%	8.4%	25.3%	13.8%	50.8%	100.0%
B38	**0.90-1.0**	K0498/72	2	7.5 YR 3/4	Dark Brown	10.0%	0.8%	0.0%	0.8%	5.5%	31.8%	22.6%	39.2%	100.0%
B40	**0.0-0.10**	K0498/73	3	7.5 YR 3/2	Dark Brown	10.9%	0.8%	0.0%	0.8%	5.4%	16.9%	14.1%	62.8%	100.0%
B40	**0.20-0.30**	K0498/74	3	10 YR 4/2	Dark Grayish Brown	13.1%	2.3%	0.0%	2.3%	8.3%	43.7%	33.6%	12.1%	100.0%
B40	**0.50-0.60**	K0498/75	2	10 YR 3/2	Very Dark Grayish Brown	13.9%	5.3%	0.0%	5.3%	5.2%	4.9%	12.4%	72.2%	100.0%
B40	**0.90-1.0**	K0498/76	2	7.5 YR 5/6	Strong Brown	15.2%	0.2%	0.0%	0.2%	3.4%	11.5%	15.7%	69.0%	100.0%
B42	**0.0-0.10**	K0498/77	2	7.5 YR 3/2	Dark Brown	7.8%	0.0%	0.0%	0.0%	6.8%	31.7%	12.6%	48.9%	100.0%
B42	**0.20-0.30**	K0498/78	2	10 YR 3/3	Dark Brown	8.5%	5.7%	3.7%	2.1%	11.2%	22.7%	15.7%	44.7%	100.0%
B42	**0.50-0.60**	K0498/79	2	10 YR 3/3	Dark Brown	8.4%	4.4%	3.8%	0.6%	6.6%	25.6%	18.4%	45.0%	100.0%
B42	**0.90-1.0**	K0498/80	2	10 YR 3/3	Dark Brown	9.9%	0.0%	0.0%	0.0%	2.5%	27.8%	29.0%	40.8%	100.0%

Note:

1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986),
in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.

2: Australian Standard 1289.3.8.1-1997 (see attached)

3. Analysis conducted between sample arrival date and reporting date.

4. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).

5. Results relate to the samples tested.

6. This report was issued on 03/12/2020.

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Graham Lancaster (Nata signatory)
Laboratory Manager

Appendix B Detailed Profile Descriptions

Land Resources Assessment Report

BM Alliance Coal Operations

SLR Project No.: 620.014601.00001

7 December 2023

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 1 Summary: Self-Mulching Black Vertosol (Site B02)

Overview	
Landscape Site B02	
ASC Name	Self Mulching Black Vertosol
Representative Site	B02
Other Mapped Sites	B03-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Linear Gilgai
Vegetation	Brigalow, Carrisa
Slope (%)	1-3%
Aspect	Nil

Table 2 Profile: Self-Mulching Black Vertosol (Site B02)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.30	Very dark greyish brown (10YR 3/2) light clay, strong structure of 90 mm subangular blocky peds with a rough fabric and very firm consistence. 20%, <5mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.60	Dark brown (10YR 3/3) light-medium clay, strong structure of 140mm subangular blocky peds with a rough fabric and firm consistence. 25% pale faint mottling; 10%, <5mm metamorphic stone content; 5% ferromanganiferous concretions <5mm and 5% calcareous soft segregations <5mm, <2% highly calcareous soft segregations; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.60	Yellowish-red (5YR 4/6) light clay, strong structure of 160mm subangular blocky peds with a rough fabric and firm consistence. 25% pale distinct mottling; 10%, <5mm metamorphic stone content; 10% ferromanganiferous concretions <2mm and 30% very highly calcareous soft segregations 10mm; coarse roots common. Sampled 0.90 – 1.0m.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 3 Summary: Self-Mulching Black Vertosol (Site B03)

Overview	
Landscape Site B03	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B03
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow, Bauhinia
Slope (%)	<1%
Aspect	Nil

Table 4 Profile: Self-Mulching Black Vertosol (Site B03)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Dusky red (2.5YR 3/2) light-medium clay, strong structure of 70 mm subangular blocky peds with a rough fabric and firm consistence. 10%, 10mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.30	Black (2.5Y 2.5/1) light clay, strong structure of 200+mm subangular blocky peds with a rough fabric and very firm consistence. 10% pale faint mottling; 20%, 20mm metamorphic stone content; 10% calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 0.30 – 0.40	Olive brown (2.5Y 4/3) light clay, strong structure of <5mm subangular blocky peds with a rough fabric and very firm consistence. 50%, 40mm metamorphic stone content; coarse roots common; gradual and wavy boundary. Sampled 0.30 – 0.40m.
	BC +0.40	Weathered parent material. Not sampled.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 5 Summary: Self-Mulching Black Vertosol (Site B04)

Overview	
Landscape Site B04	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B04
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Linear Gilgai
Vegetation	Brigalow
Slope (%)	2%
Aspect	Nil

Table 6 Profile: Self-Mulching Black Vertosol (Site B04)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Very dark greyish brown (2.5Y 3/2) light clay, strong structure of 50mm subangular blocky peds with a rough fabric and very firm consistence. Abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.40	Very dark grey (2.5Y 3/1) light-medium clay, strong structure of 120mm subangular blocky peds with a rough fabric and very firm consistence. Many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 0.40 – 1.00	Black (2.5Y 2.5/1) light clay, strong structure of 140mm subangular blocky peds with a rough fabric and firm consistence. 30% olive faint mottling; 10%, <2mm metamorphic stone content; 20% slightly calcareous soft segregations <5mm; coarse roots common; gradual and wavy boundary. Sampled 0.50 – 0.60m & 0.90 – 1.00m.
	B23 +1.00	Weathered parent material. Not sampled.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Self-Mulching Red Vertosol

Table 7 Summary: Self-Mulching Red Vertosol (Site B06)

Overview	
Landscape Site B06	
ASC Name	Self-Mulching Red Vertosol
Representative Site	B06
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	2%
Aspect	West

Table 8 Profile: Self-Mulching Red Vertosol (Site B06)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Very dark brown (7.5YR 2.5/2) clay loam, moderate structure of 100mm subangular blocky peds with a rough fabric and firm consistence. 10%, 60mm stone content; <10% ferromanganiferous concretions <5mm; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.50	Yellowish-red (5YR 4/6) light-medium clay, strong structure of 140mm subangular blocky peds with a rough fabric and very firm consistence. 20% orange faint mottling; 10%, 20mm metamorphic stone content; <5% ferromanganiferous concretions <5mm and <2% slight to moderately calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 +0.50	Yellowish-red (5YR 4/6) light-medium clay, strong structure of 100mm subangular blocky peds with a rough fabric and very firm consistence. 20% pale faint mottling; 5%, 20mm metamorphic stone content; <2% ferromanganiferous concretions 40mm and <2% moderately calcareous soft segregations <10mm; coarse roots common. Sampled 0.50 – 0.60m & 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Self-Mulching Grey Vertosol

Table 9 Summary: Self-Mulching Grey Vertosol (Site B08)

Overview

Landscape Site B08

ASC Name	Self-Mulching Grey Vertosol
Representative Site	B08
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Normal Gilgai
Vegetation	Lime Bauhinia
Slope (%)	1%
Aspect	North West

Table 10 Profile: Self-Mulching Grey Vertosol (Site B08)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Dark brown (10YR 3/3) light clay, strong structure of 80 mm subangular blocky peds with a rough fabric and weak consistence. <5%, 30mm metamorphic stone content; <5% ferromanganiferous concretions <2mm; abundant fine roots; imperfectly drained; clear and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.60	Pale brown (10YR 6/3) light-medium clay, strong structure of 80mm subangular blocky peds with a rough fabric and strong consistence. 10% pale faint mottling; <2%, 30mm metamorphic stone content; <5% ferromanganiferous concretions <2mm and 10% very highly calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.60	Yellowish-brown (10YR 5/8) light-medium clay, strong structure of 90mm subangular blocky peds with a rough fabric and very firm consistence. 20% pale distinct mottling; stone content; <2% ferromanganiferous concretions <2mm and <5% very highly calcareous soft segregations <2mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 11 Summary: Self-Mulching Black Vertosol (Site B09)

Overview	
Landscape Site B09	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B09
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Linear Gilgai
Vegetation	Brigalow, Bauhinia
Slope (%)	<1%
Aspect	Nil

Table 12 Profile: Self-Mulching Black Vertosol (Site B09)

Profile	Horizon / Depth (m)	Description
	A1 0.0 0– 0.30	Dark reddish-brown (5YR 2.5/2) silty clay, strong structure of 120mm subangular blocky peds with a rough fabric and very firm consistence. 5%, 60mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.80	Very dark grey (7.5YR 3/1) heavy clay, strong structure of 170mm subangular blocky peds with a rough fabric and firm consistence. 10% pale faint mottling; 10% slightly calcareous soft segregations tubules <5mm, slight calcareous effervescence; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.80	Very dark grey (7.5YR 3/1) heavy clay, strong structure of 150mm subangular blocky peds with a rough fabric and firm consistence. 40% orange distinct mottling; 30% moderately calcareous soft segregations 10mm, moderate calcareous effervescence; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Self-Mulching Red Vertosol

Table 13 Summary: Self-Mulching Red Vertosol (Site B10)

Overview	
Landscape Site B10	
ASC Name	Self-Mulching Red Vertosol
Representative Site	B10
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Linear Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 14 Profile: Self-Mulching Red Vertosol (Site B10)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/3) heavy clay, strong structure of 100mm subangular blocky peds with a rough fabric and firm consistence. <2% ferromanganiferous concretions <2mm; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.50	Dark reddish-brown (5YR 3/3) heavy clay, strong structure of 140mm subangular blocky peds with a rough fabric and firm consistence. 25% pale faint mottling; <2%, <2mm metamorphic stone content; <2% highly calcareous soft segregations 5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 +0.50	Dark brown (7.5YR 3/4) heavy clay, strong structure of 160mm subangular blocky peds with a rough fabric and firm consistence. 25% yellow distinct and 25% red distinct mottling; 30%, 10mm metamorphic stone content; <2% ferromanganiferous concretions 2mm; coarse roots common. Sampled 0.50 – 0.60 & 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 15 Summary: Self-Mulching Black Vertosol (Site B11)

Overview	
Landscape Site B11	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B11
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Linear Gilgai
Vegetation	Wilga
Slope (%)	<1%
Aspect	Nil

Table 16 Profile: Self-Mulching Black Vertosol (Site B11)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.15	Very dark brown (10YR 2/2) light-medium clay, strong structure of 100mm subangular blocky peds with a rough fabric and firm consistence. Abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.15 – 0.50	Very dark greyish brown (2.5Y 3/2) light clay, strong structure of 140mm subangular blocky, lenticular peds with a rough fabric and very firm consistence. 20%, <5mm metamorphic stone content; 20% ferromanganiferous concretions <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 0.50 – 0.85	Very dark greyish brown (2.5Y 3/2) light clay, strong structure of 150mm subangular blocky peds with a rough fabric and very firm consistence. 30% pale faint mottling; 30%, 50mm metamorphic stone content; 40% moderately calcareous soft segregations 10mm; coarse roots common; clear and wavy boundary. Sampled 0.50 – 0.60m.
	+0.85	Weathered parent material. Not sampled.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 17 Summary: Self-Mulching Black Vertosol (Site B13)

Overview	
Landscape Site B13	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B13
Other Mapped Sites	B02-B11, B14-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Poplar Box, SL Ironbark, Bauhinia, Brigalow
Slope (%)	<1%
Aspect	Nil

Table 18 Profile: Self-Mulching Black Vertosol (Site B13)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Very dark brown (10YR 2/2) light clay, strong structure of 90mm subangular blocky peds with a rough fabric and very firm consistence. Abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.70	Very dark greyish brown (10YR 3/2) light-medium clay, strong structure of 140mm subangular blocky peds with a rough fabric and strong consistence. 20% pale faint mottling; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.70	Very dark greyish brown (10YR 3/2) light clay, strong structure of 110mm subangular blocky, lenticular peds with a rough fabric and firm consistence. 20% pale faint mottling; 20% highly calcareous soft segregations <5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Epipedal Black Vertosol

Table 19 Summary: Epipedal Black Vertosol (Site B14)

Overview	
Landscape Site B14	
ASC Name	Epipedal Black Vertosol
Representative Site	B14
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow, Carissa
Slope (%)	1%
Aspect	Nil

Table 20 Profile: Epipedal Black Vertosol (Site B14)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Very dark brown (10YR 2/2) clay loam, sandy, moderate structure of 120mm subangular blocky peds with a rough fabric and very firm consistence. Abundant fine roots; imperfectly drained; clear and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.50	Very dark brown (7.5YR 2.5/2) light clay, strong structure of 200+mm subangular blocky peds with a rough fabric and very firm consistence. <5% pale faint mottling; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 +0.50	Dark brown (7.5YR 3/4) light clay, strong structure of 140mm subangular blocky peds with a rough fabric and firm consistence. 20% pale faint mottling; 2%, 20mm metamorphic stone content; 30% very highly calcareous soft segregations 10mm; coarse roots common. Sampled 0.50 – 0.60m & 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 21 Summary: Self-Mulching Black Vertosol (Site B15)

Overview	
Landscape Site B15	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B15
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow, Carissa
Slope (%)	2%
Aspect	Nil

Table 22 Profile: Self-Mulching Black Vertosol (Site B15)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Black (10YR 2/1) clay loam, moderate structure of 60mm subangular blocky peds with a rough fabric and very firm consistence. 20%, 10mm gravel content; 10% ferromanganiferous concretions <5mm; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.60	Very dark greyish brown (2.5Y 3/2) light clay, strong structure of 200+mm subangular blocky peds with a rough fabric and very firm consistence. 20%, 10mm gravel content; 5% ferromanganiferous concretions <5mm and 20% very highly calcareous <5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 0.60 – 0.90	Olive brown (2.5Y 4/3) light-medium clay, moderate structure of 200+mm subangular blocky peds with a rough fabric and very firm consistence. 10% dark faint mottling; 20%, 10mm gravel content; 5% ferromanganiferous concretions < 5mm and 20% very highly calcareous soft segregations <5mm; coarse roots common; gradual and wavy boundary. Sampled 0.90 – 1.00m.
	BC +0.90	Weathered parent material. Not sampled.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 23 Summary: Self-Mulching Black Vertosol (Site B16)

Overview	
Landscape Site B16	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B16
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 24 Profile: Self-Mulching Black Vertosol (Site B16)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Very dark greyish brown (10YR 3/2) light clay, strong structure of 80mm subangular blocky peds with a rough fabric and very firm consistence. <5%, <5mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.40	Black (10YR 2/1) light clay, strong structure of 170mm subangular blocky peds with a rough fabric and very firm consistence. 10% pale faint mottling; 10% slightly calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 +0.40	Yellowish-red (5YR 5/8) light-medium clay, strong structure of 200+mm subangular blocky peds with a rough fabric and very firm consistence. 30% dark faint mottling; 10%, 200mm metamorphic stone content; 10% highly calcareous soft segregation <5mm; coarse roots common. Sampled 0.50 – 0.60m & 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 25 Summary: Self-Mulching Black Vertosol (Site B17)

Overview	
Landscape Site B17	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B17
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 26 Profile: Self-Mulching Black Vertosol (Site B17)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Dark brown (10YR 3/3) heavy clay, strong structure of 100mm subangular blocky peds with a rough fabric and very firm consistence. 2%, <5mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.40	Black (5YR 2.5/1) heavy clay, strong structure of 110mm subangular blocky peds with a rough fabric and very firm consistence. 25% pale distinct mottling; 2%; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 +0.40	Very dark brown (7.5YR 2.5/2) heavy clay, strong structure of 120mm subangular blocky peds with a rough fabric and firm consistence. 30% dark distinct and 15% orange distinct mottling; <2%, <2mm metamorphic stone content; 2% moderately calcareous soft segregations 5mm; coarse roots common. Sampled 0.50 – 0.60m & 0.90– 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Brown Vertosol

Table 27 Summary: Self-Mulching Brown Vertosol (Site B18)

Overview	
Landscape Site B18	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	B18
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	1%
Aspect	Nil

Table 28 Profile: Self-Mulching Brown Vertosol (Site B18)

Profile	Horizon / Depth (m)	Description
		Very dark greyish brown (10YR 3/2) light clay, strong structure of 90mm subangular blocky peds with a rough fabric and very firm consistence. Abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	0.40	Brown (10YR 4/3) light clay, strong structure of 100mm subangular blocky peds with a rough fabric and very firm consistence. <2%, <2mm metamorphic stone content; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	0.70	Dark brown (10YR 3/3) light clay, strong structure of 100mm subangular blocky peds with a rough fabric and firm consistence. 40% pale faint mottling; <8%, <2mm metamorphic stone content; 30% slightly calcareous soft segregations 5mm; coarse roots common; gradual and wavy boundary. Sampled 0.50 – 0.60m.
		Reddish-brown (5YR 4/4) light clay, strong structure of 120mm subangular blocky peds with a rough fabric and firm consistence. 40% dark faint mottling; <2%, <2mm metamorphic stone content; 5% ferromanganiferous concretions <2mm and 10% highly calcareous soft segregations 5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 29 Summary: Self-Mulching Black Vertosol (Site B19)

Overview	
Landscape Site B19	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B19
Other Mapped Sites	B02-B11, B13-B18, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	1.5%
Aspect	Nil

Table 30 Profile: Self-Mulching Black Vertosol (Site B19)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Very dark greyish brown (10YR 3/2) silty clay, strong structure of 70mm subangular blocky peds with a rough fabric and very firm consistence. 5%, 30mm metamorphic stone content; 30% ferromanganiferous concretions 5mm; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.60	Very dark greyish brown (10YR 3/2) light clay, strong structure of 150mm subangular blocky peds with a rough fabric and very firm consistence. 15% pale faint mottling; 10%, 40mm metamorphic stone content; 2% ferromanganiferous concretions <2mm and 20% highly calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.60	Very dark greyish brown (10YR 3/2) light medium clay, strong structure of 200+mm subangular blocky peds with a rough fabric and firm consistence. 50% brown distinct mottling; 10% slightly calcareous soft segregations 10mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 3: Eutrophic Black-Brown Dermosol

Sub-Dominant Soil Type: Eutrophic Red Chromosol

Table 31 Summary: Eutrophic Red Chromosol (Site B20)

Overview	
Landscape Site B20	
ASC Name	Eutrophic Red Chromosol
Representative Site	B20
Other Mapped Sites	B12
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain/Residual Rise
Dominant Land Use	Pasture
Microrelief	Nil
Vegetation	Brigalow, Carissa, Bauhinia
Slope (%)	3%
Aspect	South

Table 32 Profile: Eutrophic Red Chromosol (Site B20)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Very dark brown (7.5YR 2.5/2) sandy loam, strong structure of 130mm subangular blocky peds with a rough fabric and weak consistence. Abundant fine roots; imperfectly drained; clear and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.60	Dark reddish-brown (5YR 3/4) light clay, strong structure of 130mm subangular blocky peds with a rough fabric and strong consistence. 50% orange faint mottling; <5%, <2mm metamorphic stone content; <1% ferromanganiferous concretions <2mm, <5% slightly calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30 & 0.50 – 0.60m.
	B22 +0.60	Strong brown (7.5YR 4/6) clay loam, strong structure of 130m subangular blocky peds with a rough fabric and strong consistence. 20% dark and 20% pale distinct mottling; 10%, 30mm metamorphic stone content; 2% ferromanganiferous concretions <5mm and 50% calcareous soft segregations <20mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Subnatric Brown Sodosol

Table 33 Summary: Subnatric Brown Sodosol (Site B21)

Overview	
Landscape Site B21	
ASC Name	Subnatric Brown Sodosol
Representative Site	B21
Other Mapped Sites	B02-B11, B13-B19, B22-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Nil
Vegetation	Bauhinia, Carissa, Brigalow
Slope (%)	<1%
Aspect	Nil

Table 34 Profile: Subnatric Brown Sodosol (Site B21)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Dark brown (7.5YR 3/4) sandy loam, weak structure of 50mm subangular blocky peds with a rough fabric and weak consistence. Abundant fine roots; imperfectly drained; clear and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.30	Brown (7.5YR 4/4) sandy clay, weak structure of 110mm subangular blocky peds with a rough fabric and weak consistence. Many fine roots; gradual and wavy boundary.
	B22 0.30 – 0.70	Dark brown (7.5YR 3/3) sandy clay, strong structure of 70mm subangular blocky peds with a rough fabric and firm consistence. 20% orange and 20% yellow distinct mottling; 2%, <2mm quartz stone content; <2% ferromanganiferous concretions <2mm and <2% calcareous soft segregations <2mm; coarse roots common; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B23 +0.70	Brown (7.5YR 4/4) light clay, strong structure of 130mm subangular blocky peds with a rough fabric and very firm consistence. 25% orange prominent and 25% yellow distinct mottling; 2%, 2mm metamorphic stone content; <2% ferromanganiferous concretions <2mm and 40% calcareous soft segregations 20mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Epipedal Black Vertosol

Table 35 Summary: Epipedal Black Vertosol (Site B22)

Overview	
Landscape Site B22	
ASC Name	Epipedal Black Vertosol
Representative Site	B22
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Bauhinia, Carissa
Slope (%)	2%
Aspect	Nil

Table 36 Profile: Epipedal Black Vertosol (Site B22)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.40	Very dark brown (7.5YR 2.5/2) clay loam, sandy, weak structure of 130mm polyhedral peds with a rough fabric and very weak consistence. 2%, 2mm quartz stone content; abundant fine roots; imperfectly; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.40 – 0.55	Dark reddish-brown (5YR 2.5/2) clay loam, sandy weak structure of 150mm polyhedral peds with a rough fabric and weak consistence. 10%, <2mm quartz stone content; abundant fine roots; gradual and wavy boundary. Sampled 0.40 – 0.50m.
	B22 0.55 – 0.90	Yellowish-red (5YR 4/6) light clay, strong structure of 160mm subangular blocky peds with a rough fabric and firm consistence. 20% black prominent and 20% orange distinct mottling; <2%, <5mm quartz stone content; many fine roots; gradual and wavy boundary. Sampled 0.60 – 0.70m.
	B23 +0.90	Strong brown (7.5YR 4/6) light-medium clay, strong structure of 90mm subangular blocky peds with a rough fabric and firm consistence. 25% black distinct and 25% orange distinct mottling; <2% ferromanganiferous concretions <2mm and40% very highly calcareous soft segregations 20mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 37 Summary: Self-Mulching Black Vertosol (Site B23)

Overview	
Landscape Site B23	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B23
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow, Bottletree
Slope (%)	<1%
Aspect	Nil

Table 38 Profile: Self-Mulching Black Vertosol (Site B23)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Dark brown (7.5YR 3/2) heavy clay, strong structure of 120mm subangular blocky peds with a rough fabric and very firm consistence. 20%, 20mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.60	Very dark grey (7.5YR 3/1) heavy clay, strong structure of 150mm subangular blocky peds with a rough fabric and very firm consistence. 20%, 5mm metamorphic stone content; 10% slightly calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.60	Dark brown (10YR 3/3) heavy clay, strong structure of 130mm subangular blocky peds with a rough fabric and firm consistence. 10% dark distinct and 5% pale faint mottling; 20%, 5mm metamorphic stone content; 30% highly calcareous soft segregations 5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 39 Summary: Self-Mulching Black Vertosol (Site B24)

Overview	
Landscape Site B24	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B24
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 40 Profile: Self-Mulching Black Vertosol (Site B24)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Very dark brown (10YR 2/2) silty clay, strong structure of 100mm subangular blocky peds with a rough fabric and firm consistence. Abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.30	Very dark greyish brown (10YR 3/2) silty clay, strong structure of 90mm subangular blocky peds with a rough fabric and very firm consistence. Many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 0.30 – 0.60	Dark brown (10YR 3/3) silty clay, strong structure of 90mm subangular blocky peds with a rough fabric and firm consistence. 30% pale faint mottling; 10% highly calcareous soft segregations <5mm; coarse roots common; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.60	Dark yellowish-brown (10YR 3/4) light clay, strong structure of 100mm subangular blocky peds with a rough fabric and firm consistence. 30% orange faint mottling; 5% highly calcareous soft segregations <5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Brown Vertosol

Table 41 Summary: Self-Mulching Brown Vertosol (Site B25)

Overview	
Landscape Site B25	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	B25
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	3%
Aspect	East

Table 42 Profile: Self-Mulching Brown Vertosol (Site B25)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Dark brown (7.5YR 3/3) heavy clay, strong structure of 80mm subangular blocky peds with a rough fabric and firm consistence. 20%, 40mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary.
	B21 0.20 – 0.70	Dark brown (7.5YR 3/3) heavy clay, strong structure of 200mm subangular blocky peds with a rough fabric and firm consistence. 30%, 50-100mm metamorphic stone content; 40% highly calcareous soft segregation 5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.70	Dark reddish-brown (5YR 3/3) clay loam, strong structure of 50mm subangular blocky peds with a rough fabric and firm consistence. 10% pale faint mottling; 80%, 200mm metamorphic stone content; 60% highly calcareous soft segregations 30mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Brown Vertosol

Table 43 Summary: Self-Mulching Brown Vertosol (Site B26)

Overview	
Landscape Site B26	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	B26
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Residual Rise
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	4%
Aspect	East

Table 44 Profile: Self-Mulching Brown Vertosol (Site B26)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Brown (10YR 4/3) light clay, strong structure of 90mm subangular blocky peds with a rough fabric and firm consistence. <5%, 10mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.60	Dark brown (7.5YR 3/2) light clay, strong structure of 130mm subangular blocky peds with a rough fabric and firm consistence. 10% orange faint and 10% pale faint mottling; 10%, 20mm metamorphic stone content; 20% ferromanganiferous concretions <2mm and 30% moderately calcareous soft segregations 5mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.60	Yellowish-red (5YR 4/6) light clay, strong structure of 200+mm subangular blocky peds with a rough fabric and firm consistence. 30% brown faint mottling; <5%, <10mm metamorphic stone content; 40% ferromanganiferous concretions 5mm and 10% slightly calcareous soft segregations 5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 45 Summary: Self-Mulching Black Vertosol (Site B27)

Overview	
Landscape Site B27	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B27
Other Mapped Sites	B02-B11, B13-B19, B21-B26, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	1.5%
Aspect	Nil

Table 46 Profile: Self-Mulching Black Vertosol (Site B27)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.70	Black (10YR 2/1) light clay, strong structure of 150mm subangular blocky peds with a rough fabric and very firm consistence. 5% pale faint mottling; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m, 0.20 – 0.30m & 0.50 – 0.60m.
	B21 0.70 – 1.00	Black (10YR 2/1) light clay, strong structure of 140mm subangular blocky peds with a rough fabric and weak consistence. 5% brown distinct mottling; 20% very highly calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.90 – 1.00m.
	B22 +1.00	Weathered parent material. Not sampled.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 47 Summary: Self-Mulching Black Vertosol (Site B29)

Overview	
Landscape Site B29	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B29
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B30-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Melonhole Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 48 Profile: Self-Mulching Black Vertosol (Site B29)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Very dark brown (7.5YR 2.5/2) heavy clay, strong structure of 130mm subangular blocky peds with a rough fabric and weak consistence. 10%, 20mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.50	Very dark greyish brown (10YR 3/2) heavy clay, strong structure of 170mm subangular blocky peds with a rough fabric and firm consistence. 50% red distinct and 50% brown distinct mottling; 5%, 20mm metamorphic stone content; 20% moderately calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 +0.50	Dark reddish-brown (5YR 3/2) heavy clay, strong structure of 120mm subangular blocky peds with a rough fabric and firm consistence. 10% dark distinct mottling; 20% moderately calcareous soft segregations <2mm; coarse roots common. Sampled 0.50 – 0.60m & 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 49 Summary: Self-Mulching Black Vertosol (Site B30)

Overview	
Landscape Site B30	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B30
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	3%
Aspect	South

Table 50 Profile: Self-Mulching Black Vertosol (Site B30)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Dark brown (10YR 3/3) light clay, strong structure of 60mm subangular blocky peds with a rough fabric and firm consistence. 10%, 60mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.60	Very dark greyish brown (10YR 3/2) light clay, strong structure of 200mm subangular blocky peds with a rough fabric and firm consistence. 5%, 2-10mm metamorphic stone content; 5% ferromanganiferous concretions 2-10mm and 10% calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.60	Dark brown (10YR 3/3) light clay, strong structure of 130mm subangular blocky peds with a rough fabric and firm consistence. <10% pale faint mottling; 10% ferromanganiferous concretions <2mm and 10% calcareous soft segregations <5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Brown Vertosol

Table 51 Summary: Self-Mulching Brown Vertosol (Site B31)

Overview	
Landscape Site B31	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	B31
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	2%
Aspect	Nil

Table 52 Profile: Self-Mulching Brown Vertosol (Site B31)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Dark brown (7.5YR 3/3) medium clay, strong structure of 110mm subangular blocky peds with a rough fabric and firm consistence. abundant fine roots; well drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.50	Brown (7.5YR 4/3) heavy clay, strong structure of 200+mm subangular blocky peds with a rough fabric and firm consistence. <2%, 5mm metamorphic stone content; <5% moderately calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m.
	B22 +0.50	Dark reddish-brown (5YR 3/3) heavy clay, strong structure of 200+mm subangular blocky peds with a rough fabric and firm consistence. 25% yellow faint and 25% orange faint mottling; <20%, 10mm metamorphic stone content; <5% ferromanganiferous concretions <2mm; coarse roots common. Sampled 0.50 – 0.60m & 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Self-Mulching Red Vertosol

Table 53 Summary: Self-Mulching Red Vertosol (Site B32)

Overview	
Landscape Site B32	
ASC Name	Self-Mulching Red Vertosol
Representative Site	B32
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	1%
Aspect	Nil

Table 54 Profile: Self-Mulching Red Vertosol (Site B32)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Dark reddish-brown (5YR 3/3) light-medium clay, strong structure of 160mm subangular blocky peds with a rough fabric and firm consistence. Abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10 & 0.20 – 0.30m.
	B21 0.30 – 0.70	Strong brown (7.5YR 4/6) heavy clay, strong structure of 200mm subangular blocky peds with a rough fabric and firm consistence. 30% pale faint mottling; 10% highly calcareous soft segregations 10mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.70	Reddish-brown (5YR 5/4) light-medium clay, strong structure of 100mm subangular blocky peds with a rough fabric and firm consistence. 10% red faint and 10% yellow faint mottling; 40%, 10mm metamorphic stone content; 40% highly calcareous soft segregations 20mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 55 Summary: Self-Mulching Black Vertosol (Site B33)

Overview	
Landscape Site B33	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B33
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 56 Profile: Self-Mulching Black Vertosol (Site B33)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Very dark brown (10YR 2/2) light clay, strong structure of 80mm subangular blocky peds with a rough fabric and weak consistence. <2%, 30mm metamorphic stone content; abundant fine roots; well drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.70	Very dark greyish brown (10YR 3/2) light clay, strong structure of 170mm subangular blocky peds with a rough fabric and firm consistence. 20% pale faint mottling; 10% ferromanganiferous concretions <5mm and 20% calcareous soft segregations 2-10mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.70	Dark yellowish-brown (10YR 4/4) light clay, strong structure of 170mm subangular blocky peds with a rough fabric and firm consistence. 20- 50% orange distinct mottling; 10%, <5mm metamorphic stone content; 5% ferromanganiferous concretions <5mm and 10% calcareous soft segregations 2-10mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 57 Summary: Self-Mulching Black Vertosol (Site B34)

Overview	
Landscape Site B34	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B34
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Crabhole Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 58 Profile: Self-Mulching Black Vertosol (Site B34)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Very dark greyish brown (10YR 3/2) heavy clay, strong structure of 130mm subangular blocky peds with a rough fabric and very firm consistence. 10%, 90mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.60	Very dark grey (7.5YR 3/1) heavy clay, strong structure of 200mm subangular blocky peds with a rough fabric and very firm consistence. <5%, 15mm metamorphic stone content; <5% very highly calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.60	Dark reddish-brown (5YR 3/2) heavy clay, strong structure of 180mm subangular blocky peds with a rough fabric and very firm consistence. 25% red distinct and 10% yellow distinct mottling; <2%, 15mm metamorphic stone content; <5% moderately calcareous soft segregations <5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Brown Vertosol

Table 59 Summary: Self-Mulching Brown Vertosol (Site B35)

Overview	
Landscape Site B35	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	B35
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 60 Profile: Self-Mulching Brown Vertosol (Site B35)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Very dark brown (10YR 2/2) silty clay, strong structure of 130mm subangular blocky peds with a rough fabric and firm consistence. <2%, 20mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.50	Brown (10YR 4/3) light clay, strong structure of 120mm subangular blocky peds with a rough fabric and firm consistence. <2%, <10mm metamorphic stone content; 10% highly calcareous soft segregations <10mm; <2%; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.50	Brown (7.5YR 4/4) light-medium clay, strong structure of 180mm subangular blocky peds with a rough fabric and firm consistence. 40% orange faint mottling; 5% ferromanganiferous concretions <5mm and 10% calcareous soft segregation <10mm; coarse roots common; poorly drained Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Brown Vertosol

Table 61 Summary: Self-Mulching Brown Vertosol (Site B36)

Overview	
Landscape Site B36	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	B36
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	2%
Aspect	Nil

Table 62 Profile: Self-Mulching Brown Vertosol (Site B36)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Dark brown (7.5YR 3/4) silty clay, strong structure of 100mm subangular blocky peds with a rough fabric and firm consistence. <5%, 10mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.0 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.70	Dark brown (10YR 3/3) heavy clay, strong structure of 140mm subangular blocky peds with a rough fabric and firm consistence. 10% pale faint mottling; 10%, 10mm metamorphic stone content; 10% ferromanganiferous concretions <5mm, 10% very highly calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.70	Yellowish-brown (10YR 5/4) light-medium clay, strong structure of 160mm subangular blocky peds with a rough fabric and firm consistence. 50% pale faint mottling; 10% ferromanganiferous concretions <5mm, 10% very highly calcareous soft segregations <2mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 63 Summary: Self-Mulching Black Vertosol (Site B37)

Overview	
Landscape Site B37	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B37
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 64 Profile: Self-Mulching Black Vertosol (Site B37)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.10	Dark greyish-brown (10YR 4/2) light clay, strong structure of 50mm subangular blocky peds with a rough fabric and firm consistence. abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.10 – 0.50	Very dark greyish brown (10YR 3/2) light clay, strong structure of 200mm subangular blocky peds with a rough fabric and firm consistence. 30% pale faint mottling; <5%, <10mm metamorphic stone content; 10% highly calcareous soft segregation <2mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30m & 0.50 – 0.60m.
	B22 +0.50	Yellowish-brown (10YR 5/8) light clay, strong structure of 180mm subangular blocky peds with a rough fabric and firm consistence. 10% grey faint mottling; <5%, <10mm metamorphic stone content; 10% moderately calcareous soft segregations <2mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Brown Vertosol

Table 65 Summary: Self-Mulching Brown Vertosol (Site B38)

Overview	
Landscape Site B38	
ASC Name	Self-Mulching Brown Vertosol
Representative Site	B38
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 66 Profile: Self-Mulching Brown Vertosol (Site B38)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Dark brown (7.5YR 3/4) medium clay, strong structure of 150mm subangular blocky peds with a rough fabric and firm consistence. <2%, <5mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.0 – 0.10 & 0.20 – 0.30m.
	B21 0.30 – 0.80	Dark yellowish-brown (10YR 4/4) heavy clay, strong structure of 200mm subangular blocky peds with a rough fabric and firm consistence. 20% pale faint mottling; <2%, 150mm sandstone stone content; 20% ferromanganiferous concretions 30mm, 10% highly calcareous soft segregations 10mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.80	Dark brown (7.5YR 3/4) light clay, strong structure of 150mm subangular blocky peds with a rough fabric and firm consistence. 40% orange faint and 40% pale faint mottling; 20%, <10mm metamorphic stone content; 20% ferromanganiferous concretions <10mm, 10% highly calcareous soft segregations 10mm; coarse roots common. Sampled 0.90 – 1.0m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 67 Summary: Self-Mulching Black Vertosol (Site B39)

Overview	
Landscape Site B39	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B39
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	1%
Aspect	Nil

Table 68 Profile: Self-Mulching Black Vertosol (Site B39)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Very dark brown (10YR 2/2) light clay, strong structure of 90mm subangular blocky peds with a rough fabric and firm consistence. <2%, 30mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.60	Dark brown (10YR 3/3) light clay, strong structure of 180mm subangular blocky peds with a rough fabric and firm consistence. 5- 10% pale faint mottling; 2% ferromanganiferous concretions 2-10mm and 2-10% calcareous soft segregations <2mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.60	Dark reddish-brown (5YR 3/3) light clay, strong structure of 160 mm subangular blocky peds with a rough fabric and firm consistence. 20% orange faint mottling; <2-10% calcareous soft segregations <2mm; coarse roots common; poorly drained Sampled 0.50 – 0.60m & 0.90 – 1.0m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Sub-Dominant Soil Type: Self-Mulching Grey Vertosol

Table 69 Summary: Self-Mulching Grey Vertosol (Site B40)

Overview	
Landscape Site B40	
ASC Name	Self-Mulching Grey Vertosol
Representative Site	B40
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Normal Gilgai
Vegetation	Brigalow
Slope (%)	2%
Aspect	Nil

Table 70 Profile: Self-Mulching Grey Vertosol (Site B40)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.20	Dark brown (7.5YR 3/2) heavy clay, strong structure of 180mm subangular blocky peds with a rough fabric and firm consistence. 20%, 20mm metamorphic stone content; abundant fine roots; poorly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m.
	B21 0.20 – 0.70	Dark greyish-brown (10YR 4/2) silty loam, strong structure of 170mm subangular blocky peds with a rough fabric and firm consistence. 20% brown faint mottling; 20%, 20mm metamorphic stone content; 20% calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.20 – 0.30 & 0.50 – 0.60m.
	B22 +0.70	Strong brown (7.5YR 5/6) heavy clay, strong structure of 200+mm subangular blocky peds with a rough fabric and firm consistence. 10% gley distinct and 40% orange distinct mottling; 10%, 10mm metamorphic stone content; <5% calcareous soft segregations <5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 71 Summary: Self-Mulching Black Vertosol (Site B41)

Overview	
Landscape Site B41	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B41
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Normal Gilgai
Vegetation	Brigalow
Slope (%)	<1%
Aspect	Nil

Table 72 Profile: Self-Mulching Black Vertosol (Site B41)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Black (10YR 2/1) light clay, strong structure of 110mm subangular blocky peds with a rough fabric and firm consistence. Abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.70	Very dark brown (7.5YR 2.5/2) light clay, strong structure of 150mm subangular blocky peds with a rough fabric and firm consistence. 25% brown faint mottling; <2%, <5mm metamorphic stone content; <2% very highly calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.70	Very dark brown (7.5YR 2.5/3) light clay, strong structure of 170mm subangular blocky peds with a rough fabric and firm consistence. 20% red distinct mottling; 20%, <10mm metamorphic stone content; 5% ferromanganiferous concretions <5mm and 2% highly calcareous soft segregations <5mm; coarse roots common. Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 73 Summary: Self-Mulching Black Vertosol (Site B42)

Overview	
Landscape Site B42	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B42
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed Lab Analysed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	2%
Aspect	Nil

Table 74 Profile: Self-Mulching Black Vertosol (Site B42)

Profile	Horizon / Depth (m)	Description
	A1 0.00 – 0.30	Dark brown (7.5YR 3/2) medium clay, strong structure of 150mm subangular blocky peds with a rough fabric and firm consistence. 20%, 120mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.80	Dark brown (10YR 3/3) medium clay, strong structure of 180mm subangular blocky peds with a rough fabric and firm consistence. 10%, 20mm metamorphic stone content; 10% ferromanganiferous concretions <5mm and <5% calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.80	Dark brown (10YR 3/3) silty clay, strong structure of 200mm subangular blocky peds with a rough fabric and firm consistence. 10% pale faint mottling; 10% ferromanganiferous concretions <5mm and <5% calcareous soft segregations <5mm; coarse roots common. Sampled 0.90 – 1.00 m Layer continues beyond sample depth.

Soil Unit 1: Self-Mulching Black-Brown Vertosol

Self-Mulching Black Vertosol

Table 75 Summary: Self-Mulching Black Vertosol (Site B43)

Overview	
Landscape Site B43	
ASC Name	Self-Mulching Black Vertosol
Representative Site	B43
Other Mapped Sites	B02-B11, B13-B19, B21-B27, B29-B43
Survey Type	Detailed
Dominant Topography	Plain
Dominant Land Use	Pasture
Microrelief	Incipient Gilgai
Vegetation	Brigalow
Slope (%)	3%
Aspect	Nil

Table 76 Profile: Self-Mulching Black Vertosol (Site B43)

Profile	Horizon / Depth(m)	Description
	A1 0.00 – 0.30	Very dark greyish brown (10YR 3/2) light clay, strong structure of 80mm subangular blocky peds with a rough fabric and firm consistence. 20%, 10mm metamorphic stone content; abundant fine roots; imperfectly drained; gradual and wavy boundary. Sampled 0.00 – 0.10m & 0.20 – 0.30m.
	B21 0.30 – 0.70	Very dark greyish brown (10YR 3/2) light clay, strong structure of 140mm subangular blocky peds with a rough fabric and firm consistence. 20% pale faint mottling; <5%, 10mm metamorphic stone content; <10% ferromanganiferous concretions 2-10mm and 10% moderately calcareous soft segregations <5mm; many fine roots; gradual and wavy boundary. Sampled 0.50 – 0.60m.
	B22 +0.70	Dark brown (10YR 3/3) light clay, strong structure of 180mm subangular blocky peds with a rough fabric and firm consistence. 20% red faint mottling; <10% ferromanganiferous concretions <2mm and 10% moderately calcareous soft segregations <5mm; coarse roots common; poorly drained Sampled 0.90 – 1.00m. Layer continues beyond sample depth.

Appendix C Check Site Descriptions

Land Resources Assessment Report

BM Alliance Coal Operations

SLR Project No.: 620.014601.00001

7 December 2023

Self-Mulching Brown Vertosol

Table 1 Summary: Self-Mulching Brown Vertosol (Check Site 1)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C01	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Yellowish brown (10YR 5/4) light-medium clay, moderate structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 2 Summary: Self-Mulching Brown Vertosol (Check Site 2)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C02	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 5/4) medium clay, strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 3 Summary: Self-Mulching Brown Vertosol (Check Site 3)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C03	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 5/3) light-medium clay, strong structure, subangular blocky peds.

Self-Mulching Black Vertosol

Table 4 Profile: Self-Mulching Black Vertosol (Check Site 4)

Overview		
ASC Name	Self-Mulching Black Vertosol	
Representative Site	C04	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.20m):Dark brown (7.5YR 3/2) light medium clay, moderate structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 5 Profile: Self-Mulching Brown Vertosol (Check Site 5)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C05	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 5/2) light medium clay, moderate structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 6 Profile: Self-Mulching Brown Vertosol (Check Site 6)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C06	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Dark yellowish brown (10YR 4/4) silty clay, moderate structure, subangular blocky peds.

Self-Mulching Black Vertosol

Table 7 Profile: Self-Mulching Black Vertosol (Check Site 7)

Overview		
ASC Name	Self-Mulching Black Vertosol	
Representative Site	C07	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Very dark grey (7.5YR 3/1) medium clay, strong structure subangular blocky peds.

Self-Mulching Brown Vertosol

Table 8 Profile: Self-Mulching Brown Vertosol (Check Site 8)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C08	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Strong brown (7.5YR 5/6) silty clay, moderate structure subangular blocky peds.

Self-Mulching Brown Vertosol

Table 9 Profile: Self-Mulching Brown Vertosol (Check Site 9)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C09	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m) Brown (7.5YR 5/3) light-medium clay, strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 10 Profile: Self-Mulching Brown Vertosol (Check Site 10)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C10	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	2-3	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Yellowish brown (10YR 5/6) medium clay, moderate structure subangular blocky peds.

Self-Mulching Brown Vertosol

Table 11 Profile: Self-Mulching Brown Vertosol (Check Site 11)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C11	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Yellowish brown (101YR 5/8) light-medium clay, moderate structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 12 Profile: Self-Mulching Brown Vertosol (Check Site 12)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C12	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 5/3) light-medium clay, moderate structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 13 Profile: Self-Mulching Brown Vertosol (Check Site 13)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C13	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 4/4) medium clay, strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 14 Profile: Self-Mulching Brown Vertosol (Check Site 14)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C14	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 4/4) medium clay, moderate structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 15 Profile: Self-Mulching Brown Vertosol (Check Site 15)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C15	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.20m): Yellowish brown (10YR 5/4) light clay, moderate structure, subangular blocky peds. B2: Strong brown (7.5YR 5/6) medium clay, strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 16 Profile: Self-Mulching Brown Vertosol (Check Site 16)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C16	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 5/3) light clay, moderate structure, subangular blocky peds.

Brown Dermosol

Table 17 Profile: Brown Dermosol (Check Site 17)

Overview		
ASC Name	Brown Dermosol	
Representative Site	C17	
Soil Map Unit	1 (Sub-Dominant Soil Type)	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Bottle Tree	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Light brown (7.5YR 6/4) sandy loam, weak crumb structure. B2 (+0.10m) Strong brown (7.5YR 5/8) clay loam, moderate structure, blocky peds.

Self-Mulching Brown Vertosol

Table 18 Profile: Self-Mulching Brown Vertosol (Check Site 18)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C18	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Bottle Tree	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Dark brown (10YR 3/3) light clay, moderate structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 19 Profile: Self-Mulching Brown Vertosol (Check Site 19)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C19	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Bottle Tree	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.0 – 0.10m): Brown (7.5YR 5/4) light-medium clay, moderate structure, subangular blocky peds.

Brown Dermosol

Table 20 Profile: Brown Dermosol (Check Site 20)

Overview		
ASC Name	Brown Dermosol	
Representative Site	C20	
Soil Map Unit	1 (Sub-Dominant Soil Type)	
Survey Type	Check Site	
Dominant Topography	Drainage Line	
Dominant Land Use	Pasture	
Vegetation	Bauhinia, Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.20m): Brown (10YR 5/4) sandy loam, weak crumb structure. B21 (+0.20m): Brown (10YR 4/4) sandy clay loam, weak structure, blocky peds.

Self-Mulching Brown Vertosol

Table 21 Profile: Self-Mulching Brown Vertosol (Check Site 21)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C21	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Dark brown (7.5YR 3/4) light clay, strong structure, subangular blocky peds.

Brown Dermosol

Table 22 Profile: Brown Dermosol (Check Site 22)

Overview		
ASC Name	Brown Dermosol	
Representative Site	C22	
Soil Map Unit	3	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Light brown (7.5YR 6/4) clay loam, moderate structure, blocky peds.

Self-Mulching Brown Vertosol

Table 23 Profile: Self-Mulching Brown Vertosol (Check Site 23)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C23	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 4/3) medium clay, strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 24 Profile: Self-Mulching Brown Vertosol (Check Site 24)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C24	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.0 – 0.10): Brown (7.5YR 5/3) light clay, moderate structure; blocky peds.

Brown Dermosol

Table 25 Profile: Brown Dermosol (Check Site 25)

Overview		
ASC Name	Brown Dermosol	
Representative Site	C25	
Soil Map Unit	1 (Sub-dominant Soil Type)	
Survey Type	Check Site	
Dominant Topography	Drainage Line	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.20m): Light brown (7.5YR 6/4) sandy loam, weak crumb structure; gradual boundary. B2 (+0.20m): Brown (10YR 5/3) sandy clay loam, weak structure, blocky peds.

Self-Mulching Brown Vertosol

Table 26 Profile: Self-Mulching Brown Vertosol (Check Site 26)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C26	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (10YR 5/3) light-medium clay, moderate structure, blocky peds.

Self-Mulching Brown Vertosol

Table 27 Profile: Self-Mulching Brown Vertosol (Check Site 27)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C27	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Drainage Line	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.20m): Brown (7.5YR 5/2) light-medium clay, strong structure, subangular blocky peds. B2 (+0.20m): Light brown (7.5YR 6/4) medium clay, strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 28 Profile: Self-Mulching Brown Vertosol (Check Site 28)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C28	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Bauhinia, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Yellowish brown (10YR 5/6) silty clay, moderate structure, blocky peds.

Self-Mulching Brown Vertosol

Table 29 Profile: Self-Mulching Brown Vertosol (Check Site 29)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C29	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 5/3) light clay, moderate structure, subangular blocky peds.

Red Dermosol

Table 30 Profile: Red Dermosol (Check Site 30)

Overview		
ASC Name	Red Dermosol	
Representative Site	C30	
Soil Map Unit	2B	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Yellowish red (5YR 4/6) sandy clay loam, weak blocky structure.

Self-Mulching Brown Vertosol

Table 31 Profile: Self-Mulching Brown Vertosol (Check Site 31)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C31	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Light brown (7.5YR 6/3) light-medium strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 32 Profile: Self-Mulching Brown Vertosol (Check Site 32)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C32	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Light brown (7.5YR 6/4) medium clay, strong structure, subangular blocky peds.

Epipedal Brown Vertosol

Table 33 Profile: Epipedal Brown Vertosol (Check Site 33)

Overview		
ASC Name	Epipedal Brown Vertosol	
Representative Site	C33	
Soil Map Unit	1 (Sub-Dominant Soil Type)	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Strong brown (7.5YR 4/6) light clay, moderate structure; blocky peds.

Self-Mulching Brown Vertosol

Table 34 Profile: Self-Mulching Brown Vertosol (Check Site 34)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C34	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Wilga, Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.20m): Brown (7.5YR 4/3) medium clay, strong structure, subangular blocky peds.

Brown Dermosol

Table 35 Profile: Brown Dermosol (Check Site 35)

Overview		
ASC Name	Brown Dermosol	
Representative Site	C35	
Soil Map Unit	3	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow, Carissa, Wilga	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Strong brown (7.5YR 5/8) clay loam, moderate structure, blocky peds.

Self-Mulching Brown Vertosol

Table 36 Profile: Self-Mulching Brown Vertosol (Check Site 36)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C36	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 5/3) medium clay, strong structure, subangular blocky peds.

Self-Mulching Brown Vertosol

Table 37 Profile: Self-Mulching Brown Vertosol (Check Site 37)

Overview		
ASC Name	Self-Mulching Brown Vertosol	
Representative Site	C37	
Soil Map Unit	1	
Survey Type	Check Site	
Dominant Topography	Plain	
Dominant Land Use	Pasture	
Vegetation	Brigalow	
Slope (%)	0-2	
Slope Type	Minimal	
Aspect	Nil	

Profile	Description
	A1 (0.00 – 0.10m): Brown (7.5YR 4/4) medium clay, strong structure subangular blocky peds.

Appendix D Emerson Aggregate Test Results

Land Resources Assessment Report

BM Alliance Coal Operations

SLR Project No.: 620.014601.00001

7 December 2023

Table 1 Summary of Emersion Aggregate Testing (EAT) Results

Sample	Layer	Depth (cm)	EAT Score	Rating
B01	A1	0– 10	3	Moderately High
	B21	20 – 30	3	
	B22	50 – 60	2	High
	B23	90 – 100	2	
B05	A1	0– 10	4	Negligible
	B21	20 – 30	4	
	B22	50 – 60	4	
	B23	90 – 100	4	
B07	A1	0 – 10	4	Negligible
	B21	20 – 30	3	Moderately High
		50 – 60		
	B22	90 – 100	2	High
B09	A1	0 – 10	4	Negligible
		20 – 30	3	Moderately High
	B21	50 – 60	2	High
	B22	90 – 100	3	Moderately High
B10	A1	0 – 10	3	Moderately High
	B21	20 – 30	3	
	B22	50 – 60	3	
		90 – 100	2	High
B12	A1	0 – 10	3	Moderately High
	B21	20 – 30	3	
	B22	50 – 60	3	
		90 – 100	2	High
B17	A1	0 – 10	2	High
	B21	20 – 30	2	
	B22	50 – 60	2	
		90 – 100	2	
B20	A1	0 – 10	3	Moderately High
	B21	20 – 30	2	High
	B22	50 – 60	4	Negligible
		90 – 100	2	High
B21	A1	0– 10	3	Moderately High
	B21	20 – 30	2	High

Sample	Layer	Depth (cm)	EAT Score	Rating
	B22	50 – 60	2	
	B23	90 – 100	2	
B23	A1	0– 10	4	Negligible
	B21	20 – 30	3	Moderately High
	B22	50 – 60	3	
		90 – 100	3	
B25	A1	0– 10	3	Moderately High
	B21	20 – 30	4	Negligible
		50 – 60	4	
	B22	90 – 100	4	
B28	A1	0– 10	3	Moderately High
	B21	20 – 30	2	High
		50 – 60	2	
	B22	90 – 100	2	
B29	A1	0– 10	4	Negligible
	B21	20 – 30	3	Moderately High
	B22	50 – 60	2	High
		90 – 100	2	
B31	A1	0– 10	4	Negligible
	B21	20 – 30	3	Moderately High
	B22	50 – 60	2	High
		90 – 100	2	
B32	A1	0– 10	2	High
	B21	20 – 30	3	Moderately High
		50 – 60	3	
	B22	90 – 100	3	
B34	A1	0– 10	3	Moderately High
	B21	20 – 30	3	
		50 – 60	3	
	B22	90 – 100	3	
B36	A1	0– 10	3	Moderately High
	B21	20 – 30	3	
		50 – 60	2	High
	B22	90 – 100	2	
B38	A1	0– 10	2	High
	B21	20 – 30	2	

Sample	Layer	Depth (cm)	EAT Score	Rating
		50 – 60	3	Moderately High
	B22	90 – 100	2	High
B40	A1	0– 10	3	Moderately High
	B21	20 – 30	3	
		50 – 60	2	High
	B22	90 – 100	2	
B42	A1	0– 10	2	High
	B21	20 – 30	2	
		50 – 60	2	
	B22	90 – 100	2	

Appendix E Land Suitability Assessment

Land Resources Assessment Report

BM Alliance Coal Operations

SLR Project No.: 620.014601.00001

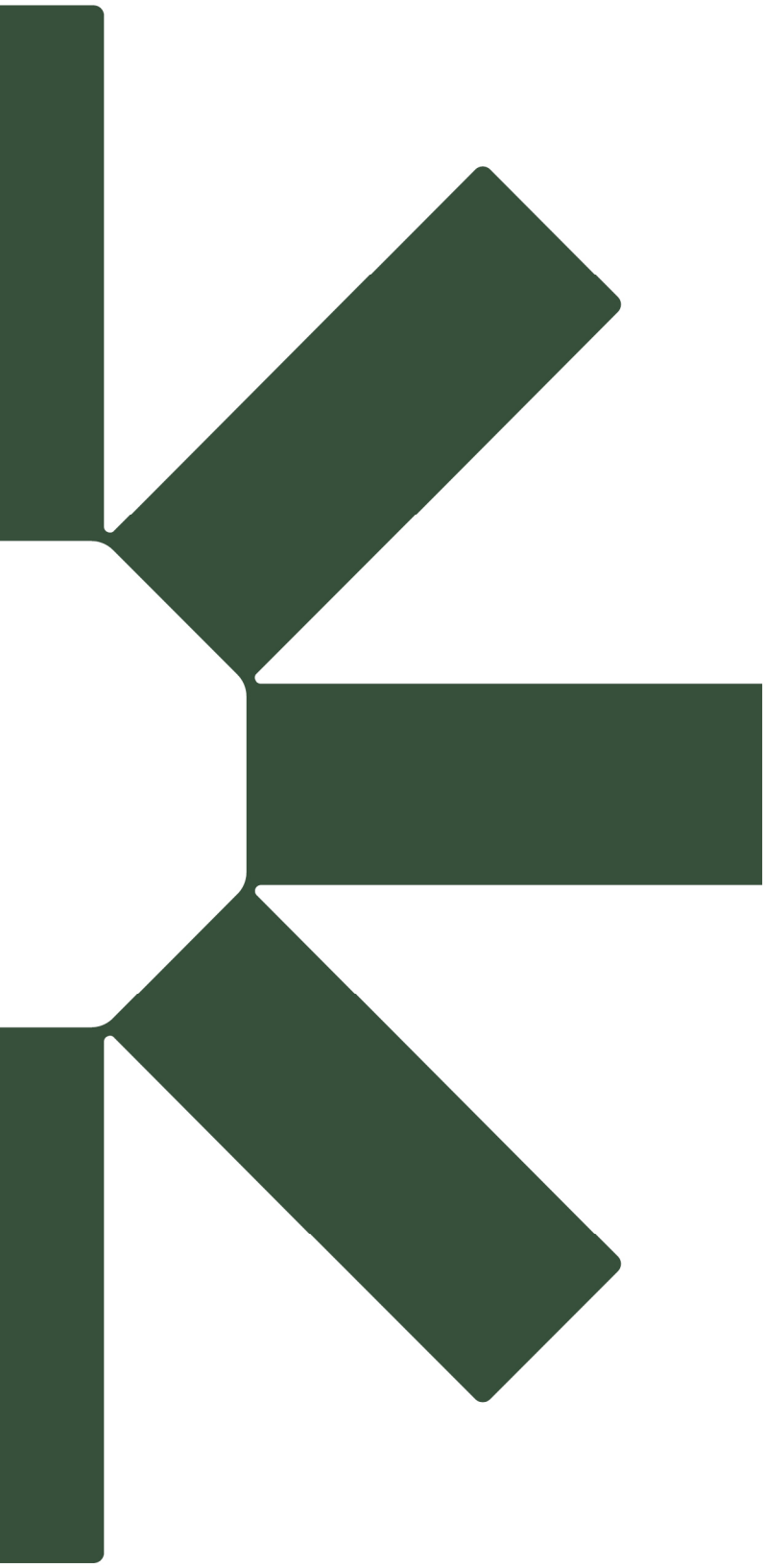
7 December 2023

Table 1 Land Suitability Class

Site	SMU	Representative Site	E	Es	M	M	M	R	R	W	W	W	Tm	Pm	Ps	Land Suitability Class
			Water Erosion	Erosion Hazard, subsoil erodibility	Soil water availability	Soil water availability	Soil water availability	Rockiness	Rockiness	Wetness	Wetness	Wetness	Microrelief	Narrow Moisture Range	Surface Condition	
Black-Brown Self-Mulching Vertosol	1	B02 – B11, B13 – B19, B21 – B27, B29 – B43	2	1	2	2	3	2	4	4	4	2	2	4	3	4
Eutrophic Red Dermosol	2A	B28	4	2	3	4	5	1	1	4	4	4	1	2	3	5
Eutrophic Red Dermosol	2B	B01	4	2	3	4	5	2	3	4	4	4	1	2	2	5
Eutrophic Black-Brown Dermosol	3	B12, B20	4	2	4	5	5	1	1	3	3	3	2	2	3	5

Table 2 Land Capability Class

Site	SMU	Representative Site	C	M	P	N	Sa	X	R	Tm	W	E	F	A	Land Capability Class
			Climatic Limitation	Soil water availability	Soil Physical Factor	Nutrients	Soil salinity or sodicity	Landscape complexity	Rockiness	Microrelief	Wetness	Water Erosion	Flooding	Wind Erosion	
Black-Brown Self-Mulching Vertosol	1	B02 – B11, B13 – B19, B21 – B27, B29 – B43	2	2	2	1	3	3	0	2	3	0	1	0	3
Eutrophic Red Dermosol	2A	B28	2	4	2	2	4	4	0	0	3	3	2	1	4
Eutrophic Red Dermosol	2B	B01	2	3	2	1	4	4	1	0	3	3	3	1	4
Eutrophic Black-Brown Dermosol	3	B12, B20	2	4	2	2	3	3	1	2	2	3	1	2	4



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