Whitehaven

2025

Maules Creek Continuation Project

Environmental Impact Statement

Appendix O
Agricultural Impact Assessment

Maules Creek Continuation Project

Agricultural Impact Assessment

26/03/2025

DOCUMENT CONTROL

Project name	Maules Creek Coal Continuation Project			
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DISCLAIMER

This report was prepared according to the scope, brief and project information provided by Whitehaven Coal Limited. All findings, conclusions or recommendations in the report are based on the information provided and collected for this project. The report is for the use of Whitehaven Coal Limited only and 2rog Consulting accept no liability or responsibility for its use by other parties.

EXECUTIVE SUMMARY

Report Purpose

The Maules Creek Continuation Project (the Project) is a proposed continuation and extension of the Maules Creek Coal Mine (MCCM). The MCCM is located approximately 17 kilometres (km) northeast of Boggabri and 55 km north of Gunnedah in northwest New South Wales (NSW) and is on the traditional lands of Kamilaroi/Gomeroi Nation country.

Maules Creek Coal Pty Ltd (MCC) is seeking approval to continue open cut mining operations within the MCCM mining and exploration tenements for a further 10 years (from 2035 to 2044). Development Consent for the Project is being sought under the State Significant provisions (i.e. Division 4.7) under Part 4 of the NSW *Environmental Planning and Assessment Act 1979*.

The Project constitutes a State Significant Development (SSD) and must consider the compatibility of the development with other land uses in the vicinity of the MCCM under Clause 2.17 of the *State Environmental Planning Policy (Resources and Energy) 2021*. The Project Development Application must be accompanied by an Environmental Impact Statement (EIS), prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the then NSW Department of Planning and Environment (now referred to as the Department of Planning, Housing and Infrastructure [DPHI]) on behalf of the Secretary.

This Agricultural Impact Assessment (AIA) has been prepared to accompany the proposed Project. The purpose of this report is to ensure that applicants, communities and consent authorities have a detailed understanding of:

- The agricultural capability and productivity of land subject to the Project;
- Potential impacts of the Revegetation Program on agricultural land and associated industries; and
- The ways in which potential impacts may be mitigated.

Proposed Project

The Project has identified an opportunity for a Revegetation Program in the vicinity of the MCCM as an important part of the Project. These revegetation areas, referred to as the Landscape Revegetation Zones, are proposed as part of the Project to:

- Establish approximately 2,300 hectares (ha) of native woodland on previously cleared land (focusing on Category 1 – Exempt Land) within approximately three to five years of Project approval;
- Provide a larger area of native vegetation cover than currently exists in the local region of Leard State Forest following completion of the Project;
- Complement the existing Leard State Forest Regional Strategy by expanding habitat for SAII species adjacent to Leard State Forest and providing linkages between woodland patches/existing conserved areas; and
- Provide a larger benefit (net gain) compared to offsetting alone (i.e. it would be additional/in excess to standard offset/credit requirements).

The revegetation works are to be permanent plantings/seeding of native species (trees, shrubs and understorey) designed to improve local and regional biodiversity over the coming decades. While the revegetation is designed to improve regional landscape functionality for native species it would permanently remove those areas for use in agricultural production.

The indicative Project general arrangement is provided on Figure 02-1.

Compared to the existing approved MCCM, the Project would include the following additional key activities:

- Extension of open cut operations within Coal Lease 375, Mining Lease 1719 and Authorisation 346 to allow mining and processing of additional coal reserves until approximately 31 December 2044;
- Extraction of approximately 117 million tonnes (Mt) of ROM coal (in addition to the approved MCCM coal resource of 240 Mt of ROM coal);
- Extraction of up to 14 million tonnes per annum (Mtpa) of ROM coal (i.e. a 1 Mtpa increase from the currently approved maximum ROM coal mining rate of 13 Mtpa);
- A Revegetation Program to establish approximately 2,300 hectares (ha) of native woodland in the vicinity of the MCCM (i.e. in addition to any offset and rehabilitation obligations);
- An increase in operational work force to an average of approximately 940, people with a peak operational workforce of approximately 1,030 people;
- Continued operation of the existing CHPP and train load-out and rail spur infrastructure, with upgrades as required;
- Continued transport of up to 12.4 Mtpa of product coal via rail (i.e. no change to the currently approved maximum product coal transport rate);
- Development of an integrated waste rock emplacement landform that incorporates geomorphic design principles;
- Construction of a remote go-line, access and infrastructure area;
- Continued operation and extension of the MCCM water management system;
- Upgrades to workshops, electricity distribution and other ancillary infrastructure;
- Continued placement of coarse rejects within the mined out voids and the out-of-pit overburden emplacement areas;
- Construction and operation of a water transfer pipeline between the MCCM water pipeline network and the approved Vickery Coal Mine to Tarrawonga Coal Mine pipeline;
- Ongoing exploration activities; and
- Other associated infrastructure, equipment and activities.

Study Area

This report focuses on areas of agricultural land that would be impacted by the Project. These areas are described as: Landscape Revegetation Zone 1 (Zone 1); Landscape Revegetation Zone 2 (Zone 2) Landscape Revegetation Zone 3 (Zone 3); and the Mined Agricultural Area (Zone 4) herein collectively referred to as the Study Area. This assessment does not require consideration of the component of the Project located in State Forest and the Water Transfer Pipeline as these components would not have impact on agricultural capabilities.

The Study Area consists exclusively of Whitehaven-managed agricultural land which is currently being leased to some previous landholders and recent land managers. The area is characterised by low lying grazing land with some areas of grain cropping, and areas that abut Leard State Forest. Land use and land production capability in the Study Area was assessed through interviews with current and previous land holders and managers; review and analysis of existing soil mapping data; and assessment of local and regional agricultural data.

The approximate extent of the Landscape Revegetation Zone is 2,300 ha. However, for the purposes of this AIA, a broader, conservative footprint (approximately 2,370 ha) has been considered and incorporates features such as such dwellings and tracks (which are not included in the approximate extent of the Landscape Revegetation Zones). An additional 86 ha of agricultural land would be disturbed by an extension of mining activities. This AIA considers the combined impact area of the revegetation works and mining disturbed agricultural land together, a total of approximately 2,456 ha.

Potential Impacts

An assessment of the potential agricultural productivity of the Study Area was undertaken through the use of available information, regional agricultural productivity data and a Land and Soil Capability (LSC) assessment. LSC for the Study Area is comprised of LSC 4 and 5 which are currently used for agricultural purposes.

Agricultural production undertaken in the Study Area consists of beef cattle, fat lamb production and some grain cropping. For agricultural purposes, the land ranges from moderate to low land capability, which is generally suitable for grazing production and occasional cropping.

For the purposes of this assessment, it has been conservatively assumed that the Landscape Revegetation Zones would permanently remove approximately 2,370 ha of land from agricultural production. However, once the woodland has reached maturity, some grazing within the Landscape Revegetation Zones would be possible.

Production estimates show that the land is capable of producing an approximate value ranging from $29,165 to $1.8 million (M) annually. The wide range in potential value accounts for different production systems, land manager and NSW Department of Primary Industries and Regional Development estimates and basing estimates on the highest possible production. It is therefore likely that the average value of production is below $1M annually. Using the highest estimate of annual value of production, the Project would result in a maximum reduction in annual value of agricultural production of approximately 0.2 per cent (%) for the Narrabri Local Government Area and 0.03% for NSW.

Conclusion

Detailed assessment of the potential impacts of the Project has forecast minimal impact on agricultural production within the region. Mitigation actions could reduce any existing agricultural conflicts, risks and losses so that these conflicts, risks and losses are minor or negligible.

This report represents the AIA undertaken to support the EIS for the Project. As such it has drawn upon regional and local datasets and relied upon modelling and assessment based on a defined area and proposed mine and revegetation site layout.

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ABBREVIATIONS

Abbreviation	Description
ABS	Australian Bureau of Statistics
AHD	Australian Height Datum
AIA	Agricultural Impact Assessment
AIARA	Agricultural Impact Assessment and Revegetation Assessment
ASL	Above Sea Level
BDAR	Biodiversity Development Assessment Report
BOM	Bureau of Meteorology
BSAL	Biophysically Significant Agricultural Land
CCC	Community Consultative Committee
DPE	Department of Planning and Environment
DPHI	Department of Planning, Housing and Infrastructure
DPI	Department of Primary Industries
DSE	Dry Sheep Equivalent
EIS	Environmental Impact Statement
GDP	Gross Domestic Product
GM	Gross Margin
GSG	Great Soil Group
GVP	Gross Value of Production
ha	hectares
kg	kilograms
km	kilometres
LGA	Local Government Area
LLS	Local Land Services
LSC	Land and Soil Capability
MCCM	Maules Creek Coal Mine

the Project	Maules Creek Continuation Project
M	Million
ML	Mining Lease
Mt	million tones
mtpa	million tonnes per annum
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PAC	NSW Planning Assessment Commission
ROM	run of mine
SAII	Serious And Irreversible Impacts
SEARS	Secretary’s Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
SSD	State Significant Development
t	tonnes
TCM	Tarrawonga Coal Mine
VCM	Vickery Coal Mine

01 INTRODUCTION

Maules Creek Coal Mine (MCCM) is an open cut coal mine located approximately 17 kilometres (km) north-east of Boggabri, New South Wales (NSW). MCCM is a joint venture between Aston Coal 2 Pty Ltd (a wholly owned subsidiary of Whitehaven) (75 per cent [%]), ICRA MC Pty Ltd (a wholly owned subsidiary of Itochu Corporation) (15%) and J-Power Australia Pty Ltd (a wholly owned subsidiary of Electric Power Development Co. Ltd) (10%). MCCM is operated by Maules Creek Coal Pty Ltd (MCC).

Mining operations at MCCM are currently approved until 31 December 2034 with a coal extraction rate of up to 13 million tonnes per annum (Mtpa) in accordance with Project Approval (PA) 10_0138 (as modified). The existing MCCM comprises a single open cut pit, Northern Emplacement and Southern Emplacement areas, and Mine Infrastructure Area (MIA). The MIA includes the Coal Handling and Preparation Plant (CHPP), run of mine (ROM) coal stockpiles, product coal stockpiles, train load-out infrastructure, workshops and administration buildings, hardstand and laydown areas, car parking, wash bays, and other associated infrastructure.

MCC is seeking approval to continue open cut mining operations within the MCCM mining and exploration tenements for a further 10 years (from 2035 to 2044). Development Consent for the Project is being sought under the State Significant provisions (i.e. Division 4.7) under Part 4 of the NSW *Environmental Planning and Assessment Act 1979*.

The Maules Creek Continuation Project (MCCP) (the Project) would involve a Revegetation Program on large areas of cleared land in the region as an important part of the Project. These revegetation areas, termed the Landscape Revegetation Zones are proposed as part of the Project to:

- Establish approximately 2,300 hectares (ha) of woodland on cleared land (focusing on Category 1 – Exempt Land) within approximately three to five years of Project approval;
- Provide a larger area of native vegetation cover than currently exists in the local region of Leard State Forest following completion of the Project;
- Complement the existing Leard State Forest Regional Strategy by expanding habitat for SAII species adjacent to Leard State Forest and providing linkages between woodland patches/existing conserved areas; and
- Provide a larger benefit (net gain)[1] compared to offsetting alone (i.e. it would be additional/in excess to standard offset/credit requirements).

01.1 Requirements for an Agriculture Impact Assessment

The purpose of this Agricultural Impact Assessment (AIA) is to ensure that applicants, communities and consent authorities have detailed understanding of:

- The agricultural capability and productivity of land subject to the Project;
- The positive contribution that the Project would have on biodiversity and vegetation connectivity in the region;
- Potential impacts of the Revegetation Program and the mine site extension on agricultural land and associated industries; and
- The ways in which potential impacts may be mitigated.

[1] The NSW Biodiversity Offset Scheme sets a standard of no net loss.

01.2 Purpose of Assessment

This AIA has been prepared to support an Environmental Impact Statement (EIS) and refers to the proposed Project. The assessment considers the:

- Likely impacts of the Project on the soils and land capability of the site and surrounds; and
- Compatibility of the Project with other land uses in the vicinity of the development in accordance with requirement of Clause 2.17 of *State Environmental Planning Policy (Resources and Energy) 2021*, paying particular attention to the agricultural land use in the region and of any land use conflicts.

The assessment would consider impacts on agricultural land from the Project including the areas designated for the Landscape Revegetation Zones.

These policies and processes require that an AIA be developed that contains the following general information:

- Detailed assessment of the agricultural resources and production local to the MCCM (Figure 02-1) and surrounds, including identification of the current agricultural enterprises;
- Identification and assessment of the potential impacts of the Project on agricultural resources or industries;
- Consideration of any changes in agricultural water resource availability;
- Assessment of socio-economic impacts;
- Development of mitigation measures to minimise adverse impacts on agricultural resources; and
- Consultation with adjoining land users and/or managers and Government Departments.

01.3 Addressing Regulatory Requirements, Policies Guidelines

This section describes the regulatory framework for this AIA including project-specific requirements.

01.3.1 Secretary's Environmental Assessment Requirements and Relevant Agency Advice

The primary objective of this study is to assess the potential agricultural impacts associated with the Project by addressing the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DPE) (now referred to as the Department of Planning, Housing and Infrastructure [DPHI]) on 21 November 2023. Relevant sections of the SEARs are outlined in Table 01-1.

Table 01-1 SEARs relevant to this AIA

Assessment requirements	Section Reference
Key Issues - Land and Soil • *An assessment of the likely impacts of the development on the soils and land capability of the site and surrounds.* • *The compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 2.17 of State Environmental Planning Policy (Resources and Energy) 2021, paying particular attention to the agricultural land use in the region and of any land use conflicts.*	Sections 05, 06, 07 and 08.

In addition, the following agency advice is of relevance (Table 01-2).

Table 01-2 Relevant Agency Advice

Agency	Advice	Section Reference
Department of Primary Industries - Agriculture	Further assessment of cumulative impacts on agriculture from all mining operations and developments in the vicinity of the Maules Creek Continuation Project, as well as an Agricultural Impact Statement that includes consideration of the compatibility of the development with existing agricultural land uses and of land use conflict (e.g. Land Use Conflict Risk Assessment (LUCRA)).	Sections 05, 06, 07 and 08.

01.4 Supporting Studies

The relevant studies undertaken for the Project's EIS, to be read in conjunction with this AIA, include:

- Soils and Land Capability Assessment (Appendix A);
- Air Quality Impact Assessment (the Project EIS Appendix I);
- Noise and Blasting Impact Assessment (the Project EIS Appendix H);
- Landscape and Visual Assessment (the Project EIS Appendix M);
- Surface Water Assessment (the Project EIS Appendix B);
- Groundwater Assessment (the Project EIS Appendix A);
- Road Transport Assessment (the Project EIS Appendix N);
- Social Impact Assessment (the Project EIS Appendix E); and
- Economic Assessment (the Project EIS Appendix K).

02 PROJECT DESCRIPTION

02.1 Project Overview

Compared to the existing approved MCCM, the Project would include the following additional key activities:

- Extension of open cut operations within Coal Lease 375, Mining Lease 1719 and Authorisation 346 to allow mining and processing of additional coal reserves until approximately 31 December 2044;
- Extraction of approximately 117 Million tonnes (Mt) of ROM coal (in addition to the approved MCCM coal resource of 240 Mt of ROM coal);
- Extraction of up to 14 Mtpa of ROM coal (i.e. a 1 Mtpa increase from the currently approved maximum ROM coal mining rate of 13 Mtpa);
- A Revegetation Program to establish approximately 2,300 hectares (ha) of native woodland in the vicinity of the MCCM (i.e. in addition to any offset and rehabilitation obligations);
- An increase in operational work force to an average of approximately 940, people with a peak operational workforce of approximately 1,030 people;
- Continued operation of the existing CHPP and train load-out and rail spur infrastructure, with upgrades as required;
- Continued transport of up to 12.4 Mtpa of product coal via rail (i.e. no change to the currently approved maximum product coal transport rate);
- Development of an integrated waste rock emplacement landform that incorporates geomorphic design principles;
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- Upgrades to workshops, electricity distribution and other ancillary infrastructure;
- Continued placement of coarse rejects within the mined out voids and the out-of-pit overburden emplacement areas;
- Construction and operation of a water transfer pipeline between the MCCM water pipeline network and the approved Vickery Coal Mine (VCM) to Tarrawonga Coal Mine (TCM) pipeline;
- Ongoing exploration activities; and
- Other associated infrastructure, equipment and activities.

The indicative Project general arrangement is provided on Figure 02-1.

02.2 Location

The Project site is located 42 km south-east of Narrabri, within the North West Local Land Services (LLS) (North West Region) region.

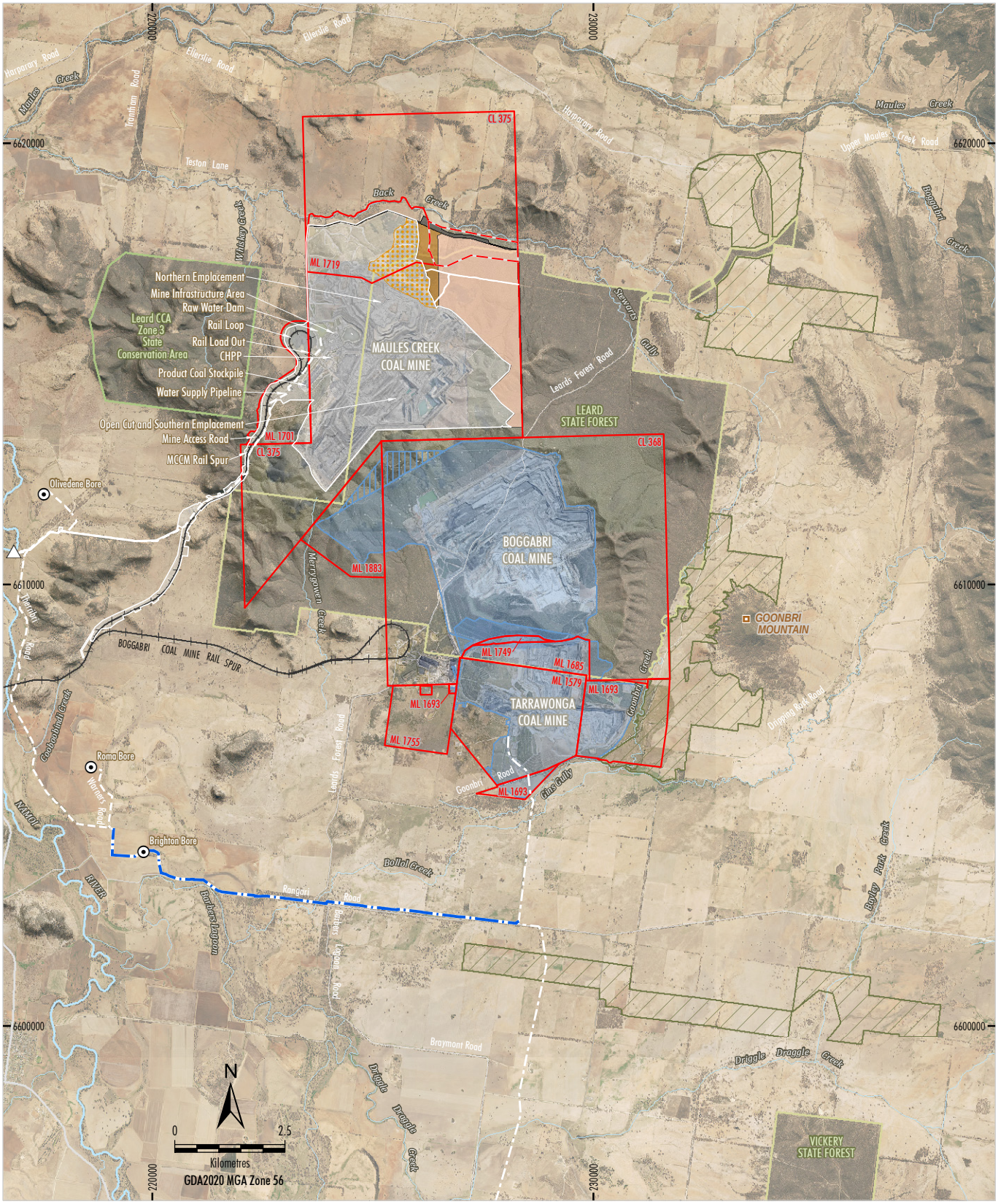
02.3 Study Area

This report focuses on areas of agricultural land that would be impacted by the Project. These areas are described as: Landscape Revegetation Zone 1 (Zone 1); Landscape Revegetation Zone 2 (Zone 2) Landscape Revegetation Zone 3 (Zone 3); and the Mined Agricultural Area (Zone 4) herein collectively referred to as the Study Area and illustrated on Figure 02-2. This assessment does not require consideration of the component of the Project located in State Forest and the Water Transfer Pipeline as these components would not have impact on agricultural capabilities.

The Study Area consists exclusively of Whitehaven managed agricultural land which is currently being leased, with the exception of Zone 4 which is not currently being leased for agricultural production. It should be noted that while Zone 4 is not currently leased for agricultural purposes the land has the capability to support agricultural activities. Therefore, this AIA has assessed the impacts of the Project in Zone 4. The Study Area is primarily grazing land with some areas of grain cropping, and some areas that abut Leard State Forest.

Land use and land production capability in the Study Area was assessed through interviews with former land holders (now current land managers) as well as land managers leasing Whitehaven-managed properties; review and analysis of existing soil mapping data; and assessment of local and regional agricultural data.

The approximate extent of the Landscape Revegetation Zone is 2,300 ha (Figure 02-1). However, for the purposes of this AIA, a broader, conservative footprint (approximately 2,370 ha) has been considered and incorporates features such as such dwellings and tracks (which are not included in the approximate extent of the Landscape Revegetation Zones). An additional 86 ha of agricultural land would be disturbed by an extension of mining activities. This AIA considers the combined impact area of the Landscape Revegetation Zones and mining disturbed agricultural land together, a total of approximately 2,456 ha (Figure 02-2).



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LEGEND

- Rail Line
- State Conservation Area
- State Forest
- Mining Tenement Boundary (ML and CL)
- Provisional Mining Lease Application Area
- Other Mining Operation *
- Other Mining Operation - Proposed *
- VCM to TCM Water Transfer Pipeline

Existing/Approved MCCM Development

- Approximate Extent of Existing/Approved Surface Development
- MCCM Water Supply Pipeline
- MCCM Groundwater Supply Bore
- MCCM Namoi River Pump Station

Maules Creek Continuation Project

- Indicative Go-line, Access and Infrastructure Area
- Indicative Open Cut Extension Area
- Indicative Overburden Emplacement Extension
- Existing Overburden Rehabilitation to be Disturbed
- Indicative Landscape Revegetation Zones#
- Indicative Water Transfer Pipeline (Proposed)

Source: NSW Spatial Services (2024)
Orthophoto Mosaic: Whitehaven (2019-2024)

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MAULES CREEK CONTINUATION PROJECT

General Arrangement of the Project

** BCM boundary digitised from Figure 1 of the BCM Modification 10 Scoping Letter.*

#Landscape Revegetation Zones shown on this figure are approximate extents only.

Figure 02-1

Figure 02-2 The Study Area

03 CONSULTATION

03.1 General Consultation

The existing MCCM has been operating since 2014. In this time considerable community and stakeholder consultation has been undertaken. Community engagement is undertaken through the following mechanisms:

- A dedicated website (https://whitehavencoal.com.au/our-business/our-assets/maules-creek-mine/);
- MCCM Community Consultative Committee (CCC) meetings (with meeting minutes provided on the Whitehaven – MCCM website and emailed directly to interested stakeholders);
- Maintenance of CCC member details and contacts; and
- Community newsletters.

03.2 EIS-specific Consultation

MCC has undertaken consultation with stakeholders in regard to the Project. This has included:

- Briefings to the CCC;
- Interviews, letter correspondence and meetings with Federal, State and Local Government Agencies, surrounding Mining Operations, infrastructure owners, service providers and public stakeholders; and
- Distribution of community Factsheets in June 2023, December 2023 and January 2025 to inform the local community about the Project.

03.2.1 Summary of Land Manager Interviews

Four land managers were interviewed for an on-ground assessment of the agricultural productivity of the Study Area, these are outlined in Section 06. No interviews were conducted for Zone 4 as the land is not currently being leased, given its proximity to the current mining operations.

Land managers within the Study Area, excluding Zone 4, sourced agricultural supplies from two local supplies. Any livestock were sold at the Gunnedah Saleyards or feedlots for cattle, and sheep were sold to the Tamworth sheep saleyards. Grains were primarily sold at Narrabri and Boggabri grain corporations.

A summary of livestock and cropping outputs for Zones 1 to 3 are outlined in Section 07.

04 REGIONAL AGRICULTURE OVERVIEW

04.1 North West LLS Region

The Project is situated in the Narrabri Shire Council Local Government Area (LGA) in the North West Region (Figure 04-1).

The North West Region is located in north west NSW and covers an area of approximately 82,000 square kilometres (km^2) (Figure 04-1). The North West Region includes the major towns of Narrabri, Moree, Gunnedah and Tamworth, falls predominantly within Kamilaroi/Gomeroi Nation country, and has a population of 113,000 residents. Major industries include agriculture, large retail centres, mining and tourism. The North West Region comprises seven LGAs: Gunnedah, Gwydir, Liverpool Plains, Moree Plains, Narrabri, Tamworth and Walgett (NRM Regions Australia, n.d).

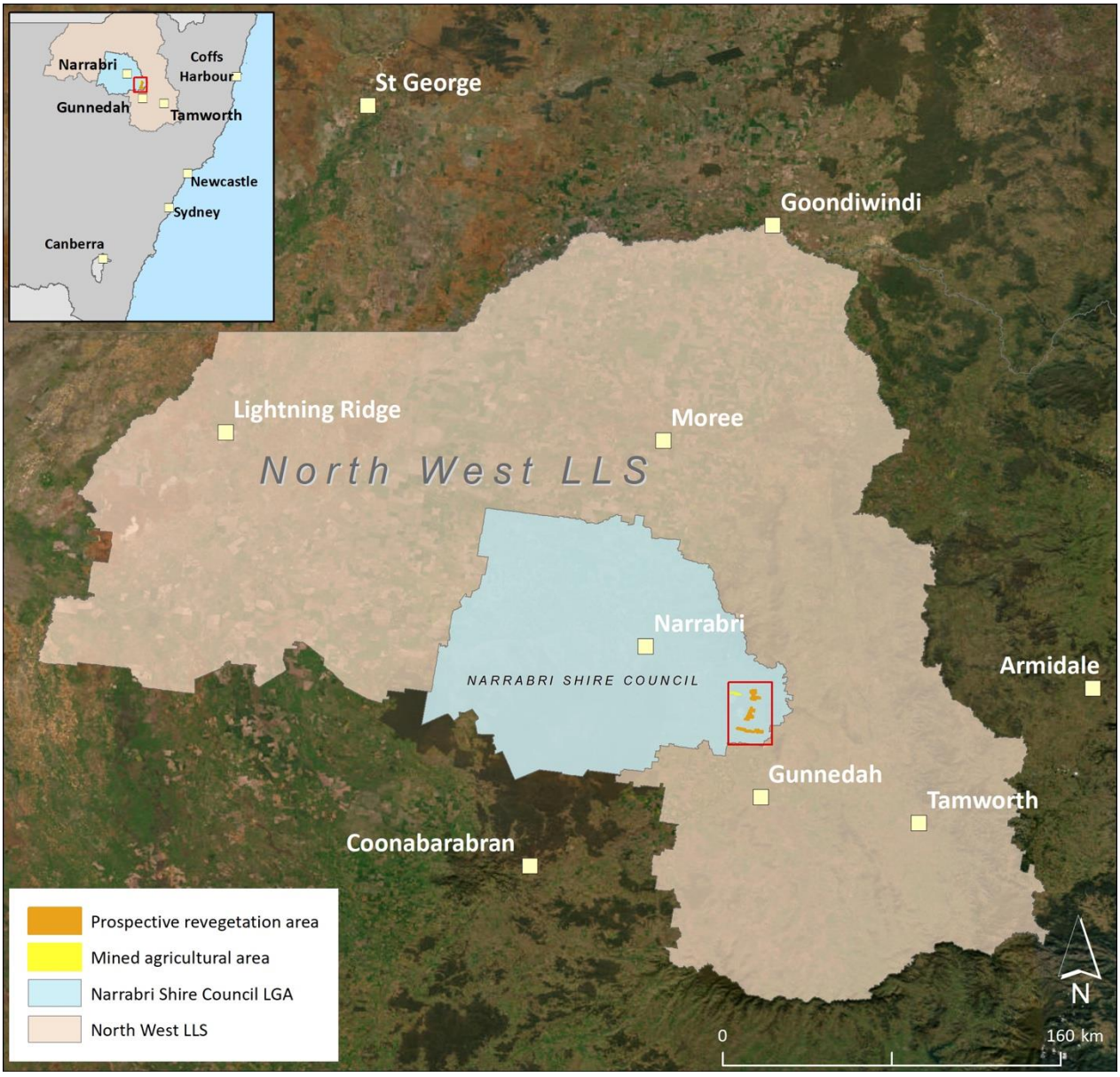

Figure 04-1 North West Region with regional location of the Narrabri Shire Council LGA, Landscape Revegetation Zones and mined agricultural area

Agriculture is a key industry for the North West Region and contributes approximately 8% of annual value of agricultural production in NSW. The North West Region produces approximately 15% of cattle and calf production in NSW (NSW Department of Primary Industries [DPI], 2021). In terms of Gross Value of Production (GVP), cattle and calf production are the main agricultural industry, in addition to significant contributions from cotton production (NSW DPI, 2021). Other agricultural activities include cropping, grazing and livestock products.

During 2019-20, agriculture in the North West Region generated 962,741,643 dollars ($) GVP (Table 04-1). There were 6,214,393 ha under agricultural production across 2,688 agricultural businesses (Table 04-2). Cattle production, the majority as beef, was undertaken across 1,934 agricultural businesses and comprising approximately 683,008 head. Sheep production was carried out by 722 businesses with approximately 1,152,745 head for both wool and meat production. Cropping was undertaken on 2,248,294 ha and comprised mainly cereals, cotton and fodder crops (Australian Bureau of Statistics [ABS], 2024a-g).

Table 04-1 Value of Agricultural Commodities produced in the North West Region 2019-20 (NSW DPI, 2021)

Commodity Description	GVP ($)
Total primary industries	962,741,643
Livestock products – Milk	25,404,775
Livestock products – Wool	38,928,239
Livestock slaughtered and other disposals – Cattle and Calves	402,436,140
Livestock slaughtered and other disposals – Poultry	54,094,360
Livestock slaughtered and other disposals – Sheep and Lambs	72,896,080
Cropping – Wheat	76,796,343
Cropping – Barley	33,972,363
Cropping – Cotton	102,180,866
Cropping – Oats	15,614,237
Cropping – Sorghum	23,410,835
Other agricultural commodities	117,007,405

GVP = value of production at the point of sale (i.e. where it passes out of the agriculture sector of the economy).

Table 04-2 Agricultural Commodities and production in the North West Region 2021-22 (Australian Bureau of Statistics [ABS], 2024a-g)

Commodity Description	Area (ha)	Estimate (no.)/ Production (t)	Number of Agricultural businesses
North West Region Area of Agricultural Land – Total	6,214,393	-	2,688
Livestock – Cattle – Total cattle	-	683,008	1,934
Livestock – Sheep and lambs – Total	-	153,780	722
Crops – Total crops (including cereals and other crops, hay, silage and horticulture)	2,248,294	-	1,925
Cereal crops – Wheat for grain	1,153,842	3,592,205	1,150
Cereal crops – Oats for grain	41,869	45,173	433
Cereal crops – Barley for grain	404,908	57,214,913	838
Cereal crops – Sorghum for grain	123,611	489,345	367
Cereal crops – Maize for grain	3,101	27,937	27
Cereal crops – Rice for grain	16.87	60.25	1.2
Hay and silage – Total pasture, cereal and other crops cut for hay and silage	38,228	252,833	634

04.2 North West Plains Subregion

The North West Plains Subregion comprises Moree Plains, Narrabri, Gunnedah and Liverpool Plains LGAs, and covers approximately 40,990 km^2 (NSW DPI, 2020; Figure 04-2). According to ABS data, the Narrabri Shire Council contributes to 22.6% (i.e. approximately $375 million) of the North West Regional agricultural GVP, the largest producer being $327.18 million for broadacre cropping, $32.6 million from beef cattle, and $4.61 million for wool production (NSW DPI, 2020). Production presented in the Narrabri LGA (Figure 04.2) is higher than that shown in North West Region (Table 04.1). The difference in production is primarily attributed to the use of varying years and in how production groups were categorised and collated.

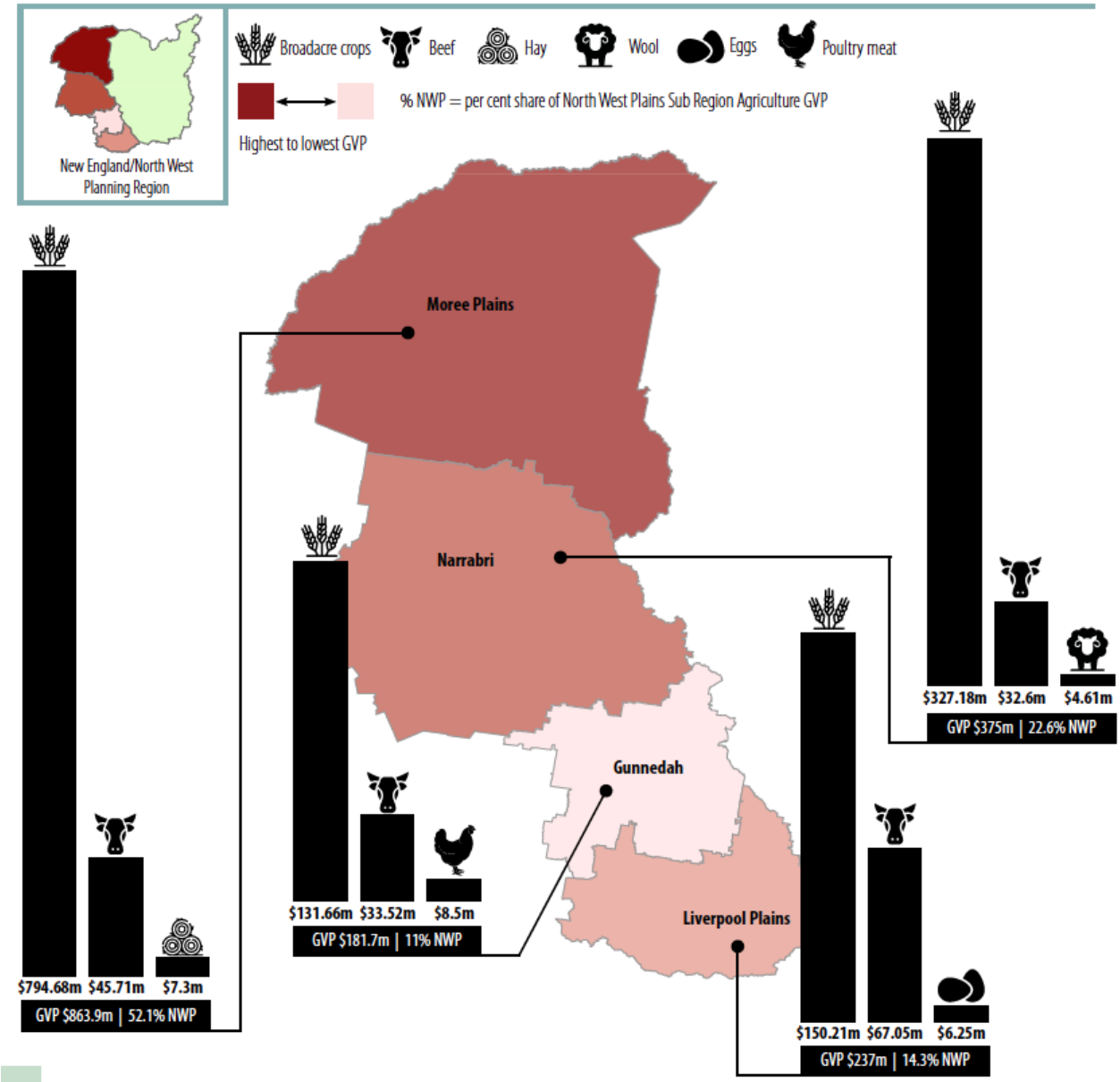

Figure 04-2 North West Plains Subregion production snapshot (NSW DPI, 2020)

04.3 Narrabri Shire LGA

The Narrabri Shire LGA covers an area of 13,000 km^2 and supports a population of 12,703 people (ABS, 2024). The Narrabri Shire LGA is dissected by the Newell and Kamilaroi Highways (Narrabri Shire Council, 2024a). The major towns within the Narrabri Shire LGA include Narrabri, Wee Waa and Boggabri and other smaller towns including the Pilliga, Gwabegar, Bellata, Edgeroi, and Baan Baa.

The Narrabri Shire LGA comprises a range of industry sectors including agriculture, mining, retail, healthcare, and construction (Narrabri Shire, 2024b).

In 2021, the agriculture, fisheries and forestry sector accounted for 18.4% of employment, followed by health care and social assistance at 11.1% and mining at 8% (ABS, 2024a). The Narrabri Shire LGA provides continued expansion of employment opportunities in the mining sector, having grown from 5.5% to 8% of total employment between 2016 and 2021 (ABS, 2024a). The Narrabri Shire LGA contains areas of highly productive agricultural land.

REMPLAN collates data from ABS 2021 Census Place of Work Employment (Scaled), ABS 2021/2022 National Input Output Tables, and ABS June 2023 Gross State Product to estimate the regional output. From the combined data sources analysed for the Narrabri Shire LGA, Table 04-3 shows that mining contributed 62.3% of the Narrabri Shire LGA's output (approximately $3.5 billion), and agriculture, forestry and fishing contribute 9.2% (approximately $519 million).

Table 04-3 Narrabri Shire LGA gross revenue generated by businesses across industry sectors (REMPLAN, 2024)

Industry sector	Narrabri Shire LGA	
	Dollars ($)	Contribution to the region (%)
Mining	3,533,603,000	62.3
Agriculture, Forestry and Fishing	519,578,000	9.2
Construction	276,497,000	4.9
Manufacturing	227,063,000	4.0
Rental, Hire and Real Estate Services	193,865,000	3.4
Health Care and Social Assistance	124,504,000	2.2
Public Administration and Safety	111,484,000	2.0
Transport, Postal and Warehousing	110,631,000	2.0
Electricity, Gas, Water and Waste Services	87,268,000	1.5
Education and Training	78,769,000	1.4
Professional, Scientific and Technical Services	72,072,000	1.3
Retail Trade	64,925,000	1.1
Other Services	52,709,000	0.9
Wholesale Trade	48,492,000	0.9
Accommodation and Food Services	43,032,000	0.8
Administrative and Support Services	39,509,000	0.7
Financial and Insurance Services	39,442,000	0.7
Information Media and Telecommunications	37,814,000	0.7
Arts and Recreation Services	9,831,000	0.2
Total	**$5,671,088,000**	**100%**

04.4 Local and region environment

04.4.1 Climate

The Project lies within North West Slopes bioregion. This area is characterised by an overall warm temperate climate consisting of hot summers with cool, dry winters.

Representative climate data for the area has been obtained from the Bureau of Meteorology (BOM) weather station located at Tamworth Airport AWS (Site Number 055325). This indicates a local mean annual rainfall of 653.1 mm, typically falling across 60.9 days (Table 04-). November shows the highest mean rainfall of 83.1 mm (Figure 04-3). Temperatures range from -6.6 degrees Celsius (ºC) to 41.5 ºC, with July typically the coldest month and January the warmest (Figure 04-4).

Table 04-4 Bureau of Meteorology statistics for Tamworth Airport AWS (055325). Temperature and rainfall data from 1992 to 2025 (BOM, 2025)

Description	Parameter
Mean maximum temperature of hottest month (January)	33 ºC
Mean minimum temperature of hottest month (January)	17.7 ºC
Highest recorded temperature (January 2014)	41.5 ºC
Mean maximum temperature of coolest month (July)	16.5 ºC
Mean minimum temperature of coolest month (July)	2.3 ºC
Lowest recorded temperature (July 2011)	-6.6 ºC
Mean annual rainfall	653.1 mm
Mean number of rain days (> 1mm)	60.9

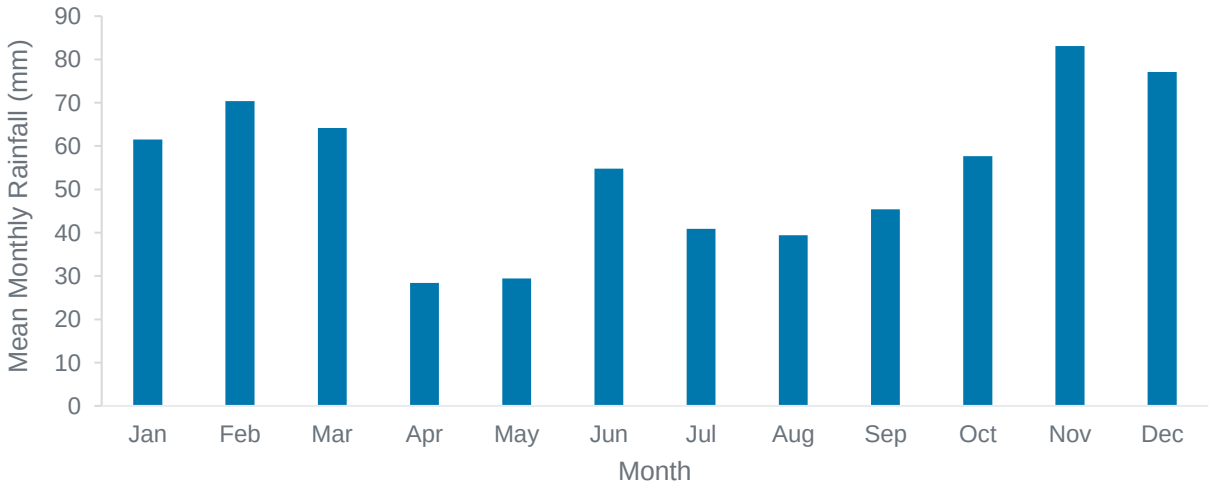

Figure 04-3 Mean monthly rainfall for years 2001 to 2024 recorded at Tamworth Airport AWS (055325) (BOM, 2025)

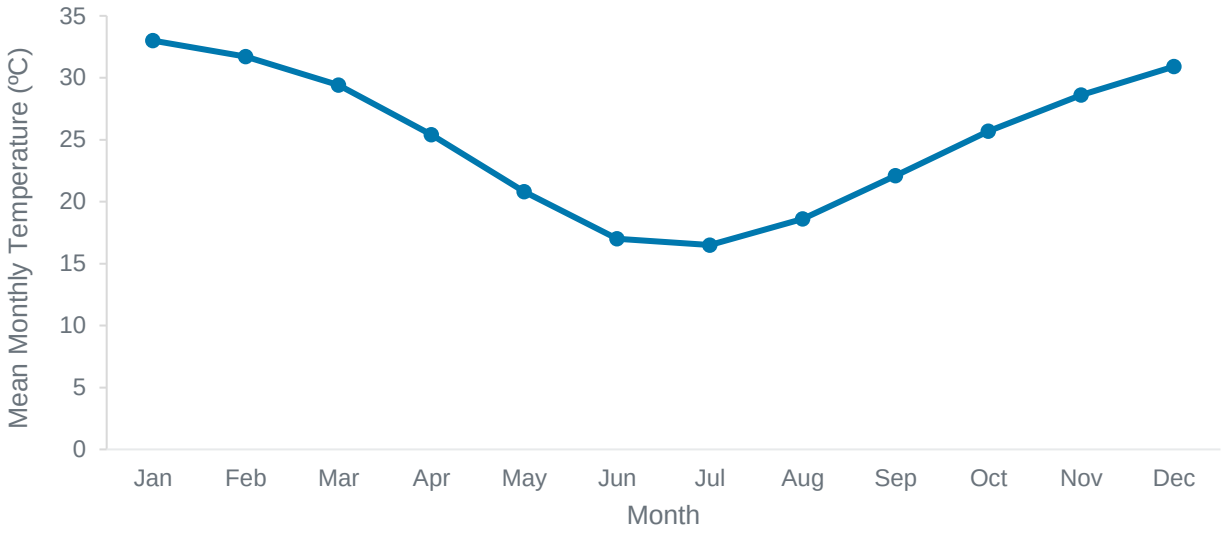

Figure 04-4 Mean monthly temperature for years 2001 to 2024 (maximum) recorded at Tamworth Airport AWS (055325) (BOM, 2025)

05 SITE RESOURCES – REGIONAL INFORMATION

To understand the nature of the agricultural land that would be impacted by the Project, a combination of desktop assessment, site inspection and landholder consultation was undertaken. This chapter presents the information gathered from regional or state datasets and information.

05.1 Study Area Land Description

The Study Area is primarily covered by two agricultural land uses, grazing and cropping. This report focuses on those areas of agricultural land that would be impacted by the Project (Figure 05-1). These areas are described as: Landscape Revegetation Zone 1 (Zone 1); Landscape Revegetation Zone 2 (Zone 2); Landscape Revegetation Zone 3 (Zone 3); and Mined Agricultural Area (Zone 4).

It is noted that the area presented in Table 05-1 for each zone represents the areas shaded in Figure 05-1.

Native vegetation across all zones has largely been historically extensively cleared and introduced pasture species sown for grazing production (Table 05-1). Sections of each zone are occasionally sown with crops generally for fodder (Figure 05-1).

Maules Creek Sub-basin forms the underlying geology of the area (AGE, 2021). This comprises a volcanic basement overlain by sedimentary coal measures and near surface alluvial sediments. Outcrops of the basement Boggabri volcanic layers form ridges that separate the western Mullaley sub-basin. Aside from these ridgelines, the topography is gently undulating. Soils in the area are predominantly chromosols and sodosols. Although native vegetation has been extensively cleared, a mixture of grassy and shrubby open woodland of *Eucalyptus albens* (White Box) and *Callitris glaucophylla* (Cypress Pine) remains (Cumberland Ecology, 2011).

Table 05-1 Land use types by area (ha) for each Zone. Data sourced from Land Use Mapping (NSW Government, 2023)

Land use	Zone 1 (ha)	Zone 2 (ha)	Zone 3 (ha)	Zone 4 (ha)	Total Area (ha)
2.1.0 Grazing native vegetation	37.2	65.0	16.8	37.9	156.9
2.2.0 Production native forests*	0.0	0.0	-	0.4	0.4
3.2.0 Grazing modified pastures	16.2	339.8	401.9	-	757.9
3.3.0 Cropping	794.2	362.5	337.2	46.8	1,540.8
5.8.1 Mines*	-	-	-	0.7	0.7
Total	**847.7**	**767.3**	**755.8**	**85.8**	**2,456.7**

Note - Potential for variation due to differences between actual land management/use and regional mapped data.
** As these areas are unable to support agricultural production, they have not been considered in the overall AIA.*

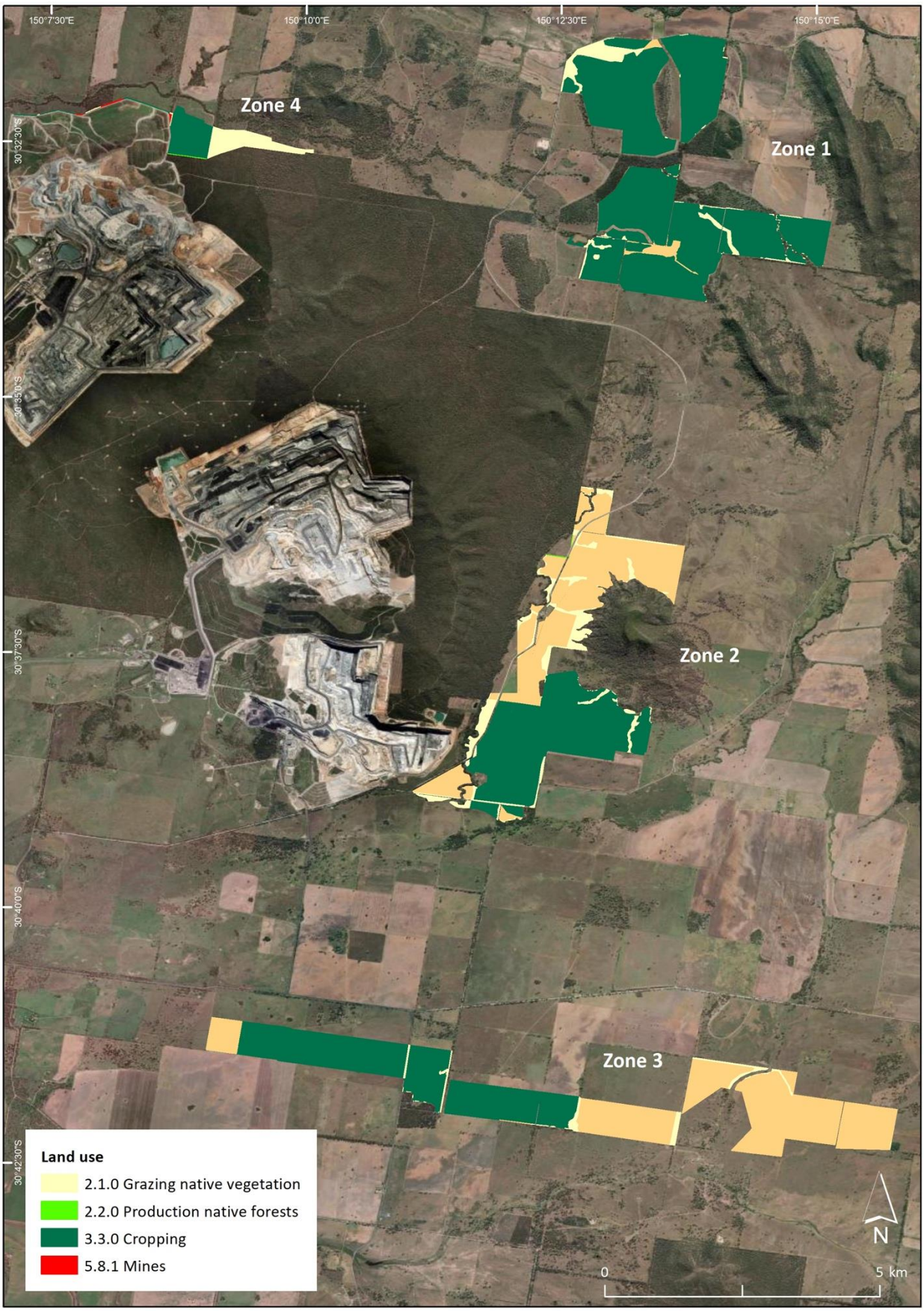

Figure 05-1 Land use within the Study Area (NSW Government, 2023)

05.2 Site Topography

The Study Area is located in the southeast portion of the Northern Inland Catchments bioregion. An area characterised by floodplains and low hills; the Landscape Revegetation Zones lie in the lower regions with elevation ranging from approximately 250 – 450 metres Above Sea level (Australian Height Datum) (Table 05-2; Figure 05-2). Slopes are generally lower than 3 degrees (º), with all zones having a slope of < 12 º on average (Table 05-2; Figure 05-2).

The slopes for the area were generated using the SRTM-derived 1 Second Digital Elevation Model (DEM) Version 1.0, which offers a 30 m resolution DEM for Australia. This dataset captures elevation variations with vertical accuracy typically around 16 m, depending on the region, enabling reliable slope calculations across the terrain.

Table 05-2 Site slope of each Zone area (ha)

Slope range (º)	Zone 1 (ha)	Zone 2 (ha)	Zone 3 (ha)	Zone 4 (ha)	Total (ha)
0 – 2.99	814.0	613.0	755.3	85.1	2,267.5
3 – 5.99	32.5	136.7	-	0.5	169.7
6 – 12	1.2	16.9	-	-	18.1
Total	**847.7**	**766.6**	**755.3**	**85.6**	**2,455.2**

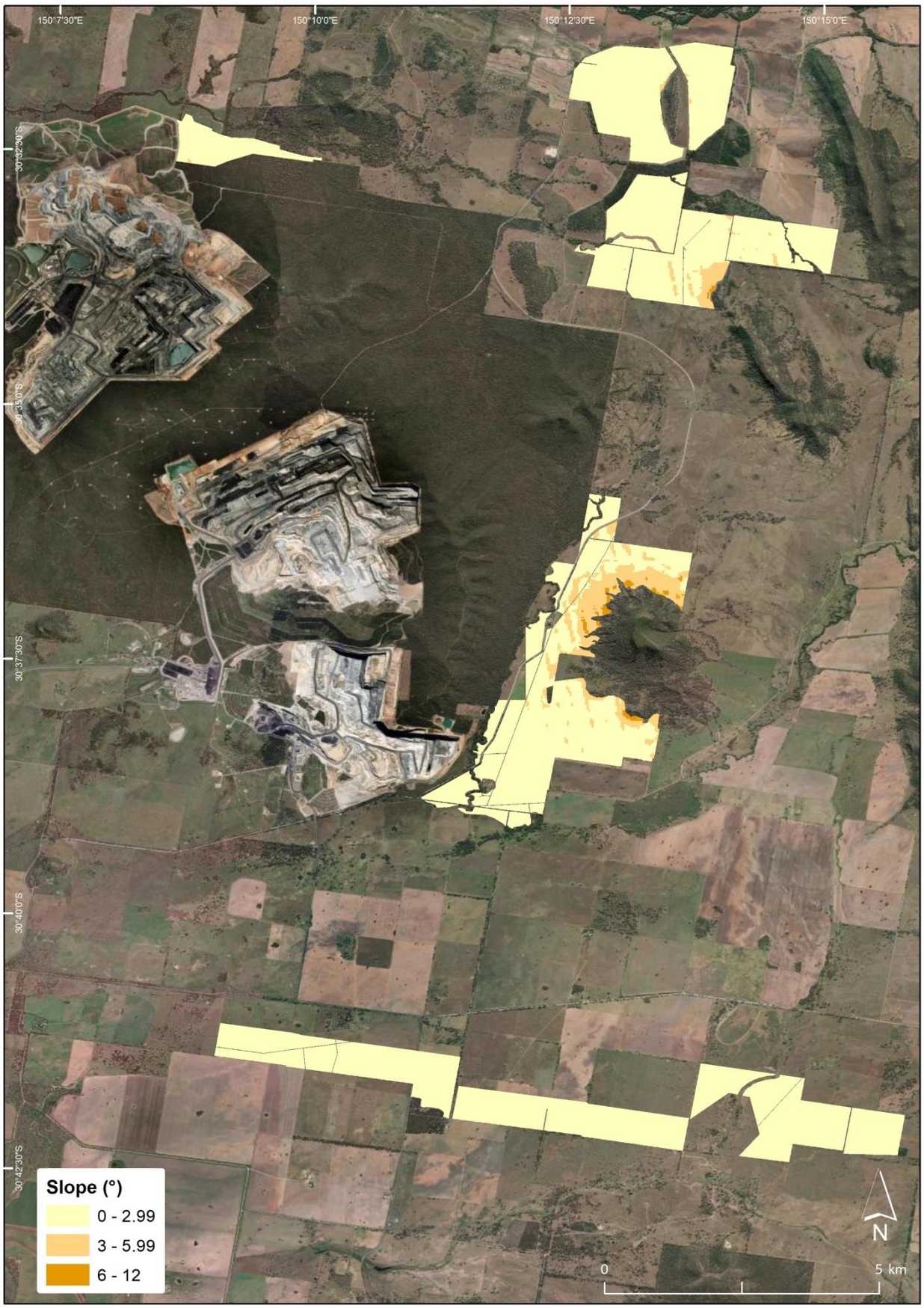

Figure 05-2 Study Area slope

05.3 Soil Fertility

NSW regional mapping (DPIE, 2021b) provides an estimate of the inherent fertility of soils in NSW. It uses the best available soil and natural resource mapping developed for the Land and Soil Capability (LSC) dataset. The mapping describes soil fertility in NSW according to a five-class system: Low (1), Moderately low (2), Moderate (3), Moderately high (4), High (5).

The Study Area predominantly contains Moderately low fertility (2) and Moderate fertility (3) (Table 05-3; Figure 05-3).

Table 05-3 Inherent soil fertility of each Zone area (ha). Data sourced from Estimated Inherent Soil Fertility of NSW (NSW Government, 2013a)

Inherent Soil Fertility	Zone 1 (ha)	Zone 2 (ha)	Zone 3 (ha)	Zone 4 (ha)	Total (ha)
Moderately low	640.9	455.7	-	85.2	1,181.8
Moderate	207.5	311.6	755.8	0.6	1,275.4
Total	**848.4**	**767.2**	**755.8**	**85.8**	**2,457.3**

Figure 05-3 Study Area soil fertility (DPIEb, 2021)

05.4 Soil Type

The soil mapping shows that the Study Area contains four Greater Soil Group Names (DPIE, 2021). The predominant soils are Solodic soils (48%) and Grey, Brown and Red Clays (42%) in the Study Area (Table 05-4; Figure 05-4).

A Project BSAL Site Verification Assessment (SVA) was undertaken by Minesoils between February 2023 and January 2024, in accordance with the Interim Protocol for site verification and mapping of biophysical strategic agricultural land (OEH and the Office of Agricultural Sustainability and Food Security, 2013) (Interim Protocol). A Site Verification Certificate issued on 29 April 2024 verified the relevant Project Mining Area is not BSAL. Therefore, there is no verified BSAL within Zone 4. Based on DPIE (2016) data no BSAL has been regionally mapped within the Study Area (Figure 05-4).

Table 05-4 Australian Soil Classifications within the Study Area. Data sourced from the Great Soil Group (GSG) Soil Type map of NSW (NSW Government, 2025)

Greater Soil Group Names	Zone 1 (ha)	Zone 2 (ha)	Zone 3 (ha)	Zone 4 (ha)	Total Area (ha)	Total % of all Zones
Grey, Brown and Red Clays	15.1	253.1	755.8	0.6	1,024.6	**41.7**
Non-Calcic Brown Soils	192.4	58.5	-	-	250.8	**10.2**
Solodic Soils	640.9	455.7	-	85.2	1,181.8	**48.1**
Total	**848.4**	**767.3**	**755.8**	**85.8**	**2,457.3**	**100.0**

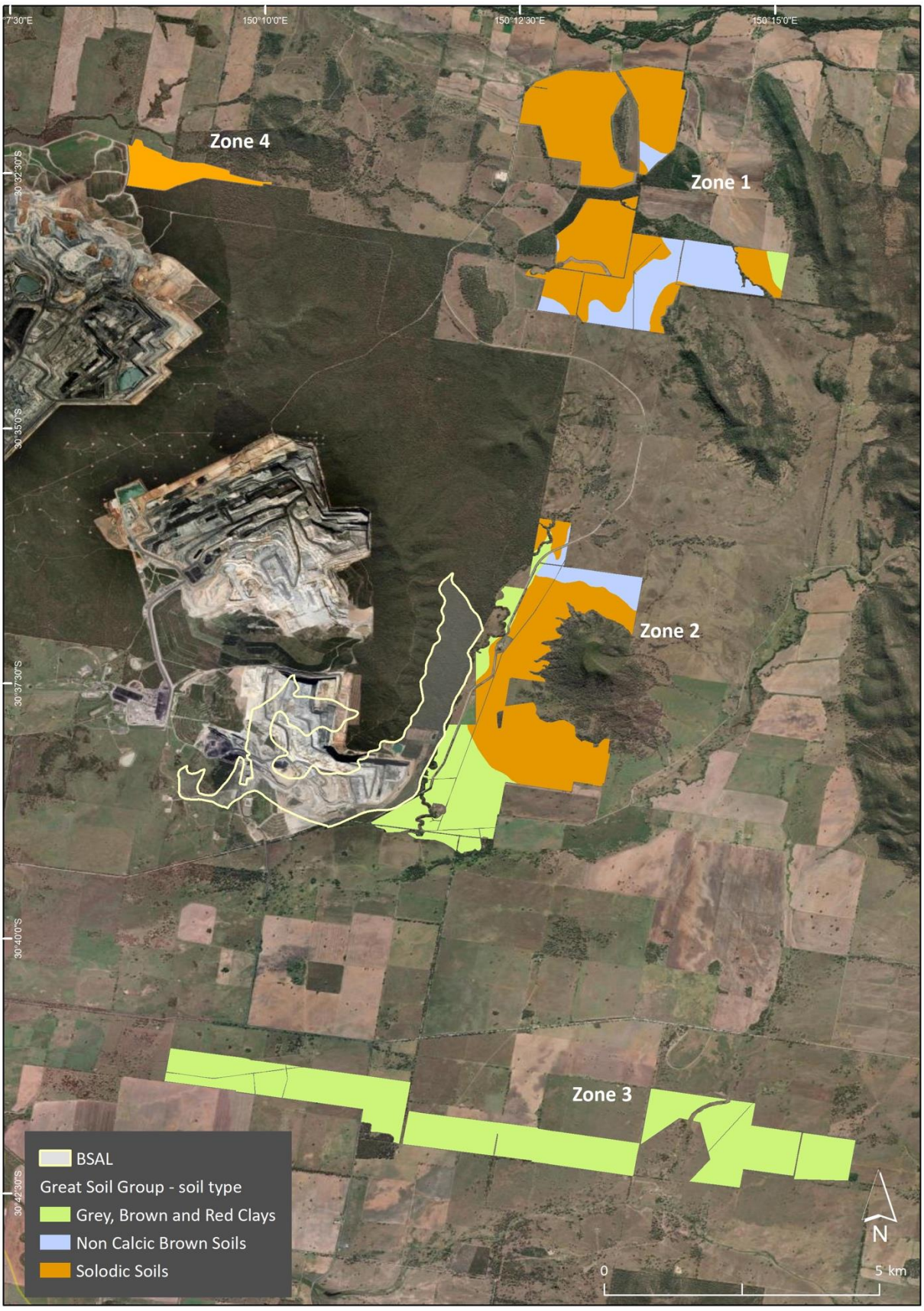

Figure 05-4 Australian Soil Classifications (DPIE, 2021) within the Study Area and nearby Regionally Mapped BSAL (DPIE 2016)

Land and Soil Capability Assessment

The LSC assessment applied to the Study Area was in accordance with the NSW Office of Environment and Heritage (OEH) guideline *The Land and Soil Capability Assessment Scheme; Second approximation* (OEH, 2012) (referred to as the LSC Guideline). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land, based on the severity of long-term limitations (Table 05-5).

Table 05-5 Land and Soil Capability Classes relevant to the Study Area (OEH, 2012).

LSC Class	Capability Description
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land:** Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land:** Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.

LSC mapping shows the area contained within Zones 1-4 are LSC 4 (moderate land capability) and 5 (moderate-low land capability) as show in Table 05-6 and Figure 05-5.

Table 05-6 Verified presence of LSC Classes within the Study Area. Data retrieved from Land and Soil Capability Mapping for NSW (NSW Government, 2013b)

LSC Class	Zone 1 (ha)	Zone 2 (ha)	Zone 3 (ha)	Zone 4 (ha)	Total area (ha)	Total % of all Zones
LSC 4: Moderate capability land	207.5	311.6	755.8	35.0	1309.9	53.3
LSC 5: Moderate-low capability land	640.9	455.7	-	50.8	1147.4	46.7
Total study area	**848.4**	**767.2**	**755.8**	**85.8**	**2457.3**	**100**

Figure 05-5 Land and Soil Capability of the Study Area (OEH, 2012)

06 SITE RESOURCES – LAND MANAGER SURVEYS

06.1 Land manager agricultural productivity surveys

Site specific agricultural production information was collected through surveys with current and past landholders and land managers. This chapter presents the information gathered and derived from this survey information. It should be noted that at the time of survey, the precise area of revegetation proposed for the project was sensitive and land managers likely provided information from broader land areas in some cases leading to higher estimates of potential agricultural production. In addition, land managers were asked to consider production potential in relatively good years, rather than longer term average years. To provide a conservative estimate of the impact of the Project on potential agricultural production these higher production estimates were considered along with the lower production information elicited from regional production data and averages (Section 05).

Prior to Whitehaven's management, the Study Area was owned by multiple landholders. Under Whitehaven's management two previous landholders and two land managers agreed to consultation regarding their agricultural systems and production (Table 06-1). One interview was in-person and over the phone, while the remaining three were undertaken over the phone. Current land managers provided information on productivity within average 'good years'. Land manager survey responses are detailed in Appendix B.

While freehold land within the Study Area is now managed by Whitehaven, portions of the Study Area are currently leased back to original landholders for agricultural production.

No land managers for the 85.8 ha within Zone 4 were surveyed as the land is not currently being leased, given its proximity to the current mining operations.

Table 06-1 Property Name(s), zone and interview method

Zone	Property Name(s)	Interview
Zone 1	Oakleigh	Yes (telephone)
Zone 2	Greenhills and Bollo Creek Station	Yes (telephone)
Zone 3	Kyalla	Yes (in-person and telephone)
Zone 3	Pine Grove, Flixton and Wean	Yes (telephone)

Surveys were undertaken using a semi-structured interview method. Each interview considered the following topics:

- Property history;
- Landholder local experience;
- Key agricultural systems;
- Typical yield/production;
- Major suppliers of materials and services;
- Number of employees;
- Water sources;
- Main markets; and

- Key agricultural infrastructure.

06.2 Zone 1

Land manager interview for Oakleigh Property

Date: 19/12/2024

This property has a land capability in the Moderate to Moderate-low range (LSC 4-5) considered suitable for cropping and grazing. Comments from the previous landholder (also the current lessee) confirm that, prior to Whitehaven's management, grazing sheep and cattle for meat and cropping was undertaken (Appendix B Table B1).

06.2.1 Zone 1 summary

The main agricultural practices in Zone 1 were grazing (Figure 06-1) and cropping (Figure 06-2). Grazers include dorper and merino sheep, and black angus-wagyu cattle.

Figure 06-1 Zone 1 grazing area (4 November 2024)

Figure 06-2 Zone 1 fodder cropping area (4 November 2024)

06.3 Zone 2

Land manager interview for Greenhills Property

Date: 19/12/2024

This property has a land capability in the moderate and moderate-low range (LSC 4-5) considered suitable for cropping and grazing. Comments from the land manager confirm that prior to Whitehaven's management, grazing sheep for meat and cattle, additional to various cropping were undertaken (Appendix B Table B2).

Land manager interview for Bollo Creek Station

Date: 19/12/2024

This property has a land capability in the moderate and moderate-low range (LSC 4-5) considered suitable for cropping and grazing. Comments from the land manager confirm that prior to Whitehaven's management, grazing sheep for meat and cattle, and occasional cropping were undertaken (Appendix B Table B3).

06.3.1 Zone 2 summary

The main agricultural practices in Zone 2 were grazing predominantly by black angus cattle. Zone 2 lies adjacent to a low-lying mountain to the east (Figure 06-3) and Leard State Forest to the west (Figure 06-3). Goonbri Creek runs alongside the western edge of Zone 2 (Figure 06-4).

Figure 06-3 Zone 2 grazing area (4 November 2024)

Figure 06-4 Zone 2 grazing area adjacent to Goonbri Creek (4 November 2024)

06.4 Zone 3

Land manager interview for Kyalla Property

In-person date: 04/11/2024

Telephone date: 17/12/2024

This property has a land capability in the moderate and moderate-low range (LSC 4-5) considered suitable for cropping and grazing. Comments from the land manager confirm that prior to Whitehaven's management, grazing sheep for meat and cattle, and occasional cropping were undertaken (Appendix B Table B4).

Land manager interview for Pine Grove, Flixton and Wean Properties

Date: 07/01/2025

Pine Grove, Flixton and Wean are neighbouring properties which are run as one large property. These properties have a land capability in the moderate and moderate-low range (LSC 4-5) considered suitable for cropping and grazing. Comments from the land manager confirm that prior to Whitehaven's management, grazing sheep for meat and cattle, and cropping were undertaken (Appendix B Table B5).

06.4.1 Zone 3 summary

The main agricultural practices in Zone 3 were grazing predominately by black angus cattle (Figure 06-5) and grain cropping (Figure 06-6).

Figure 06-5 Zone 3 grazing area looking toward Kyalla House (4 November 2024)

Figure 06-6 Zone 3 grain cropping area (4 November 2024)

06.5 Summary Site Inspection and Interviews

Interviews conducted with current land managers in Landscape Revegetation Zones 1-3 were undertaken to assess typical agricultural productivity. There is a relatively small area of impact from the Project in Zone 4 where approximately 85.8 ha of land would be disturbed by mining activities (Figure 05-1).

Agricultural land uses and productivity within the Study Area can be summarised as:

- Grazing sheep for meat, beef cattle and fat lamb production;
- Opportunistic fodder cropping;
- Grain cropping; and
- Water for livestock was sourced from dams, overland flow, and bores.

Landholders within the Study Area sourced agricultural supplies mainly from local suppliers such as:

- Noll Carpenter Agency; and
- James Bradford Rural.
- The above stock and station agents are dual providers for information and equipment and supplies.

Markets used by the interviewed land managers include:

- Gunnedah saleyards;
- Tamworth sheep saleyards; and
- Feedlots in the region.

07 AGRICULTURAL RESOURCE ANALYSIS

07.1 Agricultural Productivity Assessment – Regional Data

Regional production information was used to calculate potential livestock production assuming the Study Area (Zones 1-4) is used to produce livestock (cattle or sheep). An estimate of the current agricultural productivity across the properties was undertaken using available land use, soil capability and regional productivity data. The estimation method considered DSE; a standard animal unit based on stock energy requirement. A 50 kilogram (kg) wether maintaining weight is used as the baseline equivalent to 1 DSE. A DSE can be adjusted in ratio to different classes of stock with varying energy requirements (McDonald, 2022).

Agricultural productivity estimation considered DSE data from NSW Northern Plains (NSW DPI, 2022) and inherent production capability of LSC classes.

Agricultural productivity (livestock) was assessed using the following steps:

1. Derive estimated DSE capability and conversion of optimal stocking rates to DSE/ha;
2. Use NSW DPI gross income data for a range of grazing enterprises including beef feeder and grower cattle and sheep (wool and meat production) $/DSE; and
3. Apply Income $/DSE values to total DSE capacity to obtain estimated potential annual income.

NSW DPI undertook surveys of district agronomists in the NSW Northern Plains region to estimate carrying capacities for pasture types in the region. Results of these surveys were used to estimate DSE/ha. To provide a conservative estimate it is assumed that pasture management across the Study Area consists of a mix of natural pasture and improved pasture with sown grass and legumes. Extensive lucerne and intensive lucerne (rotationally grazed) has been excluded as an income as this form of production is only possible intermittently within the NSW Northern Plains region and it is assumed that fodder is used for supplementary feeding on farm rather than for sale. Based on data estimates for the NSW Northern Plains provided by NSW DPI (2022) natural pastures have an estimated range of 0.3 to 2.0 DSE/ha and improved pastures (sown grass and legume) has an estimated range of 0.8 – 2.5 DSE/ha.

It is considered that the likely enterprise mix includes beef cattle and Dorper sheep. Gross Margin (GM) or income per DSE was estimated through examination of the most recent NSW DPI (2024) annual Gross Margin Income per Dry Sheep Equivalent ($GM/DSE) values for each enterprise, namely:

- Beef Cattle (feeder steers) (October 2024);
- Grow out steers to feedlot weights (October 2024); and
- Dorper Ewes (self-replacing herd) (September 2022).

Income values ($GM/DSE) were applied to DSE to obtain estimated potential annual income for each enterprise type accounting for the pasture type and their low and high DSE/ha ranges. Table 07-1 summarises findings for potential annual income for each pasture and enterprise type. For natural pasture the lowest low potential annual income was $29,165 and the highest high potential annual income was $248,950. For improved pasture the lowest low potential annual income was $77,775 and the highest high potential annual income was $311,188.

Table 07-1 Annual potential income for livestock production based on a range of estimated DSE and DPI Gross Margin Budgets

Potential Enterprise	DPI Estimate GM$/DSE	Low DSE in Study Area (ha)	High DSE in Study Area (ha)	Low Potential Annual Income ($)	High Potential Annual Income ($)
Natural Pasture					
Beef Cattle (feeder steers)	52	737	4,915	38,443	256,289
Grow out steers to feedlot weights	41			30,532	203,547
Dorper Ewes (self-replacing herd)	53			39,092	260,615
Improved (Sown Grass and Legume) Pasture					
Beef Cattle (feeder steers)	52	1,966	6,144	102,516	320,361
Grow out steers to feedlot weights	41			81,419	254,433
Dorper Ewes (self-replacing herd)	53			104,246	325,768

Possible production value estimates were compared with LGA and NSW agricultural commodities gross domestic product (GDP). Using this method potential annual agricultural production represents approximately 0.01% to 0.05% of agricultural production in the LGA and 0.001% to 0.006% of agricultural production for NSW for natural pastures. Improved pastures have a higher production potential and may contribute approximately 0.02% to 0.07% of agricultural production in the LGA and 0.002% to 0.008% of agricultural production for NSW (Table 07-2).

Table 07-2 Annual agricultural livestock production in relation to the LGA and State scale as calculated from pasture type and highest and lowest potential annual income

Range of potential annual income ($)	% of LGA Agricultural Commodity GDP 2021 (ABS, 2024a-g)	% of NSW Agricultural Commodity GDP 2019-20 (DPI, 2021)
Natural Pasture		
Range: $30,532 - 260,615	0.01 – 0.06	0.001 – 0.01
Improved (Sown Grass and Legume) Pasture		
Range: $81,419 - 325,768	0.02 – 0.07	0.002 – 0.01

07.2 Estimated Value of Agricultural Productivity from Land Manager Surveys

To estimate typical agricultural production of properties within the Study Area from the land manager survey information the following steps were undertaken:

- Assess the historical land use and productivity through land manager surveys. It should be noted that land manager annual production estimates were based on non-drought (relatively good) years and that one former landholder was not available for survey;

- Calculate the possible annual production across the Study Area. This was done for a cattle and fat lamb production type;
- Use historical sales records to estimate the likely value of annual production;
- Divide the likely value of production with the combined property area to estimate the average production value per hectare; and
- Multiply the average production value per hectare by the land area of the Potential Agricultural Impact Area.

To represent the average agricultural productivity over time, the agricultural systems were considered under production types (calves, weaners, lambs, grain cropping) for each Zone (Table 07-3). Calculations considered the combined area of the four land managers interviewed (representing 7 properties). Calculations were based on land managers operating self-replacing herd systems and taking into account typical reproduction rate, survival rate, mortality and fecundity in a good year (DPI, 2020). It must be noted that estimate of agricultural produce (livestock and cropping) might be inclusive of land managers' entire property portfolio, therefore results are generally higher than might be expected from the land area.

Table 07-3 Number and type of stock produced annually at each intersecting property to the Study Area Zones as informed by the land manager interviews

Production Type	Zone 1	Zone 2	Zone 3	Zone 4	Total
Grown Steers (head)	150	47	225	No survey undertaken	422
Yearling Steers (head)	-	120	150		270
Lambs (head)	100	-	-		100
Grain cropping (t)	1,500	-	1,200		2,700

07.2.1 Gross Income Cattle

All cattle were sold through the Gunnedah local saleyards. Gunnedah saleyard data from 2024 was used to calculate the potential value of cattle production within Zones 1-3 (Table 07-4). Average live weights were used by averaging the weights of processor and feeder cattle to estimate live weight values for grown steers at approximately 400 kg per head and yearling steers at approximately 400-500 kg per head (Table 07-4). For cattle weighing 400 kg, value estimates in dollars per head ($/head) were retrieved from Meat & Livestock Australia (MLA) (2025a). These values provide an upper range for potential cattle production within the Study Area. Total gross income was calculated without accounting for ongoing costs such as animal husbandry costs, fencing or feeding.

Collectively across land managers properties, 422 grown steers and 270 yearling steers can be sold in a good year. Table 07-4 shows the potential total gross price of grown steers is a total of $622,787 and yearling steers at a total gross price of $462,019. Therefore, the annual total gross annual income able to be produced from beef cattle production in the Study Area is $1,084,806. A 29% variability exists between land manager-reported cattle production potential and lower regional estimates, as regional data is based on the Study Area (2,456 ha), while land manager data may include livestock sales from the property's entire portfolio.

Table 07-4 Average prices and weights for cattle 400 kg or greater sold at Gunnedah Sale Yards 2024

Category	No. head	Average Price ($/head)	Total Gross Income ($)
Grown Steers	422	1,475.80	622,787
Yearling Steers	270	1,711.18	462,019
-	-	**Total**	**1,084,806**

07.2.2 Gross Income Sheep

All sheep were sold through the Tamworth local saleyards. Sheep production was analysed by estimating annual sheep production from interview information and by relating this to saleyard data (Table 07-5). Saleyard data from the Tamworth Saleyards was used for the 2024 year, and estimates were retrieved from MLA (2025b). These were used to determine the value of potential gross annual income for the properties. Estimates were based on a self-replacing herd system and that lambs were sold at an average weight of 20 kg.

While sheep fecundity, growth rates and market prices are estimates, and total property sizes are unknown, these values provide an upper range of gross income from sheep production of the properties. Total gross income was calculated without accounting for ongoing maintenance costs such as fencing or feeding.

Collectively across land managers properties, 100 lambs (Dorper) can be sold in a good year. Table 07-5 estimates the value of these sales around $11,097 total annual gross income.

Table 07-5 Estimated value of sheep from average prices and weights for categories of sheep sold at Tamworth Saleyards between 2023-24

Category	No. head	Average Price ($/head)	Total Gross Income ($)
Lambs (Dorper)	100	110.97	11,097

07.2.3 Gross Income Grain

All grain was sold via Boggabri or Narrabri Grain Corps. Grain estimates for each grain type were averaged from sales at Boggabri and Narrabri for the 2024/25 cropping season. Estimates were retrieved from GrainCorp (2025). Total gross income was calculated without accounting for costs such as irrigation, seed or fertiliser.

Based on land manager interviews, a total of 2,700 tonne (t) of various grain types per year is able to be produced. For the purpose of estimating total gross income, estimates have been based on the three most likely crops to be harvested. Based on these, sorghum will produce the highest total gross income at approximately $792,450 annually. The average potential annual total gross income of the Study Area is $716,895 (Table 07-6).

Table 07-6 Estimated gross income from grain crops from average prices of grain sold at Narrabri and Boggabri Grain Crops in 2024/25

Grain Type	Total Annual Produced (t)	Average Price per t	Total Gross Income ($)
Barley	2,700	232.30	627,210
Wheat		270.75	731,025
Sorghum		293.50	792,450
		Average	**716,895**

07.3 Comparison of Land Manager Estimated Gross Income with Regional and State Production

Table 07-7 shows that using the estimates provided by current land managers total annual agricultural income in the Study Area is as high as $1.8M which is 0.2% of total value of production in the LGA and 0.03% of NSW.

Table 07-7 Potential gross annual income of each production type across land manager properties in relation to the LGA and State value of agricultural production

Production Type	Potential Annual Income ($)	% of LGA Agricultural Commodity GDP 2021 (ABS 2024)	% of NSW Agricultural Commodity GDP 2019-20 (DPI 2021)
Cattle	1,084,806	0.24	0.03
Sheep	11,097	0.002	0.0003
Cropping	716,895	0.17	0.06
Total	**1,812,798**	**0.2**	**0.03**

08 IMPACT ASSESSMENT

08.1 Nature of Proposed Mining Activities

The Project would involve the continuation of the MCCM, including extraction of additional coal within the MCCM mining and exploration tenements and revegetation of existing cleared land referred to as Landscape Revegetation Zones. Landscape Revegetation Zones would be established on land currently used for agricultural production (Zones 1-3) and mining would disturb approximately 86 ha of agricultural land (Zone 4). The Landscape Revegetation Zones are to be permanent plantings/seeding of native species (trees, shrubs and understorey) designed to improve local and regional biodiversity over the coming decades. While the revegetation is designed to improve regional landscape functionality for native species it would permanently remove those areas for use in agricultural production, for the purposes of this assessment. This AIA considers the combined impact of the Landscape Revegetation Zones (Zone 1-3) and mining disturbed agricultural land (Zone 4) together. The combined area of Zones 1-4 is approximately 2,456 ha.

For the purposes of this assessment, it has been conservatively assumed that the Landscape Revegetation Zones would permanently remove approximately 2,370 ha of land from agricultural production. However, once the woodland has reached maturity, some grazing within the Landscape Revegetation Zones would be possible.

08.2 Changes in Availability and Productivity of Land for Agricultural Use

The Landscape Revegetation Zones would permanently remove approximately 2,370 ha of land from agricultural production, for the purposes of this assessment. An additional 86 ha of land (Zone 4) would be disturbed during mining operation and permanently lost for agricultural use. Works on the Landscape Revegetation Zones would involve minimal impact with surface soils and water systems. Grazing would temporarily be excluded from the Landscape Revegetation Zones while the planted trees establish. Tree planting within the Landscape Revegetation Zones would be seeded with native mid- and under-storey species (shrubs and grasses) and managed to minimise pest species (fauna and flora). The more conservative land use in these areas would increase vegetative cover, decrease soil erosion and increase habitat for native species.

Assessment of agricultural production within the Study Area shows that the area is predominantly used for grazing livestock (cattle and sheep) with approximately 600 ha used for cropping. LSC mapping shows the combined area of all zones comprises LSC 4 and 5. LSC 4 is land of moderate capability and LSC 5 is land of moderate-low capability, both generally suitable for grazing production with occasional cropping (Section 05).

Production estimates show the land is capable of yielding approximately $29,165 per annum (pa) to $1.8M pa (Section 07) in gross income with the wide range indicating different production systems and estimates based on very good years. It is likely that the average value of production is below $1M pa. Using the highest estimate of annual value of production approximately 0.2% of the Narrabri Shire LGA's annual production value or 0.03% of State annual production value would be forgone as a result of the Project.

08.3 Surface and Groundwater

Appendices A and B to the Project EIS show that the Project would have no adverse effects on agricultural water supplies with no impacts expected on surface water or groundwater sources used for agriculture.

08.4 Neighbouring Properties

Appendices H, I, M and N to the Project EIS show no significant impacts on visual amenity, air quality, background noise or local traffic.

The Project would allow for the extraction of additional coal adjacent to the approved MCCM open cut pit within existing mining and exploration tenements.

08.5 Summary of AIA

Evidence from assessment undertaken for the Project show that there is likely to be insignificant impacts to regional agricultural resources and agricultural production as a result of the Project, given appropriate management. The impacts are addressed in Table 08-1.

Table 08-1 Summary of AIA

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Resource			
Soil (Zones 1-3)	Removal from agricultural production.	N/A.	Permanently removed from agricultural production.
Soil (Zone 4)	Loss of agricultural soil.	Progressive backfilling and rehabilitation.	Removed during life of mine. Reconstructed during rehabilitation.
Surface Water	None expected.	Revegetation is likely to improve surface water quality.	No significant impact.
Groundwater	The Project is unlikely to result in a substantial change in the hydrology or quality of groundwater resources.	Progressive backfilling and rehabilitation.	No significant impact to groundwater users in the highly productive alluvial aquifers.
Weeds	Weeds decrease agricultural productivity in adjacent land.	Ongoing weed management in the mine operational and Landscape Revegetation Zones. Weed management procedures to minimise potential risk of weed establishment and spread. Incorporate weed management into routine property management practices.	No significant impact.
Biosecurity	Introduction or spread of agriculturally significant disease or pest (no significant risk anticipated with appropriate management).	Ongoing pest species management. Develop land management practices for the properties to minimise the threat of disease and pest risking property and regional biosecurity. Incorporate biosecurity management into routine property management practices.	No significant impact.

Agricultural Resource, Practice or Infrastructure	Potential Impact	Management or Mitigation	Consequence to Agricultural Productivity
Practice			
Grazing (Zone 1-3)	Loss of grazing land within the Zones1-3.	N/A.	Permanently removed from agricultural production.
Grazing (Zone 4)	Loss of grazing land within Zone 4 during life of mine.	No management or mitigation during life of mine.	Permanently removed from agricultural production.
Cropping (fodder and grain)	Loss of cropping land within the Zones 1-3.	N/A.	Permanently removed from agricultural production.
Infrastructure			
Fences and Gates	Changed infrastructure layout within the Zones 1-3.	Create new infrastructure as required.	No significant impact.
Neighbouring Agricultural Impacts			
Visual Sensitivity	No impact to visual amenity.	Returning landscape to woodland landscapes.	No significant impact.
Noise	No material noise impacts at privately-owned properties used for agricultural production.	Expected minimal noise impacts mitigated through Project design and proactive management.	No significant impact.
Road transport	No significant impact on the capacity, safety, or efficiency of the current road network because of the Project.	Limited to small vehicles or a tractor equivalent as required.	No significant impact.

08.6 Potential Socio-Economic Impacts

Development of the Project is likely to have negligible impact on agricultural productivity within the region. The estimated upper value of annual agricultural production forgone in the Study Area is 0.2% of production in the Narrabri Shire LGA.

Employment impacts are expected to be minimal as the Landscape Revegetation Zones would require establishment and ongoing maintenance that would at least in part offset any employment lost in changing land use.

08.7 Cumulative Impact Assessment

With minimal change in agricultural production at the regional scale, the impact to agriculture due to the Project is considered to be negligible, therefore the Project would not materially contribute to potential cumulative impacts on the regional agricultural industry.

08.8 Addressing the SEARs

The SEARs state the following requirements regarding the AIAs key issues for land and soil:

- *An assessment of the likely impacts of the development on the soils and land capability of the site and surrounds.*

Soil disturbance mitigation measures and management recommendations have been provided as controls to temporary and long-term risk of the Project on land and soil resources (Appendix A). The salvage of available soil material to stripping depths recommended by Minesoils (2025), combined with sound soil management practices during construction and operational phases of the Project, would ensure that the rehabilitation of the Project Mining Area is capable of facilitating the intended post-mining land uses.

- *The compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements of Clause 2.17 of State Environmental Planning Policy (Resources and Energy) 2021, paying particular attention to the agricultural land use in the region and of any land use conflicts.*

Section 08.5 assesses the impacts of the Project to agricultural land use referring to visual sensitivity, air quality, noise and road and transport considerations to determine that there would be no significant impacts to agricultural activities within the vicinity of the Project.

09 CONCLUSION

The Project is located within the Narrabri Shire LGA, NSW. This LGA is encompassed by the North West Region. The project includes rehabilitation of the mine site as well as revegetation of larger areas of cleared land, managed by Whitehaven, within the vicinity of the MCCM.

The Study Area has moderately low to moderate land capability. Cattle and sheep (fat lamb) production are the dominant land uses along with some grain cropping. Using historical information on land use, production and typical values it is estimated that the value of annual agricultural production from within the Study Area is approximately 0.2% of the annual production from the Narrabri Shire Council LGA and approximately 0.03% of the annual production from the State.

Minesoils (2025) verified that no BSAL is present within Zone 4 (the mine extension area in this AIA). Regional BSAL mapping shows no BSAL within the Study Area.

Specialist studies concerning dust, traffic and visual amenity found no significant impact on neighbouring properties or land users (Minesoils, 2025; Whitehaven, 2025). Noise impacts on nearby receivers would be managed in accordance with the proposed pro-active noise management strategy.

This report represents the AIA undertaken to support the EIS for the Project. As such it has drawn upon regional and local datasets, land manager surveys, and relied upon modelling and assessment based on the proposed mine continuation areas and the Landscape Revegetation Zones.

Evidence from the assessment undertaken for the Project, show that there is likely to be insignificant impacts to site/agricultural resources, grazing, cropping, infrastructure and neighbouring agricultural activities relative to the broader North West Region given appropriate management. Therefore, it can be concluded that with minimal change in agricultural production at the regional scale, the impact to agriculture due to the Project is considered to be negligible, hence the Project would not materially contribute to potential cumulative impacts on the regional agricultural industry.

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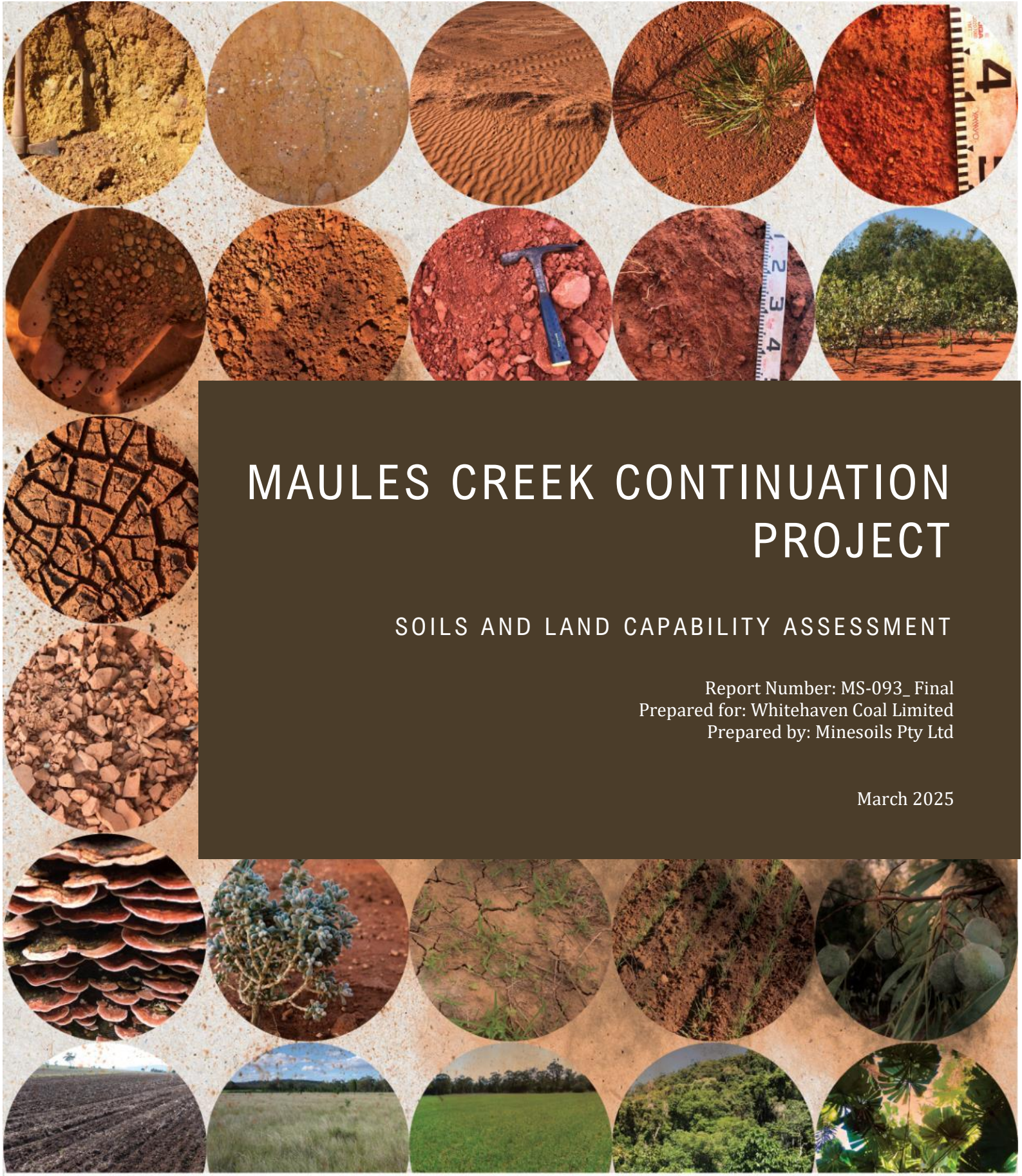
APPENDIX A: SOILS AND LAND CAPABILITY ASSESSMENT



MAULES CREEK CONTINUATION PROJECT

SOILS AND LAND CAPABILITY ASSESSMENT

Report Number: MS-093_ Final
Prepared for: Whitehaven Coal Limited
Prepared by: Minesoils Pty Ltd

March 2025

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DOCUMENT CONTROL

Reference	Date	Prepared by	Approved
MS-093_Draft 1	6 September 2024	Matt Hemingway	Clayton Richards
MS-093_Draft 2	14 October 2024	Matt Hemingway	Matt Hemingway
MS-093_Draft Final	2 December 2024	Matt Hemingway	Matt Hemingway
MS-093_Final	19 December 2024	Matt Hemingway	Matt Hemingway
MS-093_Final v2	19 December 2024	Matt Hemingway	Matt Hemingway

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

The Maules Creek Coal Mine (MCCM) is located approximately 17 kilometres (km) north-east of Boggabri, within the Narrabri Shire Local Government Area (LGA) in New South Wales (NSW) (refer **Figure 1**). MCCM is a joint venture between Aston Coal 2 Pty Ltd (a wholly owned subsidiary of Whitehaven Coal Limited [Whitehaven]) (75 per cent [%]), ICRA MC Pty Ltd (a wholly owned subsidiary of Itochu Corporation) (15%) and J-Power Australia Pty Ltd (a wholly owned subsidiary of Electric Power Development Co. Ltd) (10%). MCCM is operated by Maules Creek Coal Pty Ltd (MCC).

Mining operations at the MCCM are currently approved until 31 December 2034 with a coal extraction rate of up to 13 million tonnes per annum (Mtpa) in accordance with Project Approval (PA) 10_0138 (as modified). The existing MCCM comprises a single open cut pit, Northern Emplacement and Southern Emplacement areas, and Mine Infrastructure Area (MIA). The MIA includes the Coal Handling and Preparation Plant (CHPP), run-of-mine (ROM) coal stockpiles, product coal stockpiles, train load-out infrastructure, workshops and administration buildings, hardstand and laydown areas, car parking, wash bays, and other associated infrastructure.

MCC has engaged Minesoils Pty Ltd (Minesoils) to undertake a Soils and Land Capability Assessment for the proposed extension and continuation of mining operations at the MCCM mining area, which is hereafter referred to as the Maules Creek Continuation Project (the Project).

1.2 PROJECT DESCRIPTION

MCC is seeking approval to continue open cut mining operations within the MCCM mining and exploration tenements for a further 10 years (from 2035 to 2044). Development Consent for the Project is being sought under the State Significant provisions (i.e. Division 4.7) under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). The indicative Project general arrangement is provided in Figure 2.

Compared to the existing approved MCCM, the Project would include the following additional key activities:

- extension of open cut operations within Coal Lease (CL) 375, Mining Lease (ML) 1719 and Authorisation (AUTH) 346 to allow mining and processing of additional coal reserves until approximately 31 December 2044;
- extraction of approximately 117 Mt of ROM coal (in addition to the approved MCCM coal resource of 240 Mt of ROM coal);
- extraction of up to 14 Mtpa of ROM coal (i.e. a 1 Mtpa increase from the currently approved maximum ROM coal mining rate of 13 Mtpa);
- a revegetation program to establish approximately 2,300 ha of native woodland in the vicinity of the MCCM (i.e. in addition to any offset and rehabilitation obligations);
- an increase in the operational workforce to an average of approximately 940 people, with a peak operational workforce of approximately 1,030 people;
- continued operation of the existing CHPP and train load-out and rail spur infrastructure, with upgrades as required;
- continued transport of up to 12.4 Mtpa of product coal via rail (i.e. no change to the currently approved maximum product coal transport rate);
- development of an integrated waste rock emplacement landform that incorporates geomorphic design principles;
- construction and use of a remote go-line, access and infrastructure area;

- continued operation and extension of the MCCM water management system;
- upgrades to workshops, electricity distribution and other ancillary infrastructure;
- continued placement of coal rejects within the mined out voids and the out-of-pit overburden emplacement areas;
- construction and operation of a water transfer pipeline between the MCCM water pipeline network and the approved VCM to TCM pipeline;
- ongoing exploration activities; and
- other associated infrastructure, equipment and activities.

1.3 STUDY AREAS

This assessment focuses on the mine site component of the Project (i.e. the extension of open cut operations within CL 375, ML 1701, ML 1719 and AUTH 346) as other components of the Project (e.g. the water transfer pipeline and revegetation areas) are not expected to have a significant impact on soil resource and/or land capability.

The Study Area for this soils assessment therefore includes the open cut extension area, the go-line, access and infrastructure area, and the previously undisturbed areas of the approved surface development area (**Figure 3**). The Study Area covers an area of approximately 752 hectares (ha).

For the land and soil capability (LSC) assessment, a larger study area has been adopted, that includes the approved MCCM surface development area, the open cut extension area, the go-line, access and infrastructure area, and the previously undisturbed areas of the approved MCCM surface development area within CL 375, ML 1701, ML 1719 and AUTH 346 (the LSC Study Area) (**Figure 3**). This larger study area has been adopted as the Project includes a revised final landform across the approved MCCM surface development area, the open cut extension area, and the go-line, access and infrastructure area.

1.4 REPORT PURPOSE AND APPROACH

This Soil and Land Capability Assessment forms part of an Environmental Impact Statement (EIS) which has been prepared to accompany a Development Application made for the Project in accordance with Part 4 of the EP&A Act.

The Secretary's Environmental Assessment Requirements (SEARs) outline the specific requirements for the Project EIS, including the assessment of the soil and land capability impacts. The purpose of this report is to address the following SEARs item: *An assessment of the likely impacts of the development on the soils and land capability of the site and surrounds.*

This report is structured as follows:

Section 1 Introduction – outlines the Project, defines the study areas, and presents the purpose of this report.

Section 2 Existing Environment – overview of existing information on soil resources in the direct impact area and wider region.

Section 3 Soil Resource Assessment – describes the methodology of the soil survey in the Study Area, and an overview of soil resources within the Study Area.

Section 4 Land and Soil Capability Assessment – describes the methodology of the LSC assessment within the LSC Study Area and presents impacts to LSC status as a result of the Project.

Section 5 Disturbance Management – provides a summary of the environmental mitigation and management recommendations, including calculation of total soil material available for stripping and re-use.

Section 6 Conclusion.

Section 7 References.

In order to conceptualise the impacts on soil resources and LSC as a result of the Project, the approved final landform and land use domains for the approved MCCM surface development area are used to represent a baseline for Sections 4 and 5, as described further in these sections.

LEGEND

- MCCM Mining Tenement Boundary (CL and ML)
- Mine Site
- Local Government Boundary
- State Forest
- State Conservation Area, Aboriginal Area
- Rail Line

Source: NSW Spatial Services (2023); Geoscience Australia (2011)

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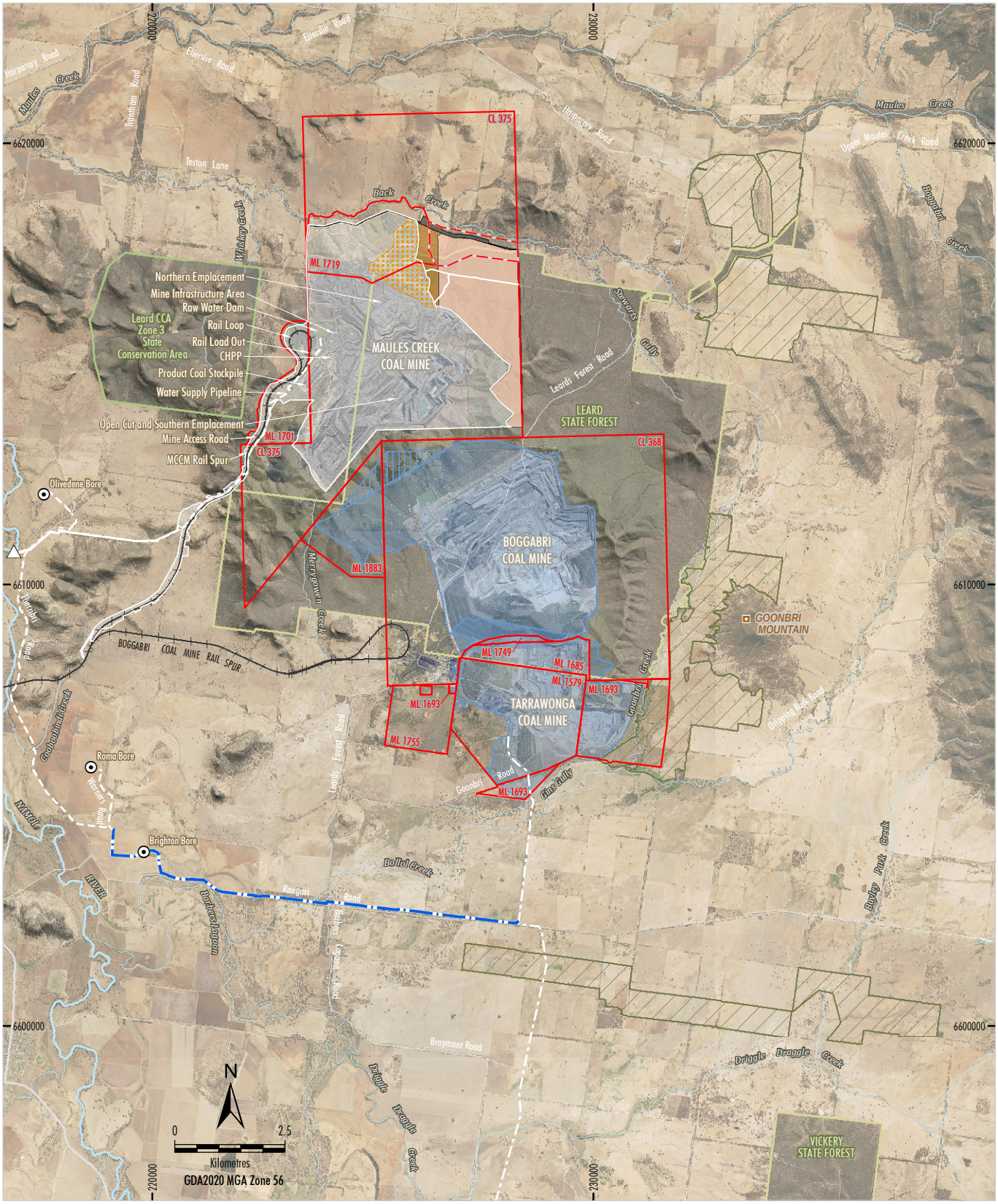
MAULES CREEK CONTINUATION PROJECT

Project Location

Figure 1

WHC-23-95 EIS_App SCE_201C



WHC-23-95 EIS_App CL_202A

LEGEND

- Rail Line
- State Conservation Area
- State Forest
- Mining Tenement Boundary (ML and CL)
- Provisional Mining Lease Application Area
- Other Mining Operation *
- Other Mining Operation - Proposed *
- VCM to TCM Water Transfer Pipeline

Existing/Approved MCCM Development

- Approximate Extent of Existing/Approved Surface Development
- MCCM Water Supply Pipeline
- MCCM Groundwater Supply Bore
- MCCM Namoi River Pump Station

Maules Creek Continuation Project

- Indicative Go-line, Access and Infrastructure Area
- Indicative Open Cut Extension Area
- Indicative Overburden Emplacement Extension
- Existing Overburden Rehabilitation to be Disturbed
- Indicative Landscape Revegetation Zones#
- Indicative Water Transfer Pipeline (Proposed)

Source: NSW Spatial Services (2024)
Orthophoto Mosaic: Whitehaven (2019-2024)

Whitehaven

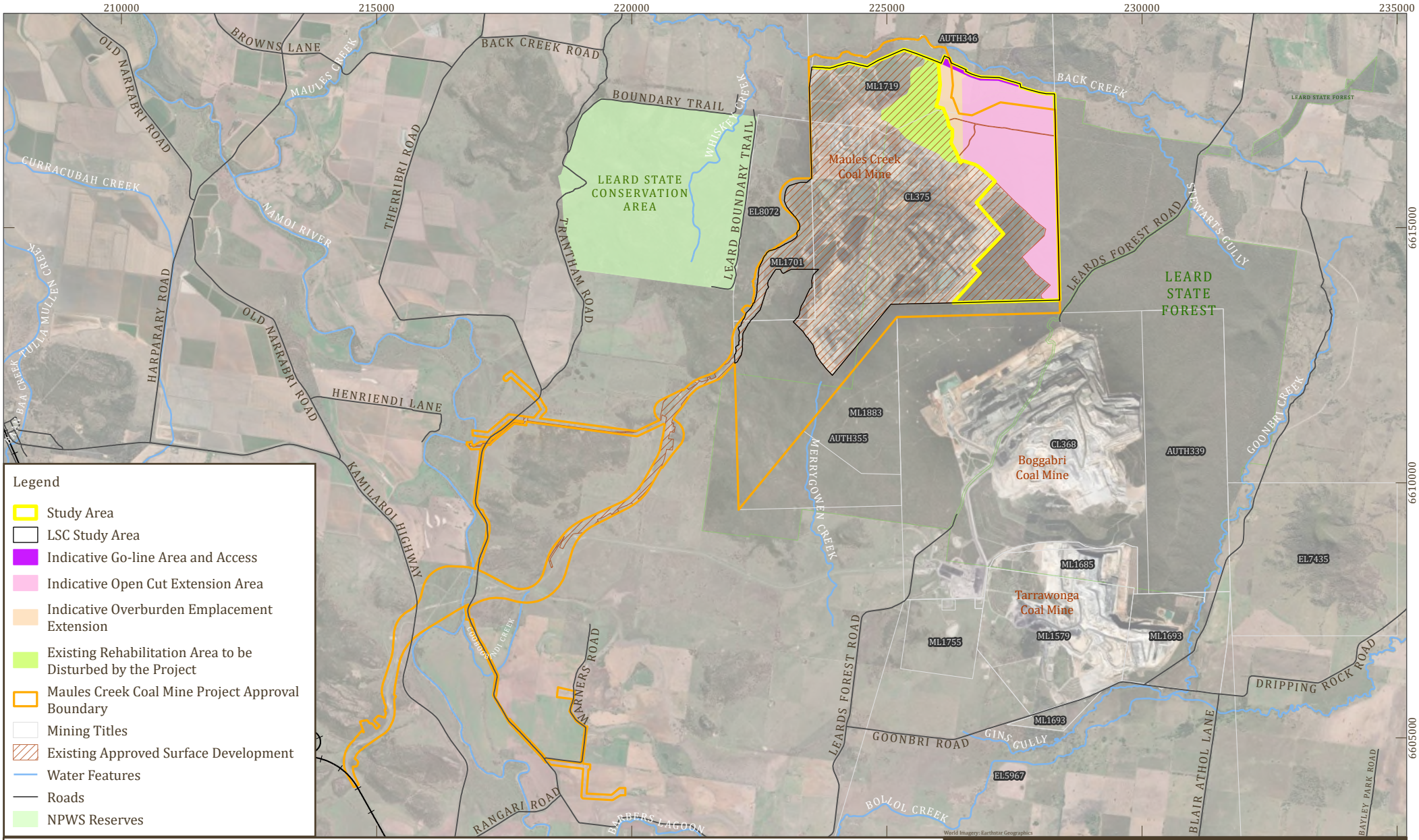
MAULES CREEK CONTINUATION PROJECT

General Arrangement of the Project

** BCM boundary digitised from Figure 1 of the BCM Modification 10 Scoping Letter.*

#Landscape Revegetation Zones shown on this figure are approximate extents only.

Figure 2



GDA2020 MGA Zone 56

Meters
0 500 1,000 2,000

Scale 1:100,000 at A4

MINESOILS
LAND & REHABILITATION SPECIALISTS

Study Areas

FIGURE 3

MS093_MaulesEIS 12/01/2025 9:50 AM

2 EXISTING ENVIRONMENT

2.1 CLIMATE

The Project lies within the Namoi subregion of the New England North West region, which is characterised by hotter and drier climate in the west and by cooler and wetter climate in the east. Subtropical areas are located to the west of Narrabri, with temperate areas to the east and south.

Annual average potential evapotranspiration is highest in the north-east of the subregion, and lower in the west and south-west. In contrast, average annual actual evapotranspiration exhibits a strong decreasing gradient from west to east. Annual rainfall varies from a minimum of approximately 200 millimetres (mm) to a maximum of approximately 1,100 mm, with the majority of rainfall typically occurring in the warmer months. Widespread drought has occurred in the past, lasting for several years in the Namoi River basin. Under drought conditions, severe water shortage typically occurs in the subregion from May to December.

The annual average rainfall across the three nearest daily rain gauges to the Project, with over 100 years of records, is 581 mm. Over this period of record, the highest average monthly rainfall occurs in January (74 mm) and the lowest in April (33 mm).

The annual average maximum temperature recorded at the site is 26.8 degrees Celsius (°C) and the annual average minimum temperature is 12.1°C. The highest average maximum temperature of 34.1°C is recorded in January, while the lowest average minimum temperature of 4.0°C is recorded in July (Bureau of Meteorology [BoM], 2024a).

2.2 LAND USE

The Narrabri LGA, within which the Project lies, forms part of the Namoi River catchment, bounded by the Nandewar Range in the north, the New England Plateau in the north-east, the Liverpool Plains in the south-east and the Warrumbungle Range in the south-west. The landscape of the Narrabri Shire consists of flat open plains to the west and steep land that is associated with Mount Kaputar and the accompanying ranges to the east.

The Namoi River system is subject to extensive flooding and is regulated with several dams, the largest being Lake Keepit, which provides major water storage for the catchment. The associated Namoi alluvium is a key source of water, in addition to the Great Artesian Basin.

The Namoi River catchment has been used extensively for agricultural activities for over 100 years. It is one of Australia's most developed irrigation areas, supporting significant cotton and broad acre cropping (mainly sorghum, sunflower and wheat) as well as other crops, and some sheep and cattle grazing.

Current agricultural uses in the Narrabri LGA include sheep and cattle grazing, grain crops, cotton, piggeries, feedlots and vineyards. The open flat floodplains located in the west of the Narrabri LGA provide areas which are used for irrigated agriculture, particularly cotton. These crops rely heavily on water from the Namoi River and groundwater. Grazing of sheep and cattle is the primary form of agriculture to the south-west of the Narrabri LGA where the Project lies.

In addition, significant portions of the locality around the Project are designated as State Forests and have historically been used predominantly for forestry, recreation and more recently mining related activities. Uncleared, native vegetation associated with the higher elevations and slopes of Mount Kaputar National Park occurs to the east of the Project.

The Study Area is dominated by heavily timbered native bushland within the Leard State Forest and on Whitehaven-managed land. A small extent of previously cleared land used historically for light grazing on native pastures covers 75 ha in the north west of the Study Area.

2.3 GEOLOGY, TOPOGRAPHY AND HYDROLOGY

The Project is located within the Mullaley Sub-basin, which forms part of the larger Gunnedah Basin. The Study Area is underlain by Quaternary alluvium comprising unconsolidated clays, silts, sands and gravels as well as the Maules Creek Formation in the south of the site, which consist of basal carbonaceous claystone, pelletoidal clay sandstone, minor coal, passing upwards into upward-fining cycles of sandstone, thinly bedded siltstone / sandstone and coal, with conglomerate dominant towards the top (refer **Figure 4**).

Geological features identified in the locality include the Nandewar Volcanics, consisting of rhyolitic to dacitic lavas and ashflow, and extensive presence of quaternary alluvium.

The topography of the Study Area generally consists of hillslopes and low rises in the south, descending to a gently undulating lower plain in the north (refer **Figure 5**). Hillslopes consist of a series of narrow gullies and of ridges reaching to approximately 450 metres (m), with slopes ranging up to approximately 30% in these areas (refer **Figure 6**). The lower plain area in the north generally contains more subtle slopes ranging from 0 to 5% and flats leading to Back Creek (**Figure 6**).

Natural surface water flows along several unnamed drainage lines from higher elevations generally north towards Back Creek, a fourth-order stream under the Strahler ordering system. Back Creek is a tributary of Maules Creek. Maules Creek drains westwards into the Namoi River about 30 km south-east of Narrabri. Flow in the Namoi River is significantly affected by releases from Keepit Dam, a 420 gigalitre storage located about 50 km south-east of Boggabri. The Namoi River has a catchment area to Boggabri of about 22,600 square kilometres and consists of an incised main channel that meanders across a wide alluvial floodplain.

2.4 REGIONALLY MAPPED SOIL LANDSCAPES

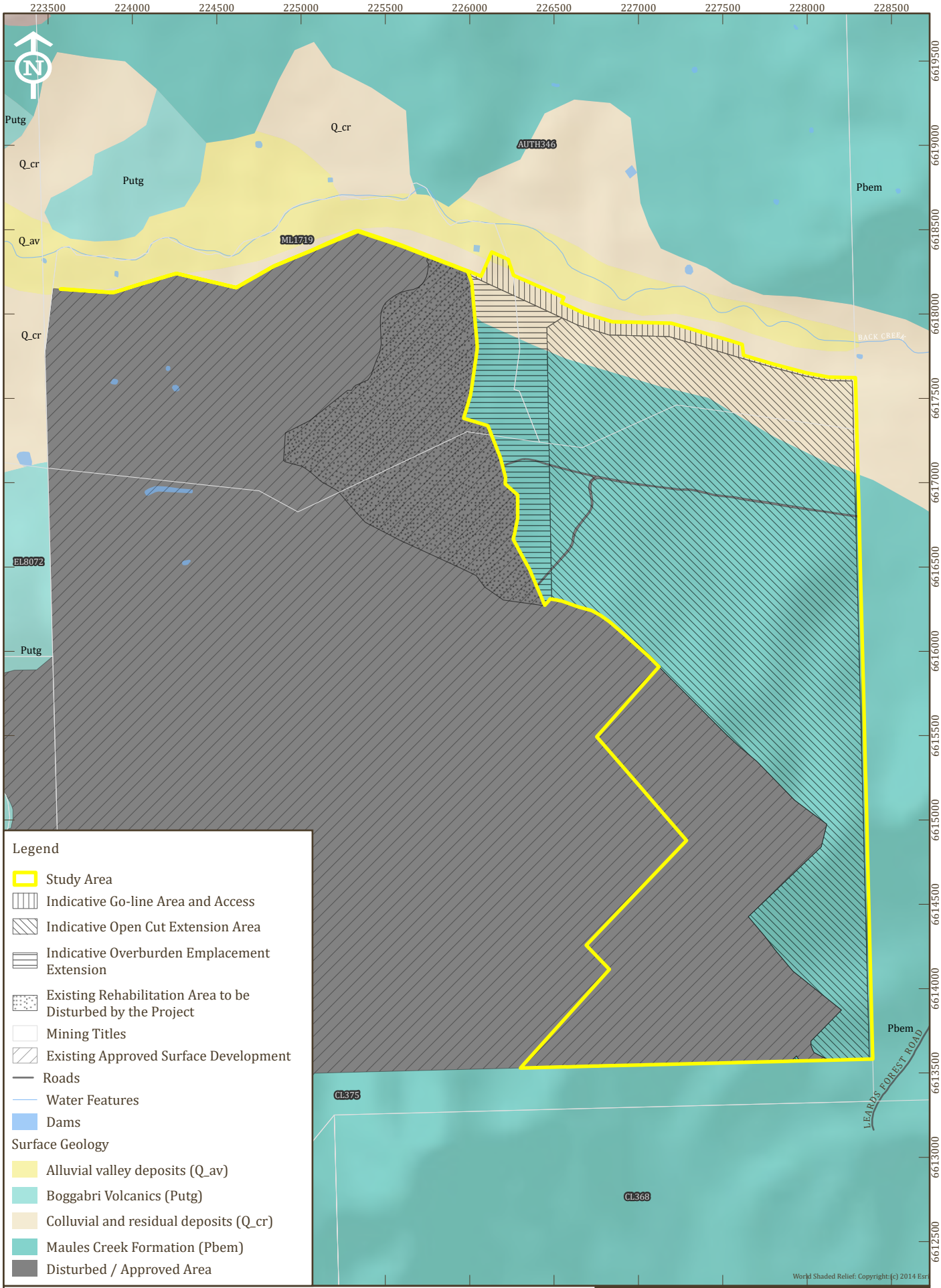
Soil Landscape units are areas of land that have recognisable and specific topographies and soils that can be presented on maps and described by concise statements. These classifications take into account the limitations each unit poses that may restrict rural or urban development. Although the Study Area has not been mapped, the Leard and Blue Vale Soil Landscapes of the Soil Landscape Report for Liverpool Plains v 1.0.0 (Office of Environment and Heritage [OEH], 2011) is mapped to the south of the Study Area (refer **Figure 7**) and these are considered to be representative of a large portion of the Study Area. The Leard and Blue Vale Soil Landscapes are further described below.

Leard Soil Landscape

Landscape— Rolling, occasionally steep low hills to hills on Permian sandstones and conglomerates in the northern Curlewis Hills. Slopes 10 – 35%, local relief <150 m, elevation 290 – 500 m, rock outcrop ~10%. Woodland and open forest partially cleared for grazing.

Soils— Shallow, well-drained Rudosols and Tenosols (Lithosols) on crests and benched sideslopes, with shallow to moderately deep, moderately well-drained Brown Kurosols (Brown Podzolic Soils) and minor Red and Brown Chromosols (Non-calcic Brown Soils and Brown Podzolic Soils) on acid shales and mudstones.

Qualities and limitations— widespread shallow soils, localised poor moisture availability, variable soil fertility, localised rock outcrop hazard, localised woody weeds, widespread recharge zone, localised gully erosion hazard, localised sheet erosion hazard, localised high run-on, localised poor drainage.



Legend

- Study Area
- Indicative Go-line Area and Access
- Indicative Open Cut Extension Area
- Indicative Overburden Emplacement Extension
- Existing Rehabilitation Area to be Disturbed by the Project
- Mining Titles
- Existing Approved Surface Development
- Roads
- Water Features
- Dams

Surface Geology

- Alluvial valley deposits (Q_av)
- Boggabri Volcanics (Putg)
- Colluvial and residual deposits (Q_cr)
- Maules Creek Formation (Pbem)
- Disturbed / Approved Area

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0 250 500 1,000 Meters

Scale 1:30,000 at A4

Surface Geology

FIGURE 4

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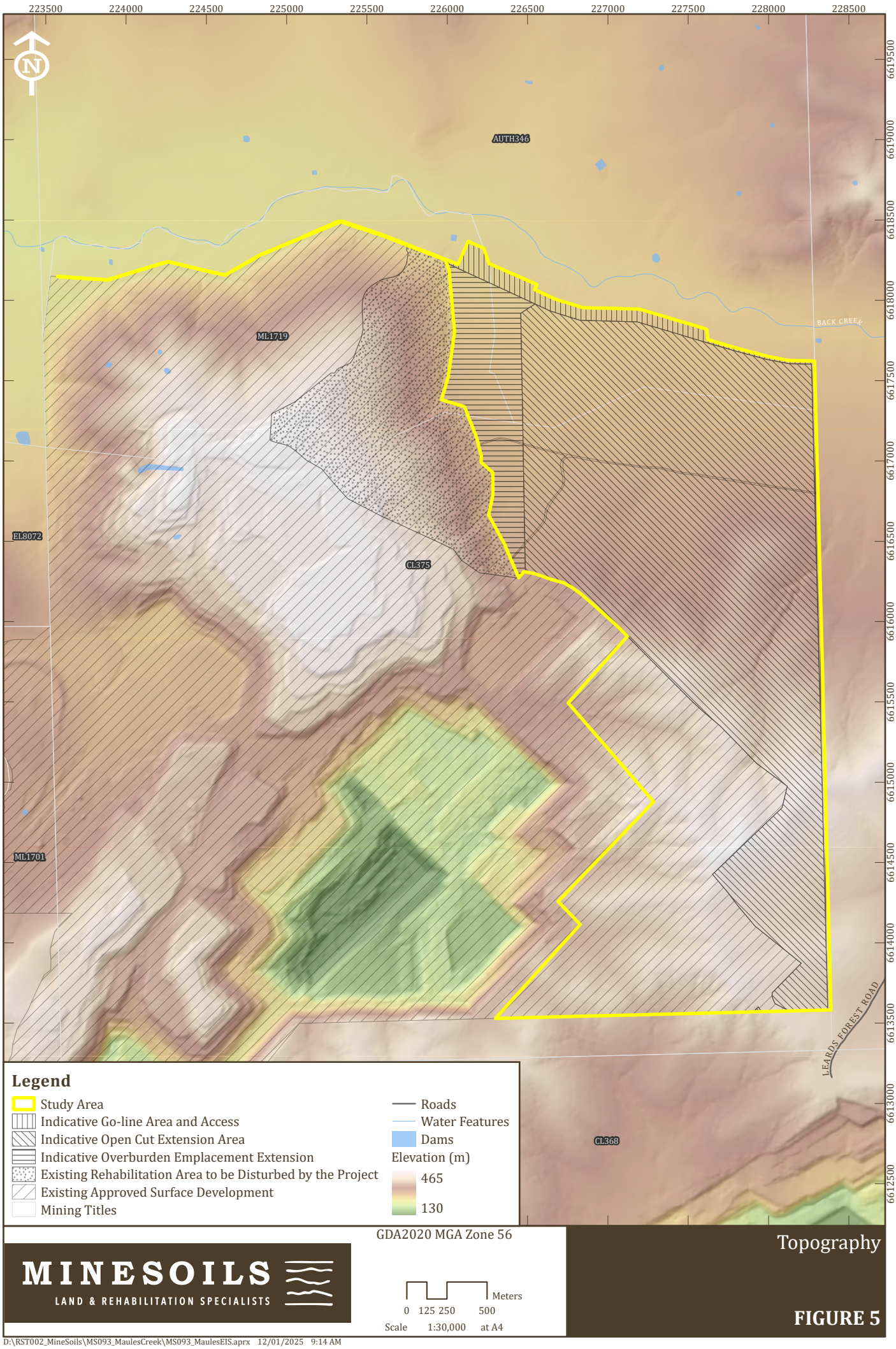

Legend

- Study Area
- Indicative Go-line Area and Access
- Indicative Open Cut Extension Area
- Indicative Overburden Emplacement Extension
- Existing Rehabilitation Area to be Disturbed by the Project
- Existing Approved Surface Development
- Mining Titles
- Roads
- Water Features
- Dams

Elevation (m)

465

130

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Topography

FIGURE 5

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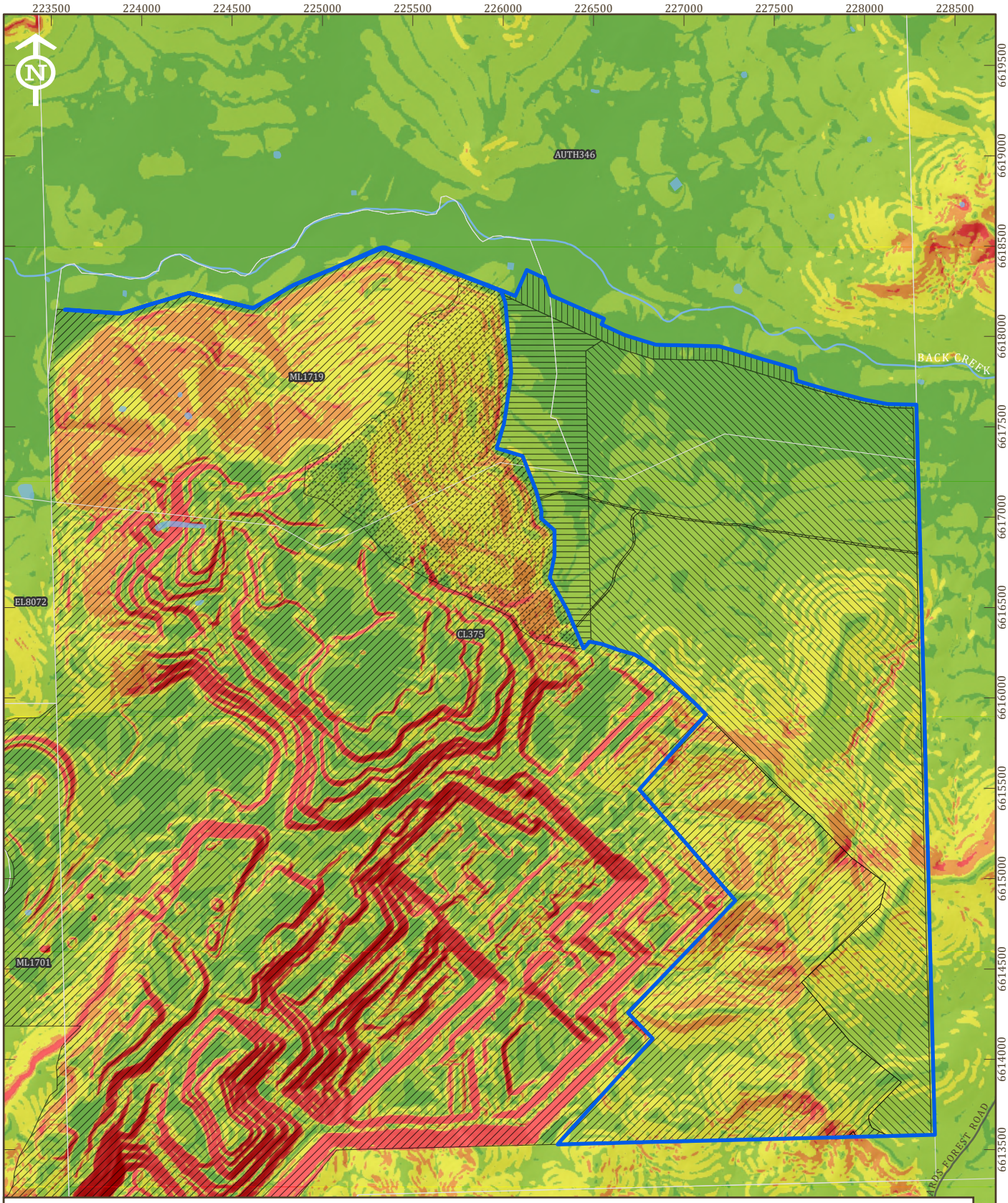

Legend

- Study Area
- Indicative Go-line Area and Access
- Indicative Open Cut Extension Area
- Indicative Overburden Emplacement Extension
- Existing Rehabilitation Area to be Disturbed by the Project
- Mining Titles
- Existing Approved Surface Development
- Roads
- Water Features
- Dams

Slope (%)

- 0 - 3
- 3 - 10
- 10 - 20
- 20 - 33
- > 33

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Slope Analysis

FIGURE 6

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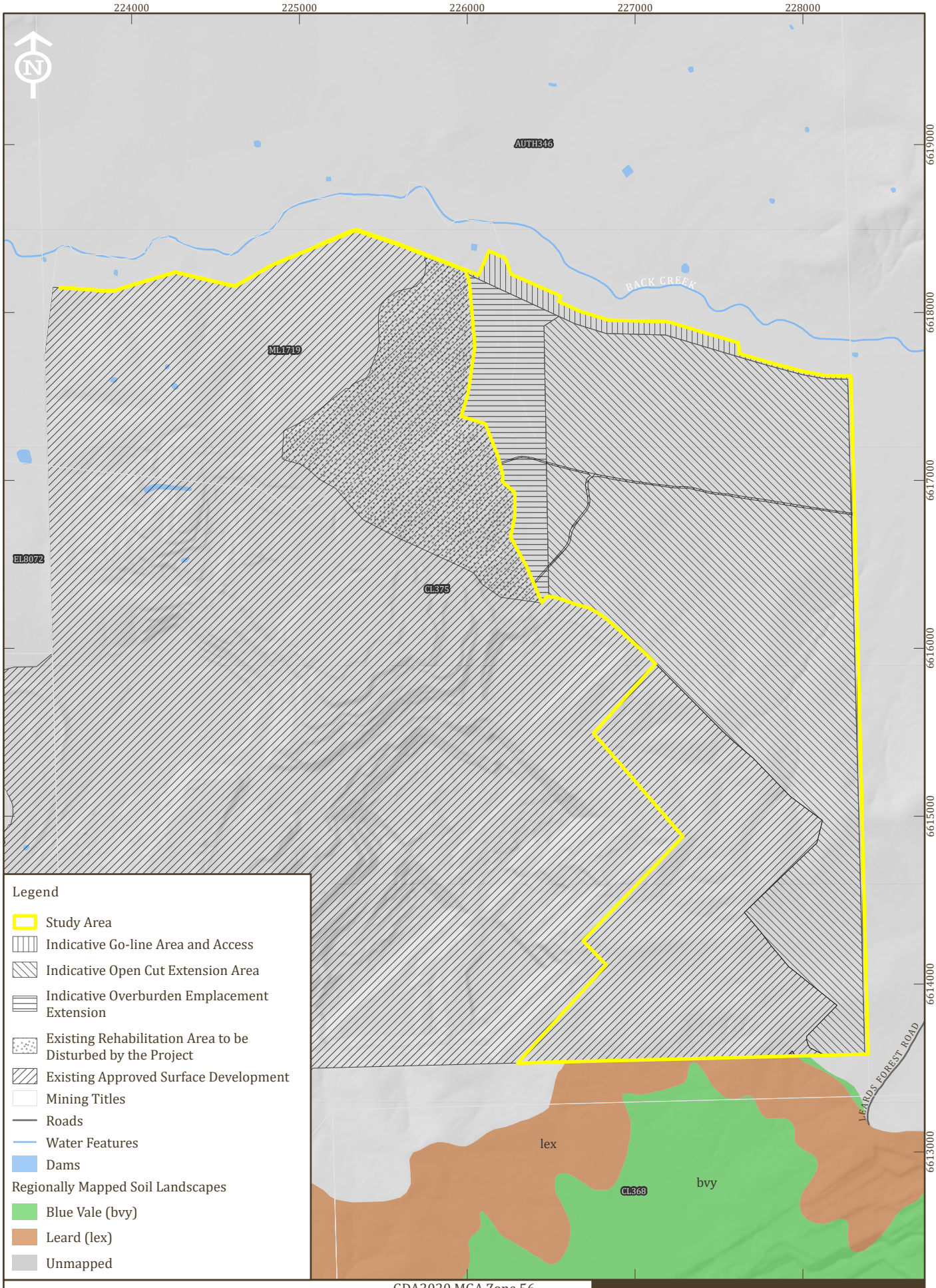

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0 250 500 1,000 Meters

Scale 1:30,000 at A4

Regionally Mapped Soil Landscapes

FIGURE 7

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Blue Vale Soil Landscape

Landscape— Undulating low hills and hills on Permian sandstones and conglomerates in the Curlewis Hills. Slopes 1 - 10%, local relief <70 m, elevation 250 - 420 m. Woodland and grassland, in State Forests or cleared for grazing or opencut coal mining.

Soils— Brown and Red Chromosols (Non-calcic Brown Soils) and Brown Sodosols (Solonetz), with some Bleached Brown and Red Chromosols (Non-calcic Brown Soils).

Qualities and limitations— localised shallow soils, localised poor moisture availability, moderate soil fertility, localised foundation hazard, widespread woody weeds, localised recharge zone, localised gully erosion hazard, widespread sheet erosion hazard, localised high run-on.

2.5 REGIONALLY MAPPED SOIL TYPES

The NSW regional soil mapping (NSW Government, 2023) indicates the dominant soil types within the Study Area are Chromosols and Sodosols, as per Australian Soil Classification (ASC) (Isbell, R. F., 2021) (refer **Figure 8**).

Chromosols are soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2t horizon (or the major part of the entire B2t horizon if it is less than 0.2 m thick) is not sodic and not strongly acid.

Sodosols are soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is sodic and not strongly acid.

2.6 REGIONALLY MAPPED INHERENT SOIL FERTILITY

NSW regional soil mapping (NSW Government, 2023) provides an estimation of the inherent fertility of soils in NSW. It uses the best available soils and natural resource mapping developed for LSC dataset. The mapping describes soil fertility in NSW according to a five-class system: Low (1), Moderately Low (2), Moderate (3), Moderately High (4) and High (5).

Soils with 'Low' fertility, due to their poor physical and/or chemical status, only support limited plant growth. Soils with 'Moderately Low' fertility can generally only support plants suited to grazing; large inputs of fertiliser are required to make the soil suitable for arable purposes. Soils with 'Moderate' fertility usually require fertilisers and/or have some physical restrictions for arable use. Soils with 'Moderately High' fertility have a high level of fertility in their virgin state which is significantly reduced after a few years of cultivation (Murphy *et al*., 2007).

The Study Area is dominated by soils with Moderately Low fertility (2), with some areas of Moderate fertility (3) (refer **Figure 9**).

2.7 REGIONALLY MAPPED LAND AND SOIL CAPABILITY

LSC, as detailed in the OEH guideline *The Land and Soil Capability Assessment Scheme; Second approximation* (OEH, 2012) (referred to as the LSC Guideline), uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations, as further detailed in Section 4.

The regionally mapped LSC classes are described in **Table 1** and their definition has been based on two considerations:

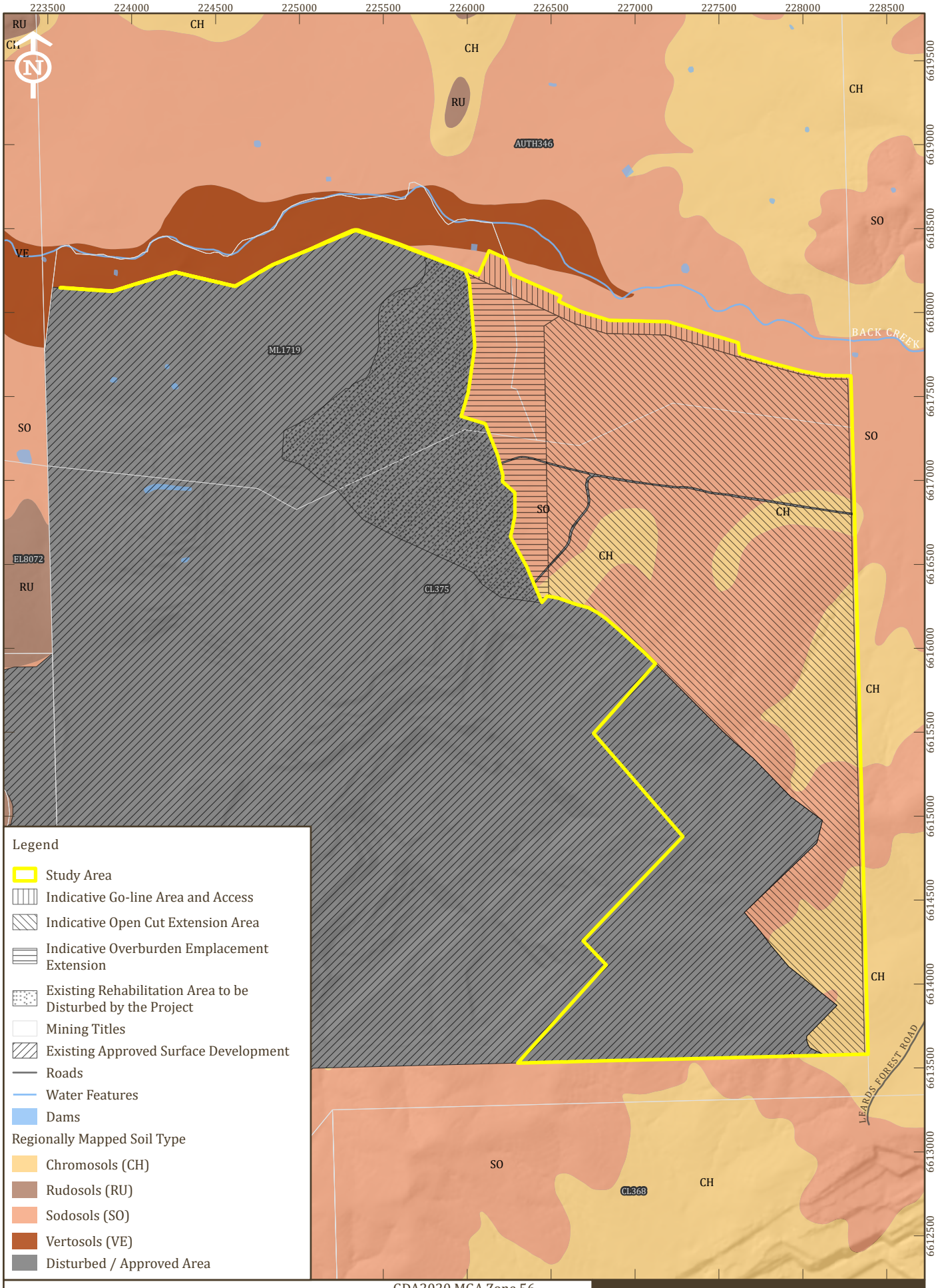
- The biophysical features of the land to derive the LSC classes associated with various hazards.
- The management of the hazards including the level of inputs, expertise and investment required to manage the land sustainably.

Table 1: Land and Soil Capability Classification

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, nature conservation)	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

(Source: OEH, 2012)

The regionally mapped LSC classes within the Study Area are LSC Class 4 and 5 land (refer **Figure 10**).



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Scale 1:30,000 at A4

Regionally Mapped Soil Types

FIGURE 8

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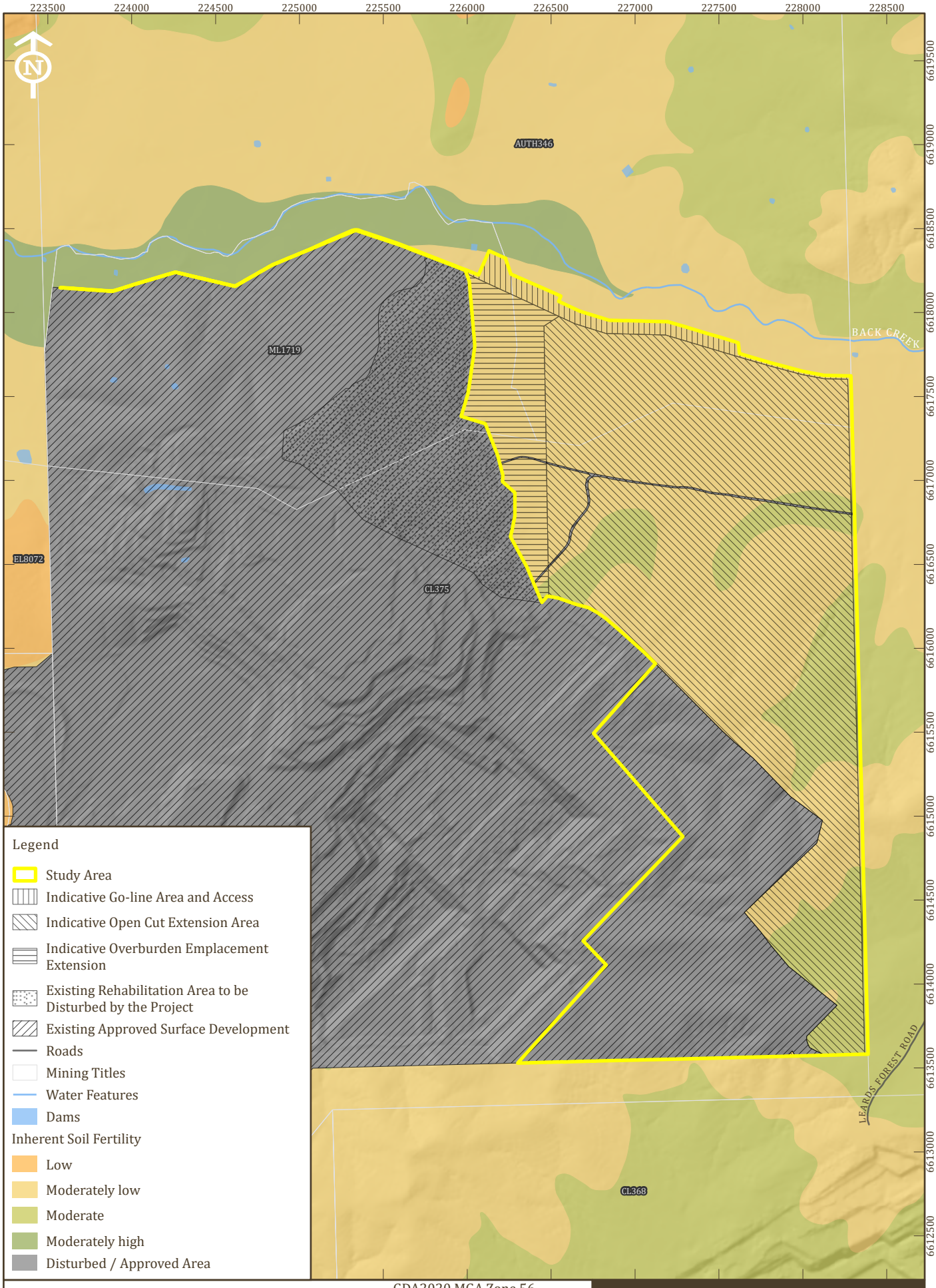

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Scale 1:30,000 at A4

Regionally Mapped Inherent Soil Fertility

FIGURE 9

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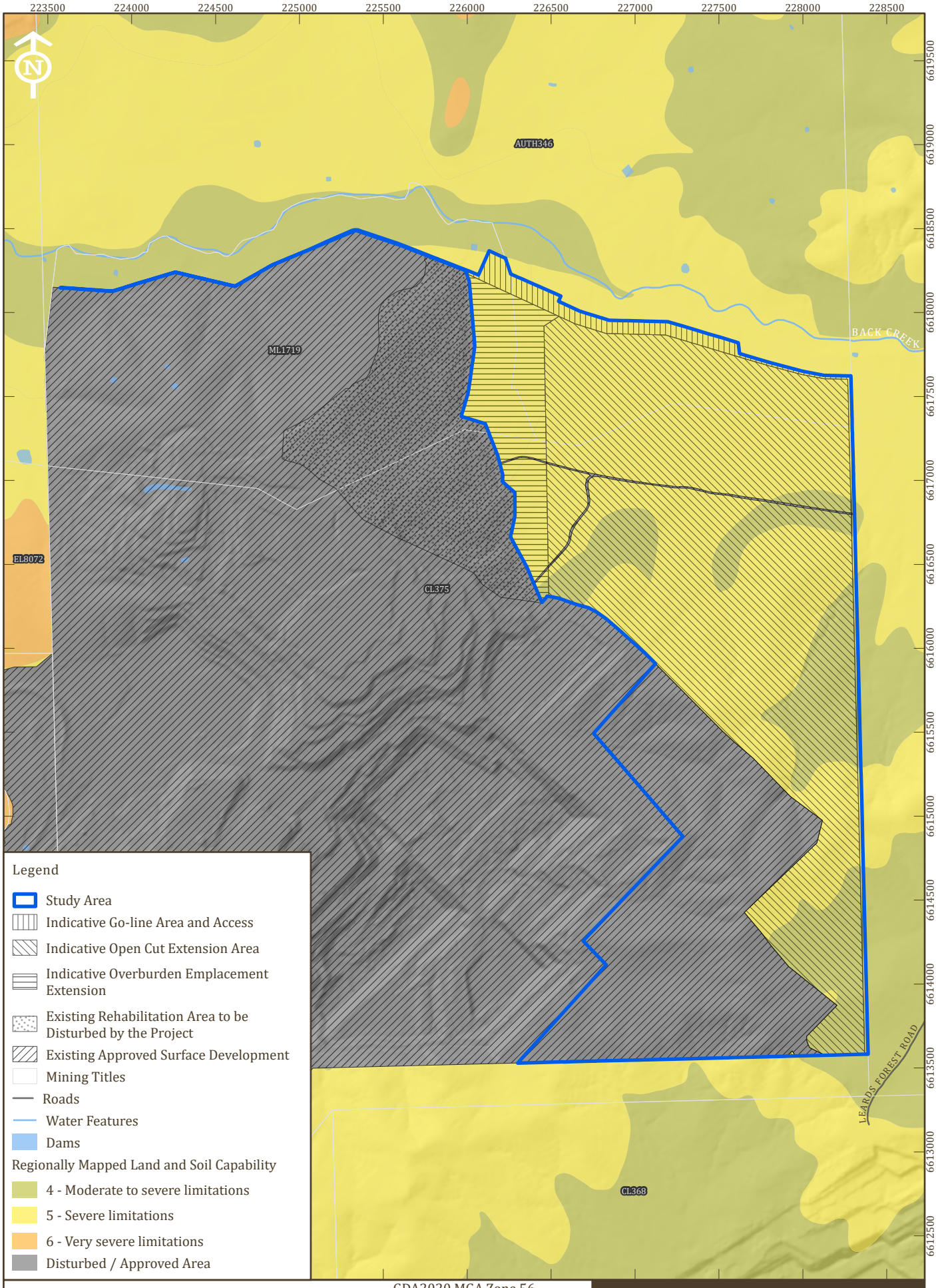

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0 250 500 1,000 Meters

Scale 1:30,000 at A4

Regionally Mapped Land and Soil Capability

FIGURE 10

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2.8 BIOPHYSICAL STRATEGIC AGRICULTURAL LAND

Biophysical Strategic Agricultural Land (BSAL) is land with a combination of natural resources highly suitable for agriculture. These lands have suitable landforms, soil and water resources that are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality.

The *State Environmental Planning Policy (Resources and Energy) 2021* (the SEPP) include mapping of lands identified as BSAL. This mapping does not identify any BSAL or critical industry clusters in the vicinity of the Study Area, with the closest regionally mapped BSAL located approximately 7 km to the south-east of the Study Area.

A Project BSAL Site Verification Assessment (SVA) was undertaken by Minesoils' Clayton Richards between February 2023 and January 2024, in accordance with the Interim Protocol (OEH and Department of Primary Industries – Office of Agricultural Sustainability and Food Security, 2013), which assists proponents and landholders to understand what is required to identify the existence of BSAL and outlines the technical requirements for on-site identification and mapping of BSAL.

As part of the SVA a total of 25 sites were assessed over an area of 121 ha within the Study Area in accordance with the Interim Protocol. Of these, 22 sites failed to meet the criteria and were determined to be verified non-BSAL. A further three sites assessed met the soil profile criteria but were determined to be sub-dominant within their respective soil unit and represent an area of <20 ha contiguous and therefore were verified as non-BSAL status.

A Site Verification Certificate issued on 29 April 2024 verified the relevant Project areas outside existing mining tenements is not BSAL. Therefore, there is no verified BSAL within the Study Area.

3 SOIL ASSESSMENT

3.1 SOIL SURVEY METHODOLOGY

Minesoils undertook a soil survey to inform the following tasks:

- soil assessment and fieldwork program, including identifying soil units, soil qualities and risks including erosion, acid sulphate soils (ASS) risk and salinity;
- LSC assessment; and
- develop management and mitigation measures for handling soil during construction, operations and decommissioning.

The objective of the Minesoils soil survey was to satisfy the field assessment, sampling and testing requirements related to soil and land resources, as listed below:

- Soil survey and mapping: This was undertaken at 1:25,000 survey intensity (1 site every 25 ha minimum), for areas subject to the BSAL assessment, (Section 2.8) and approximately 1:50,000 for all remaining soil survey areas. The survey included collection of landform pattern and element information, soil profile data, and taxonomic parameters to distinguish Soil Units according to the ASC criteria, within the Study Area.
- LSC: The information required for the LSC assessment was collected during both the desktop assessment and verified on the ground during the fieldwork program. The LSC system requires data on biophysical features from in situ measurements.
- Soil qualities: Additional information was recorded in the field on erosion and evidence of potentially erosive soils including tunnelling, rill, gully and sheet erosion, which may require specific handling and management techniques during construction or operational activities, and the consequences of this for stripping, handling, storing and rehabilitation. Observations were made on risks of ASS and salinity.

The field program was designed as an integrated free survey. An integrated survey assumes that many land characteristics are interdependent and tend to occur in correlated sets (National Committee on Soil and Terrain [NCST], 2008). Survey points are 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 pits were excavated by a tracked excavator to 1 m. Site clearances and dial before you dig plans were undertaken as part of the excavation planning requirements.

The soil survey area covered the 752 ha Study Area (refer **Figure 11**). A total of 58 sites were assessed, resulting in a survey intensity of approximately 1 site per <15 ha. Soil profiles within the Study Area (refer to **Figure 11**) were assessed in accordance with the Australian Soil and Land Survey Field Handbook soil classification procedures (NCST, 2009). Detailed soil profile descriptions were recorded covering the major parameters specified in **Table 2** below. Soil profile logging was undertaken in the field using Minesoils soil data sheets, including Global Positioning System (GPS) recordings and photographs of the landforms and soil profiles. Soils were keyed out in accordance with the ASC Third Edition (2021).

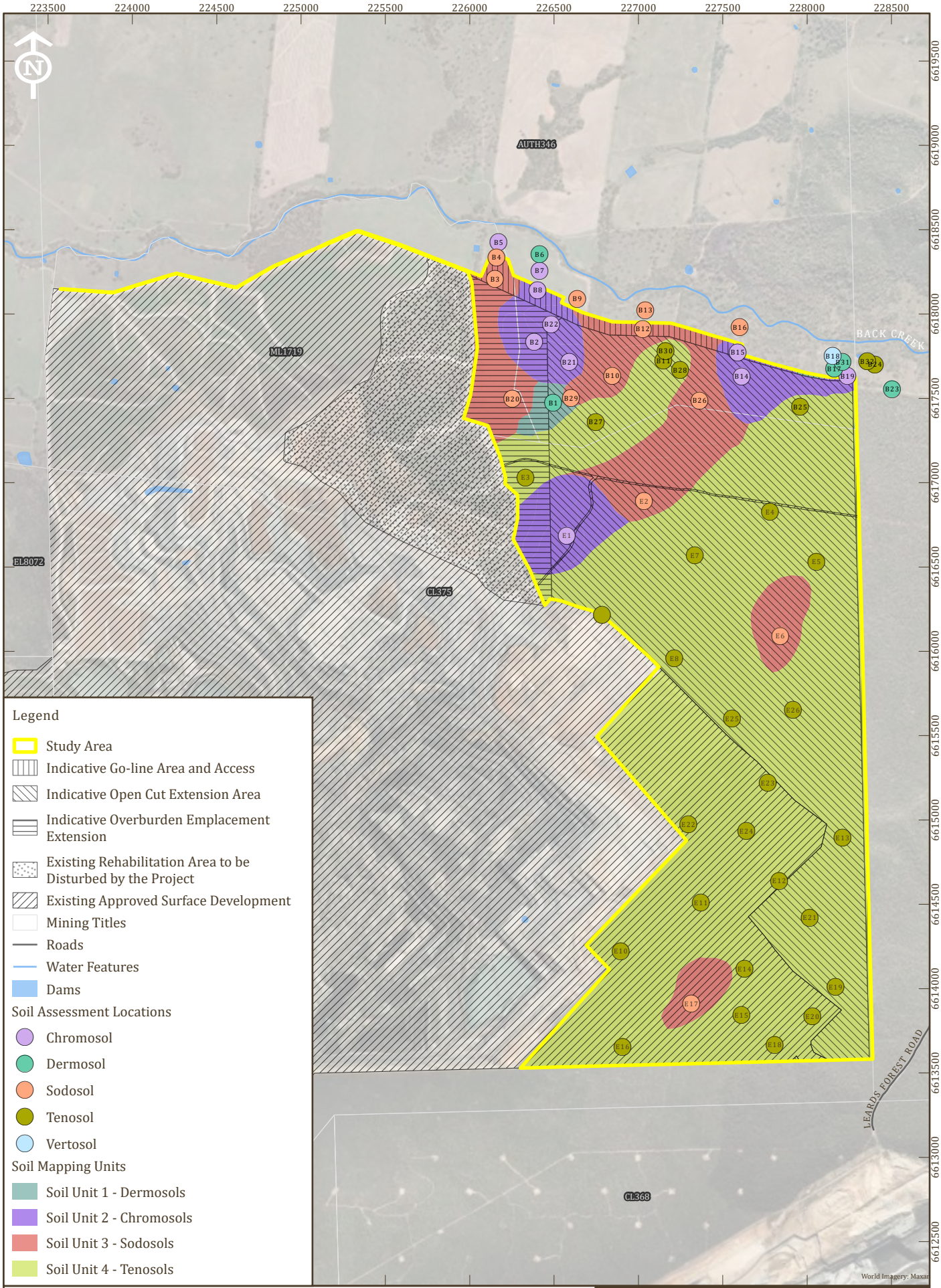
Soil samples were collected at 55 assessment site's to a depth of 1 m. A total of 195 samples collected from these 55 sites were considered representative and subject to laboratory testing. The laboratory testing suite for these sites is detailed in the **Table 3** below. Laboratory results were interpreted in accordance with *Interpreting Soil Test Results – What do all the numbers mean?* (Hazelton. and Murphy, 2016).

Table 2: Detailed Soil Profile Description 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

Table 3: Soil Sample Laboratory Analysis

Lab Analysis	
Analyte	**Methodology**
pH (1:5 water & CaCl)	Rayment & Lyons 2011-4A1
Electrical Conductivity (EC) and Chloride	Rayment & Lyons 2011-3A1
Cation Exchange Capacity (CEC) & ESP and Ca:Mg Ratio	Rayment & Lyons 2011-15J1
Particle Size Analysis (PSA)	ISSS Hydrometer plus 0.2 and 2.0 mm Sieving (CSIRO 'Yellow Book')
Emerson Aggregate Test (EAT)	AS1289.3.8.1-2017



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Scale 1:30,000 at A4

Soil Mapping Units

FIGURE 11

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3.2 SOIL SURVEY RESULTS

The soil survey undertaken by Minesoils found the Study Area to contain four dominant soil mapping units (refer to **Figure 11**):

- Soil Unit 1: Dermosols – covering 7 ha;
- Soil Unit 2: Chromosols – covering 68 ha;
- Soil Unit 3: Sodosols – covering 115 ha; and
- Soil Unit 4: Tenosols – covering 562 ha.

Although the NSW regional soil mapping indicates Chromosols and Sodosols present throughout the Study Area, additional soil types have been determined to be a feature of the Study Area as a result of the above-mentioned soil survey.

A summary of the soil mapping units is provided below, with an overview of soil types within each unit provided in **Table 4**. Full soil profile descriptions are included as **Appendix 1**. Laboratory certificates of analysis are included as **Appendix 2**.

Soil Unit 1: Dermosols

This unit is characterised by Dermosols, which are soils other than Vertosols, Hydrosols, Calcarosols and Ferrosols which:

1. Have B2 horizons that have grade of pedality greater than weak throughout the major part of the horizon; and
2. Do not have clear or abrupt textural B horizon.

Within this unit, a sub-dominant Vertosol soil type is present. Vertosols are soils with the following:

- a clay field texture or 35% or more clay throughout the solum except for thin, surface crusty horizons 30 mm or less thick; and
- 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; and
- slickensides and/or lenticular peds occur at some depth in the solum.

Soils within this unit are generally characterised by sandy clay loam, light medium clays and medium clay topsoils with moderate to strong pedality grading to sandy clay and heavy clay subsoils with strong pedality. Topsoils are consistently non-sodic, non-saline and range from neutral to slightly acidic, while subsoils are occasionally saline, occasionally sodic and are generally strongly alkaline. These soils are moderately well drained, with moderately high to high fertility, and are shallow to moderately deep.

This soil unit is the most spatially limited within the Study Area, occurring in three small locations on the lower plain landform in the north.

Soil Unit 2: Chromosols

This unit is characterised by Chromosols, which as defined in Section 2.5, are soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2t horizon (or the major part of the entire B2t horizon if it is less than 0.2 m thick) is not sodic and not strongly acid.

Soils within this unit are generally characterised by loamy sand, sandy loam and loam topsoils with moderate pedality overlying clay subsoils with moderate to strong pedality via a clear boundary. Topsoils are consistently non-sodic, non-saline and range from neutral to slightly acidic, while subsoils are occasionally saline, consistently non-sodic and are generally moderately or strongly alkaline, with some occurrence of subsoil acidity. These soils and generally moderately well drained, with moderate to moderately high fertility, occasionally have high coarse fragment content which increases with depth, and are moderately deep to deep.

Similar to Soil Unit 1, this soil unit is spatially limited within the Study Area, occurring in three small locations on the lower plain landform in the north.

Soil Unit 3: Sodosols

This unit is characterised by Sodosols, which as defined in Section 2.5, are soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is sodic and not strongly acid.

These soils are generally similar to those of Soil Unit 2, albeit with a presence of sodic clays in the subsoil, being generally characterised by loamy sand, sandy loam and loam topsoils with moderate pedality overlying clay or clay loam subsoils with moderate to strong pedality via a clear boundary. Topsoils are consistently non-sodic, non-saline and range from neutral to slightly acidic, while subsoils are occasionally saline and range from moderately acidic to strongly alkaline. These soils and generally moderately well drained, occasionally mottled with bleached A2 horizons, have moderate to moderately low fertility, and are moderately deep to deep.

This soil unit occurs mostly on the lower plain in the north of the Study Area, with isolated occurrence on mid slopes and upper slopes areas higher in the landform.

Soil Unit 4: Tenosols

This unit is characterised by Tenosols, which are soils that do not fit the requirements of any other soil orders and generally with one or more of the following:

- A peaty horizon.
- A humose, melacic or melanic horizon, or conspicuously bleached A2 horizon, which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
- A horizon which meets all the conditions for a peaty, humose, melacic or melanic horizon except the depth requirement, and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
- A1 horizons which have more than a weak development of structure and directly overlie a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
- An A2 horizon which overlies a calcrete pan, hard unweathered rock or other hard materials; or partially weathered or decomposed rock or saprolite, or unconsolidated mineral materials.
- B2 horizon with 15% clay (SL) or less, or a transitional horizon (C/B) occurring in fissures in the parent rock or saprolite which contains between 10 and 50% of B horizon material (including pedogenic carbonate).
- A ferric or bauxitic horizon >0.2 m thick.
- A calcareous horizon >0.2 m thick.

Soils within this unit are generally characterised by sands, loamy sands and sandy loam profiles with weak to moderate topsoil pedality and apedal to weakly structured subsoils. Soils are consistently non-sodic, generally non-saline and range from neutral to moderately acidic in the topsoil, often trending to slightly or moderately acidic at depth. These soils are moderately well to rapidly drained, with low fertility, often have a high coarse fragment content, and range from shallow to deep.

This soil unit is the most spatially extensive, occurring widespread over the elevated hillslope and crested areas of the mid and southern portion of the Study Area.

Table 4: Soil Map Units and Soil Types Summary

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
B1	1	Dermosol	Vertic Eutrophic Brown Dermosol	CGOOV
B2	2	Chromosols	Vertic Eutrophic Grey Chromosol	BGLOWNR
B3	3	Sodosols	Eutrophic Mottled-Mesonatric Red Sodosol	BHLOVNR
B4	3	Sodosols	Eutrophic Mottled-Mesonatric Red Sodosol	BHLOVNR
B5	3	Sodosols	Vertic Eutrophic Brown Chromosol	BELOWNR
B6	2	Chromosols	Vertic Eutrophic Brown Dermosol	BFMMW
B7	2	Chromosols	Bleached-Mottled Eutrophic Brown Chromosol	BGLOWNR
B8	2	Chromosols	Bleached-Mottled Eutrophic Brown Chromosol	BGLOWNR
B9	3	Sodosols	Eutrophic Subnatric Black Sodosol	BELOWNR
B10	3	Sodosols	Eutrophic Subnatric Grey Sodosol	BHLOWNR
B11	4	Tenosols	Basic Paralithic Leptic Tenosol	BELKWNR
B12	3	Sodosols	Eutrophic Mottled-Mesonatric Brown Sodosol	BFKMWNR
B13	3	Sodosols	Eutrophic Subnatric Brown Sodosol	BELOWNR
B14	2	Chromosols	Haplic Eutrophic Brown Chromosol	BEMOUNR
B15	2	Chromosols	Sodic Eutrophic Grey Chromosol	BGLOVNR
B16	3	Sodosols	Eutrophic Mesonatric Brown Sodosol	BELLWNR
B17	1	Dermosol	Vertic Eutrophic Black Dermosol	BHNOU
B18	1	Dermosol	Haplic Epipedal Black Vertosol	FRSU

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
B19	2	Chromosols	Haplic Eutrophic Grey Chromosol	BGLOVNR
B20	3	Sodosols	Eutrophic Subnatric Grey Sodosol	BELMWNR
B21	2	Chromosols	Sodic Eutrophic Brown Chromosol	BEKMWNR
B22	2	Chromosols	Bleached-Mottled Eutrophic Grey Chromosol	BEKOWNR
B23	1	Dermosol	Bleached-Sodic Eutrophic Grey Dermosol	BELMU
B24	4	Tenosols	Basic Arenic Bleached Tenosol	BEKKWNR
B25	4	Tenosols	Basic Arenic Grey Tenosol	BEKKWNR
B26	3	Sodosols	Eutrophic Mesonatric Brown Sodosol	BGLMWNR
B27	4	Tenosols	Acidic Gritty Brown Tenosol	BEKKWNR
B28	4	Tenosols	Basic Lithic Grey Tenosol	BFKKVNR
B29	3	Sodosols	Eutrophic Subnatric Brown Sodosol	BFLOVNR
B30	4	Tenosols	Basic Paralithic Brown-Orthic Tenosol	CGLLWNR
B31	1	Dermosol	Vertic Eutrophic Black Dermosol	BHNOU
B32	4	Tenosols	Basic Regolithic Brown-Orthic Tenosol	BEKKWNR
E1	2	Chromosols	Haplic Eutrophic Grey Chromosol	CFMOWNR
E2	3	Sodosols	Eutrophic Hypernatric Grey Sodosol	CGLOWNR
E3	4	Tenosols	Basic Lithic Grey Tenosol	BGLLWNR
E4	4	Tenosols	Basic Lithic Black Tenosol	BHLLUNR
E5	4	Tenosols	Basic Lithic Black Tenosol	BHLLUNR
E6	3	Sodosols	Eutrophic Mottled-Subnatric Grey Sodosol	CGLOWNR
E7	4	Tenosols	Basic Lithic Brown Tenosol	AGLLUNR
E8	4	Tenosols	Basic Lithic Grey Tenosol	AGKKUNR
E9	4	Tenosols	Basic Lithic Grey Tenosol	AGLKVNR

Site #	Soil Map Units		Soil Profile - ASC	ASC Family Criteria
	#	Name		
E10	4	Tenosols	Basic Lithic Brown Tenosol	BHLLVNR
E11	4	Tenosols	Acidic Lithic Brown Tenosol	BIKLVNR
E12	4	Tenosols	Basic Lithic Brown Tenosol	BHLLVNR
E13	4	Tenosols	Basic Lithic Black Tenosol	BHLLUNR
E14	4	Tenosols	Basic Lithic Brown Tenosol	BHLLVNR
E15	4	Tenosols	Basic Lithic Brown Tenosol	BHLLVNR
E16	4	Tenosols	Acidic Lithic Brown Tenosol	BHLLVNR
E17	3	Sodosols	Eutrophic Subnatric Grey Sodosol	BHLOWNR
E18	4	Tenosols	Basic Lithic Brown Tenosol	BHLLVNR
E19	4	Tenosols	Acidic Lithic Brown Tenosol	BHLLWNR
E20	4	Tenosols	-	-
E21	4	Tenosols	Basic Lithic Brown Tenosol	BHLLUNR
E22	4	Tenosols	Acidic Lithic Brown Tenosol	BHLLUNR
E23	4	Tenosols	Basic Lithic Brown Tenosol	BHLLUNR
E24	4	Tenosols	Basic Lithic Brown Tenosol	BHLLUNR
E25	4	Tenosols	Basic Lithic Brown Tenosol	BHLLUNR
E26	4	Tenosols	Basic Lithic Brown Tenosol	BHLLVNR

3.3 ACID SULPHATE SOILS FINDINGS

ASS have been classified into 5 different classes based on the likelihood of the ASS being present in particular areas and at certain depths (DPE, 2018):

- *Class 1: Acid Sulphate Soils in a class 1 area are likely to be found on and below the natural ground surface.*
- *Class 2: Acid Sulphate Soils in a class 2 area are likely to be found below the natural ground surface.*
- *Class 3: Acid Sulphate Soils in a class 3 area are likely to be found beyond 1 metre below the natural ground surface.*
- *Class 4: Acid Sulphate Soils in a class 4 area are likely to be found beyond 2 metres below the natural ground surface.*
- *Class 5: Acid Sulphate Soils are not typically found in Class 5 areas. Areas classified as Class 5 are located within 500 metres on adjacent class 1,2,3 or 4 land.*

The Study Area does not contain any of the above classes on the NSW Acid Sulphate Soil Planning Map.

Assessing land elevation and distance from the coast, in conjunction with existing ASS mapping for NSW, the potential for ASS is considered a very low risk.

Further, there was no evidence of ASS indicators such as soil gleying, odour, marine sediments and organic materials recorded as part of the soils survey.

4 LAND CAPABILITY ASSESSMENT

4.1 LAND AND SOIL CAPABILITY ASSESSMENT

The LSC classification applied to the LSC Study Area was in accordance with the LSC Guideline (OEH, 2012). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards (Section 2.6).

To establish a baseline LSC status, the LSC Study Area was subject to a LSC assessment in accordance with the methodology outlined in Section 4.2. The approved final landform and land use domains of the existing MCCM were used to allocate an LSC status to represent the baseline for the approved MCCM surface development area.

4.2 METHODOLOGY

The biophysical features of the land that are associated with various hazards are broadly soil, climate and landform and more specifically: slope, landform position, acidity, salinity, drainage, rockiness; and climate. The eight hazards associated with these biophysical features that are assessed by the scheme are:

1. Water erosion
2. Wind erosion
3. Soil structure decline
4. Soil acidification
5. Salinity
6. Water logging
7. Shallow soils and rockiness
8. Mass movement

Each hazard is assessed against set criteria tables, as described in the LSC Guideline; each hazard for the land is ranked from 1 through to 8 with the overall ranking of the land determined by its most significant limitation.

Hazard 1: Water Erosion

The Study Area lies within the Eastern and Central NSW Division, and the appropriate criteria for this division were used in the assessment. Assessment of water erosion hazard is almost solely dependent on the slope percentage of the land, based on each soil landscape unit. The only exception is land which falls within the slope range of 10-20%, which may be designated LSC Class 4 or 5 depending on the presence of gully erosion and/or sodic/dispersible soils.

Hazard 2: Wind Erosion

There are four factors used to assess wind erosion hazard for each soil type. Three criteria were assessed to be consistent for each soil type:

- wind erosive power for the LSC Study Area has been mapped as ‘High’;
- exposure of the land to wind was also determined to be ‘Moderate’; and
- the average rainfall for the LSC Study Area is approximately 581 mm (refer Section 2.1), and therefore the LSC Study Area lies within the “greater than 500 mm rainfall” category.

The determining factor with regard to wind erosion hazard was therefore the erodibility of each soil type as determined by soil texture according the LSC Guideline.

Hazard 3: Soil Structure Decline

Soil structure decline is assessed on soil characteristics, including surface soil texture, sodicity (laboratory tested) and degree of self-mulching (field tested). These parameters assess the soil structure, stability and resilience of the soil.

Hazard 4: Soil Acidification

The soil acidification hazard is assessed using three criteria, being soil buffering capacity, pH and mean annual rainfall. In this assessment, soil buffering capacity was based on surface soil texture; surface soil pH and a regional mean annual rainfall range of 550 – 700 mm.

Hazard 5: Salinity

The salinity hazard is determined through a range of data and criteria. The recharge potential for the site was determined based on an average annual rainfall of 581 mm, with annual evaporation of 600 mm (BoM, 2024b). This would suggest a moderate recharge potential to discharge potential.

The LSC Study Area according to the Salt Store Map of NSW (OEH, 2012), is located in area of low salt store. However, due to the current available scale of this mapping, laboratory tested EC values were used to determine salt store. The Study Area generally contained non saline soils, with few instances of slightly saline or moderately saline EC results.

Hazard 6: Water Logging

Water logging was determined by the soil drainage characteristics, specifically field sample evidence of mottling, soil texture attributes as well as slope and climate.

Hazard 7: Shallow Soils and Rockiness

The shallow soils and rockiness hazard is determined by an estimated exposure of rocky outcrops and average soil depth.

Hazard 8: Mass Movement

The mass movement hazard is assessed through a combination of three criteria; mean annual rainfall, presence of mass movement and slope class.

4.3 BASELINE LSC

An overview of the baseline land capability for the LSC Study Area is presented in **Figure 12**, and summarised in **Table 5**. The findings of the LSC assessment on each soil profile assessed within the LSC Study Area are presented in **Table 6**.

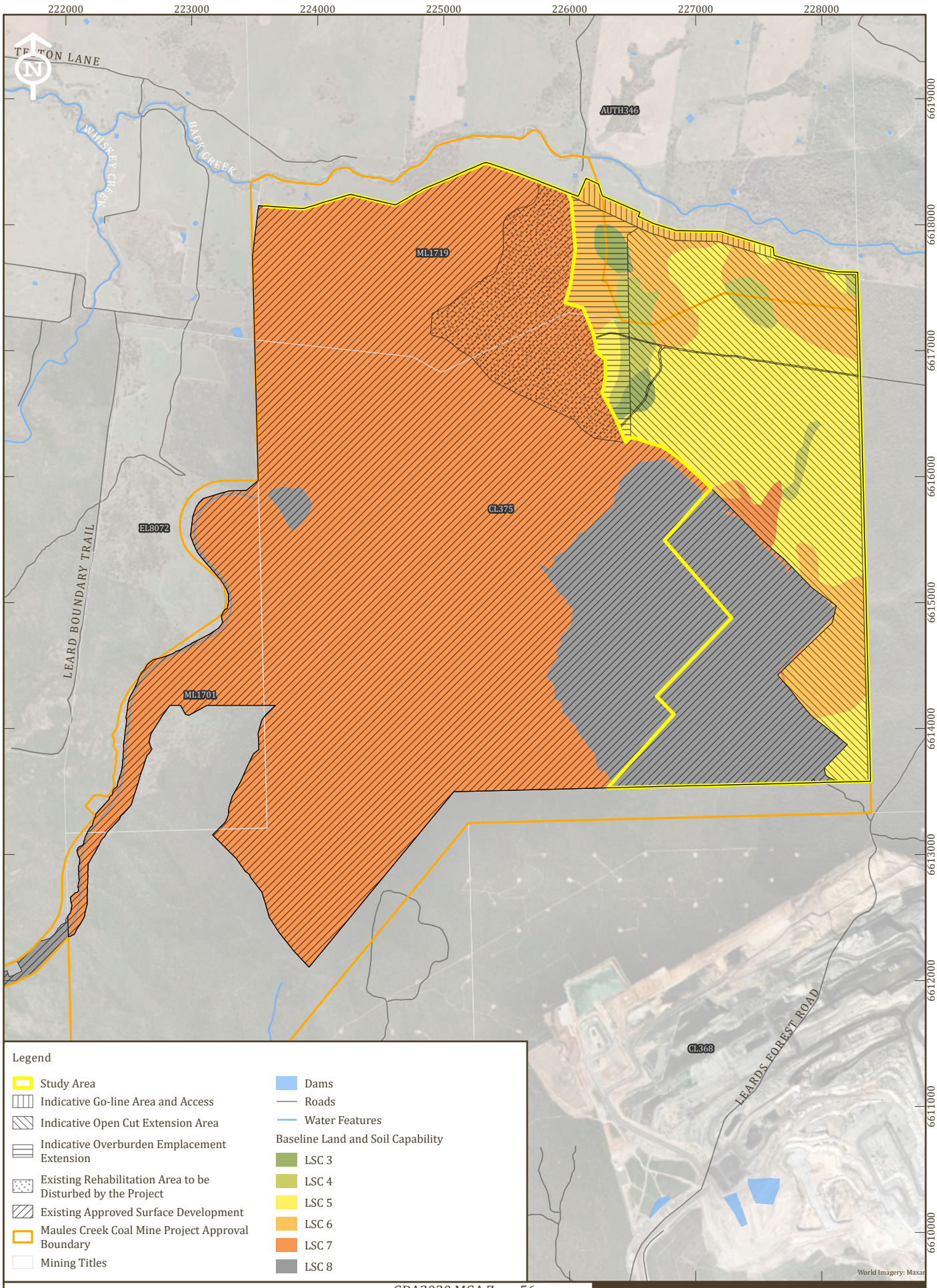
Table 5: Baseline LSC

LSC Class	Approved MCCM Surface Development Area		Extension Area		Go-Line, Access and Infrastructure Area		LSC Study Area	
	ha	%	ha	%	ha	%	ha	%
3	0	0	16	3	0	0	16	1
4	0	0	40	8	1	4	41	2
5	0	0	282	56	7	26	289	12
6	0	0	156	31	18	67	174	7
7	1,499	88	12	2	1	4	1,512	61
8	440	12	0	0	0	0	440	18
Total	1,939	100	506	100	27	100	2,472	100

Table 6: Baseline LSC Criteria Ratings

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
		Water erosion	Wind erosion	Structure	Acidity	Salinity	Water-logging	Soil depth	Movement	Class
B1	Vertic Eutrophic Brown Dermosol	1	3	3	2	1	2	4	1	**4**
B2	Vertic Eutrophic Grey Chromosol	1	3	3	3	1	2	1	1	**3**
B3	Eutrophic Mottled-Mesonatric Red Sodosol	1	4	3	5	1	6	3	1	**6**
B4	Eutrophic Mottled-Mesonatric Red Sodosol	1	4	3	5	1	6	3	1	**6**
B5	Vertic Eutrophic Brown Chromosol	1	3	3	4	1	2	1	1	**4**
B6	Vertic Eutrophic Brown Dermosol	1	3	3	4	1	2	1	1	**4**
B7	Bleached-Mottled Eutrophic Brown Chromosol	1	4	3	5	1	6	3	1	**6**
B8	Bleached-Mottled Eutrophic Brown Chromosol	1	4	3	5	1	6	3	1	**6**
B9	Eutrophic Subnatric Black Sodosol	1	4	3	5	4	2	1	1	**5**
B10	Eutrophic Subnatric Grey Sodosol	1	3	3	4	4	2	1	1	**4**
B11	Basic Paralithic Leptic Tenosol	1	4	3	5	1	1	1	1	**5**
B12	Eutrophic Mottled-Mesonatric Brown Sodosol	1	6	1	5	1	6	1	1	**6**
B13	Eutrophic Subnatric Brown Sodosol	1	3	3	4	1	2	1	1	**4**
B14	Haplic Eutrophic Brown Chromosol	1	3	3	4	1	2	6	1	**6**
B15	Sodic Eutrophic Grey Chromosol	1	4	3	5	1	2	1	1	**5**
B16	Eutrophic Mesonatric Brown Sodosol	1	4	3	5	1	4	1	1	**5**
B17	Vertic Eutrophic Black Dermosol	1	3	3	2	1	2	6	1	**6**
B18	Haplic Epipedal Black Vertosol	1	3	3	2	1	2	4	1	**4**
B19	Haplic Eutrophic Grey Chromosol	1	4	3	5	1	2	1	1	**5**
B20	Eutrophic Subnatric Grey Sodosol	1	4	3	5	1	6	1	1	**6**
B21	Sodic Eutrophic Brown Chromosol	1	6	1	5	1	3	1	1	**6**
B22	Bleached-Mottled Eutrophic Grey Chromosol	1	6	1	4	1	6	1	1	**6**
B23	Bleached-Sodic Eutrophic Grey Dermosol	1	3	6	4	1	2	6	1	**6**
B24	Basic Arenic Bleached Tenosol	1	6	1	5	1	1	1	1	**6**
B25	Basic Arenic Grey Tenosol	1	6	1	4	1	1	1	1	**6**
B26	Eutrophic Mesonatric Brown Sodosol	1	3	3	4	1	2	1	1	**4**
B27	Acidic Gritty Brown Tenosol	1	6	1	5	1	1	1	1	**6**
B28	Basic Lithic Grey Tenosol	1	6	1	5	1	1	1	1	**6**
B29	Eutrophic Subnatric Brown Sodosol	1	3	3	4	1	2	4	1	**4**
B30	Basic Paralithic Brown-Orthic Tenosol	1	4	3	5	1	1	1	1	**5**

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
		Water erosion	Wind erosion	Structure	Acidity	Salinity	Water-logging	Soil depth	Movement	Class
B31	Vertic Eutrophic Black Dermosol	1	3	3	4	1	2	6	1	**6**
B32	Basic Regolithic Brown-Orthic Tenosol	1	4	3	5	1	1	1	1	**5**
E1	Haplic Eutrophic Grey Chromosol	1	3	3	3	1	1	1	1	**3**
E2	Eutrophic Hypernatric Grey Sodosol	3	4	3	5	1	1	1	1	**5**
E3	Basic Lithic Grey Tenosol	3	4	3	5	1	1	1	1	**5**
E4	Basic Lithic Black Tenosol	3	4	3	5	1	1	4	1	**5**
E5	Basic Lithic Black Tenosol	4	4	3	5	1	1	4	1	**5**
E6	Eutrophic Mottled-Subnatric Grey Sodosol	3	3	4	4	1	1	1	1	**4**
E7	Basic Lithic Brown Tenosol	3	4	3	5	1	1	4	1	**5**
E8	Basic Lithic Grey Tenosol	4	6	1	5	1	1	4	1	**6**
E9	Basic Lithic Grey Tenosol	3	4	4	5	1	1	4	1	**5**
E10	Basic Lithic Brown Tenosol	4	4	4	5	1	1	1	1	**5**
E11	Acidic Lithic Brown Tenosol	4	6	1	5	1	1	6	1	**6**
E12	Basic Lithic Brown Tenosol	3	4	3	5	1	1	6	1	**6**
E13	Basic Lithic Black Tenosol	3	3	3	4	1	1	6	1	**6**
E14	Basic Lithic Brown Tenosol	3	3	3	4	1	1	6	1	**6**
E15	Basic Lithic Brown Tenosol	2	4	3	5	1	1	4	1	**5**
E16	Acidic Lithic Brown Tenosol	3	4	3	5	1	1	4	1	**5**
E17	Eutrophic Subnatric Grey Sodosol	3	4	3	5	1	1	4	1	**5**
E18	Basic Lithic Brown Tenosol	6	4	3	5	1	1	4	1	**6**
E19	Acidic Lithic Brown Tenosol	4	4	3	5	1	1	3	1	**5**
E20	-	3	4	3	5	1	1	-	1	**5**
E21	Basic Lithic Brown Tenosol	3	4	3	5	1	1	6	1	**6**
E22	Acidic Lithic Brown Tenosol	6	4	3	5	1	1	6	1	**6**
E23	Basic Lithic Brown Tenosol	3	4	3	4	1	1	6	1	**6**
E24	Basic Lithic Brown Tenosol	4	4	3	5	1	1	7	1	**7**
E25	Basic Lithic Brown Tenosol	3	4	3	5	1	1	7	1	**7**
E26	Basic Lithic Brown Tenosol	3	4	3	5	1	1	1	1	**5**



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Baseline Land and Soil Capability

FIGURE 12

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A description of the LSC classes within the LSC Study Area are provided below.

LSC class 3

Class 3 land occurs in a limited extent of land in the northern portion of the LSC Study Area. LSC class 3 land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation. The key limitations of this class within the LSC Study Area are soil structure decline, wind erosion and soil acidity.

LSC class 4

Class 4 land largely occurs on the lower plain to the north of the LSC Study Area, with an isolated area of LSC class 4 land occurring on a crest in the centre of the LSC Study Area. LSC class 4 land has moderate to high limitations for high-impact land uses, and would restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology. The key limitations of this class within the LSC Study Area are soil structure decline, wind erosion, soil depth and soil acidity.

LSC class 5

Class 5 land occurs widespread throughout the LSC Study Area. Land has high limitations for high-impact land uses, and would largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation. The key limitation of this class within the LSC Study Area is soil acidity.

LSC class 6

Class 6 land occurs throughout the northern and southern portions of the LSC Study Area. Class 6 land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation. The key limitations of this class within the LSC Study Area are wind erosion, waterlogging and soil depth.

LSC class 7

Class 7 land occurs on a crest area of the LSC Study Area and across all rehabilitated native ecosystem areas of the approved MCCM surface development area. Class 7 land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation. The key limitation of this class within the LSC Study Area is slope and soil depth.

LSC class 8

The final void and water management areas of the LSC Study Area are designated as class 8 lands. Class 8 land is extremely low capability land with imitations that are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

4.4 POST-DISTURBANCE LSC

Due to the nature of the Project (i.e. open cut mining operations), major landform modification and soil stripping impacts on baseline LSC classes would occur. During operations, the LSC class within these areas would be considered LSC class 8 which is not suitable for agriculture, due to mining operations and associated infrastructure.

The post-disturbance LSC of the LSC Study Area is determined by assessing the post mining landform and final land uses in the context of available soil resources and respread depths, which are all further detailed in Section 5.

Following the life of the Project, the LSC Study Area would be rehabilitated to the following post mining land use domains:

- *Domain A – Native Ecosystem*.
- *Domain J – Final Void*.
- *Domain I – Infrastructure*.

A full description and justification of the final land use domains, as well as rehabilitation methodology and respective completion criteria, is presented in the Rehabilitation Strategy and EIS prepared for the Project.

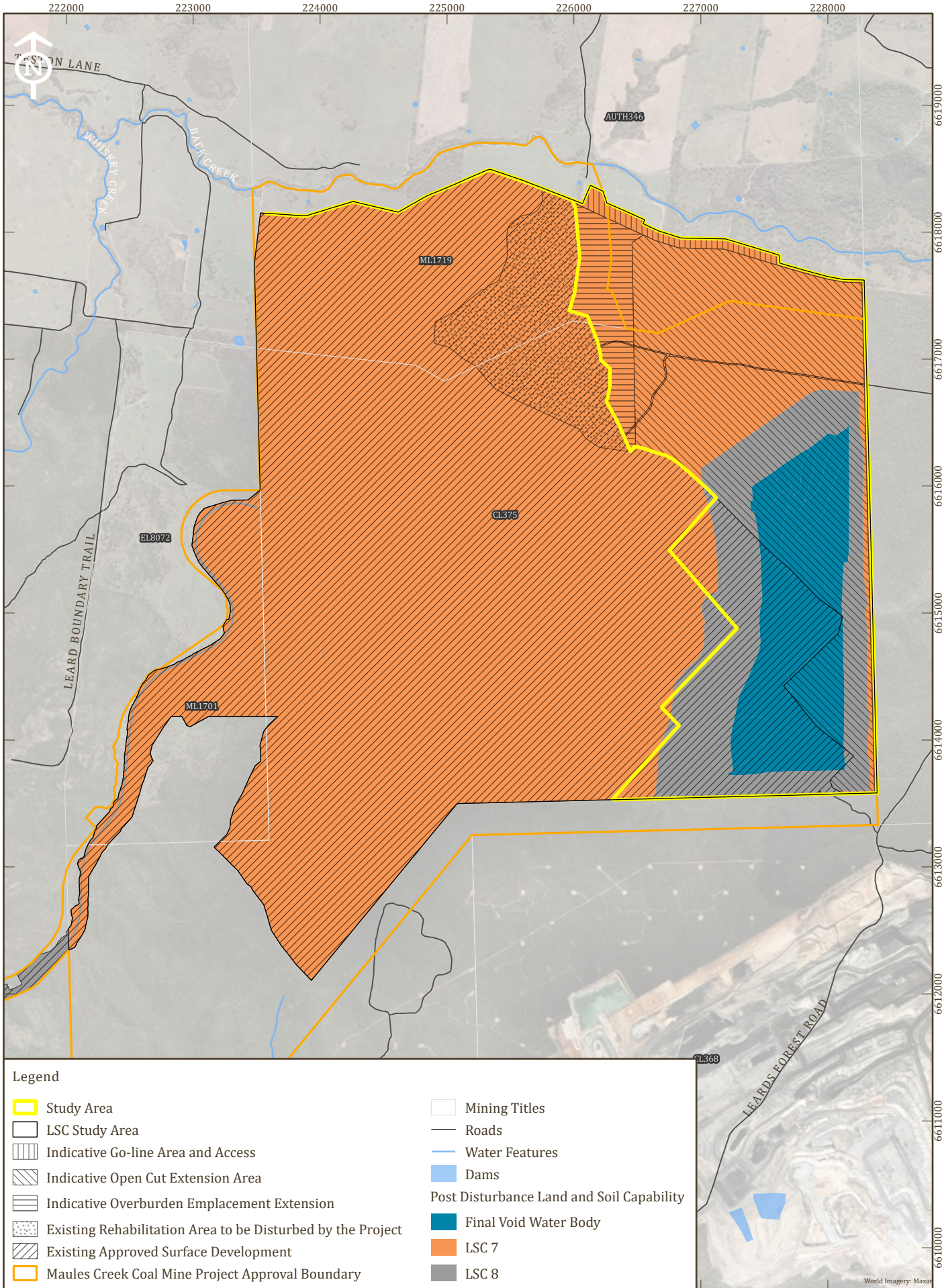
Direct impact areas to be rehabilitated to *Domain A – Native Ecosystem* would be graded into a suitable landform and respread with stockpiled soil resources. These areas would then be revegetated with target species appropriate for the final land use. This strategy, along with the soil management practices as outlined in Section 5, would facilitate the rehabilitation areas achieving a target post mining land use that is generally aligned with LSC class 7, a conservative classification that allows for variances in soil respread depth and slope at the final landform establishment stage.

The remaining areas subject to *Domain J – Final Void* would not support any form of LSC. These areas will default to LSC class 8.

The indicative post-disturbance LSC of the LSC Study Area is shown on **Figure 13** and presented in **Table 7** below.

Table 7: Post-Disturbance LSC of the Direct Impact Area

Post Mining Land Use Domain	LSC	LSC Study Area	
		ha	%
Domain A – Native Ecosystem	7	2,062	83
Domain J – Final Void	8	410	17
Domain I – Infrastructure			
Total		2,472	100



Legend

- Study Area
- LSC Study Area
- Indicative Go-line Area and Access
- Indicative Open Cut Extension Area
- Indicative Overburden Emplacement Extension
- Existing Rehabilitation Area to be Disturbed by the Project
- Existing Approved Surface Development
- Maules Creek Coal Mine Project Approval Boundary
- Mining Titles
- Roads
- Water Features
- Dams

Post Disturbance Land and Soil Capability

- Final Void Water Body
- LSC 7
- LSC 8

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Post-Disturbance Land and Soil Capability

FIGURE 13

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5 SOIL MANAGEMENT

Soil that is proposed to be disturbed during the Project has been assessed to determine suitability for stripping, salvage and re-use. This assessment is an integral process for successful rehabilitation of the Project. This section provides information on the following key areas related to the management of the topsoil resources within the Study Area.

5.1 SOIL STRIPPING METHODOLOGY

The procedure for determining soil stripping depths involves assessing soils based on a range of physical and chemical parameters. This is combined with an understanding of the nature of disturbance and potential alternative options for suitable material. Determination of suitable soil to conserve for later use in rehabilitation has been conducted. **Table 8** below lists the key parameters and corresponding desirable selection criteria used as a guide for the selection of soil material for use as topdressing. However, given the nature of the soils present on site, consideration and weight is also given to existing soil material appropriate for establishing similar bushland habitat as a final land use in rehabilitated areas.

Table 8: Desirable Soil Stripping Characteristics

Parameter	Desirable Criteria
Structure Grade	>30% peds
Coherence	Coherent (wet and dry)
Mottling	Absent
Macrostructure	>10 centimetres
Force to Disrupt Peds	≤ 3 force
Texture	Finer than a Fine Sandy Loam
Gravel & Sand Content	<60%

Gravel and sand content, pH and salinity were determined for all samples using the laboratory test results. Texture was determined in the field and cross referenced with laboratory results, specifically particle size analysis. All other physical parameters outlined in the table above were determined during the field assessment.

Structural grade is significant in terms of the soil's capability to facilitate water retention and aeration. Good permeability and adequate aeration are essential for the germination and establishment of plants. The ability of water to enter soil generally varies with structure grade and depends on the proportion of coarse peds in the soil surface. Better structured soils have higher infiltration rates and better aeration characteristics. Structureless soils, without pores, can be problematic as topdressing materials. The shearing test is used as a measure of the soil's ability to maintain structure grade. Brittle soils are not considered suitable for revegetation where structure grade is weak or moderate because peds are likely to be destroyed and structure is likely to become massive following mechanical work associated with the excavation, transportation and spreading of topdressing material. Consequently, surface sealing and reduced infiltration of water may occur which would restrict the establishment of plants.

The force to disrupt peds, when assessed on soil in a moderately moist state, is an indicator of solidity and the method of ped formation. Deflocculated soils are hard when dry and slake when wet, whereas flocculated soils produce crumbly peds in both the wet and dry state. The deflocculated soils are not suitable for revegetation and may be identified by a strong force required to break aggregates.

The presence of mottling within the soil may indicate reducing conditions and poor soil aeration. These factors are common in soil with low permeability; however, some soils are mottled due to other reasons, including proximity to high water-tables or inheritance of mottles from previous conditions. Reducing soils and poorly aerated soils are unsuitable for revegetation purposes.

5.2 SOIL STRIPPING STRATEGY

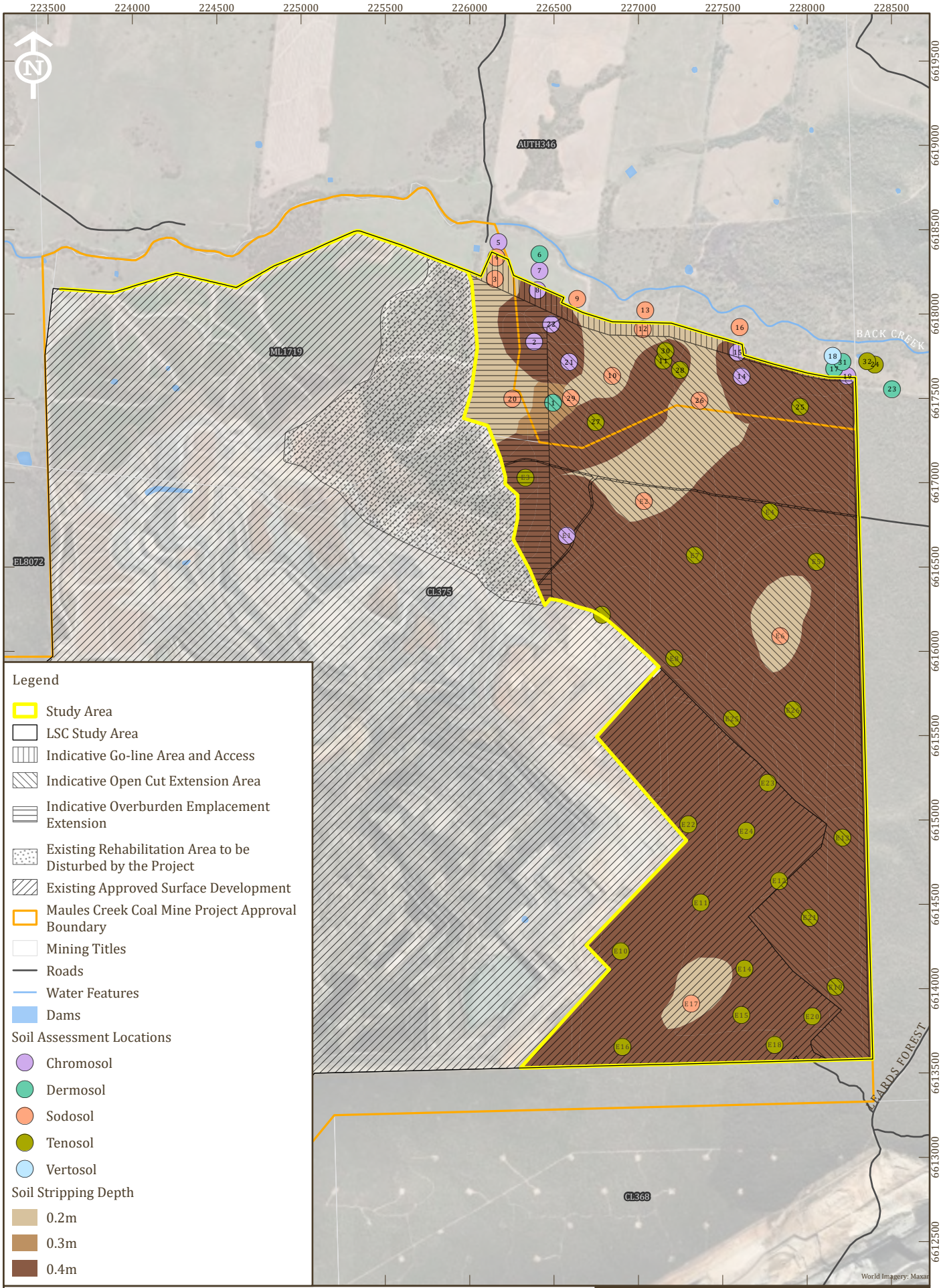
Laboratory soil analytical results (refer **Appendix 2**) were used in conjunction with the field assessment (refer Section 3) to determine the available soil material suitable for recovery and re-use as a topdressing material in rehabilitation, following the life of the Project. Structural and textural properties of soils, along with stones, dispersion potential, sodicity and acidity/alkalinity are the most common and significant limiting factors in determining depth of soil suitability for re-use.

Soil Unit 1: Dermosols

Soil Unit 1 generally contains desirable topsoil material, however the subsoils associated with this unit are inconsistent and problematic due to sporadic occurrence of sodic clays. Sodic clays would typically be inappropriate for stripping and rehabilitation purposes due to their dispersive nature. However, due to the inconsistent presence of sodic clay subsoils within this soil unit, and the otherwise desirable characteristics of the material (such as structure, macropores and consistency), these soils may be salvaged and utilised if controls are implemented to manage the risk of surface water erosion likely to occur once excavated, exposed and stored.

Upon respreading, the clay subsoils associated with this unit should be used as a subsoil where practical, and encapsulated by the sandy and loamy topsoils and/or subsoils associated with Soil Units 2, 3 and 4. Establishing a subsoil layer with soils with a greater clay fraction followed by topdressing with coarser textured materials will be beneficial to revegetation efforts by increasing the growth medium rootzone and water holding capacity. Further, the capping of potentially sodic clays with topsoils will limit dispersion risk.

These soils can be stripped to 0.3 m where mapped (refer **Figure 14**). Avoid salvage to further depths to limit likelihood of salvaging sodic materials or rocky, decomposing parent materials.



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Soil Stripping Depths

FIGURE 14

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Soil Unit 2: Chromosols

Soil Unit 2 generally contains desirable topsoil and subsoil material, and represent the most chemically and physically stable soils within the Study Area. These soils can be salvaged for re-use with low management risk. Upon respreading, material from this unit should be reinstated in a similar way to the original profile condition, with coarser materials encapsulating clay materials, as per strategy outlined for Soil Unit 1.

These soils can be stripped to 0.4 m where mapped, noting that topsoil should be stripped to 0.2 m, followed by subsoils to a depth of 0.4 m, with measures in place to avoid mixing. Opportunistic recovery of deeper material may be undertaken in pockets of this unit where a low coarse fragment presence occurs at depth.

Soil Unit 3: Sodosols

The topsoils for Soil Unit 3 are generally desirable. Subsoils are not considered appropriate, or worth the additional risk for soil budgeting purposes, given these soils represent additional management risks during stripping and rehabilitation due to the consistent presence of poorly structured, often mottled, and dispersive sodic clay materials within the Sodosol unit.

These soils can be stripped to 0.2 m where mapped. Opportunistic recovery of deeper material may be undertaken in pockets of this unit where coarser topsoils depths (i.e. sand, loams and clay loam) are visually observed during stripping, as required.

Soil Unit 4: Tenosols

Soil Unit 4 has a coarser texture and poorer structure throughout the entire profile than would ordinarily be desirable for stripping and re-use. Nonetheless, given the generally non-dispersive and chemically stable nature of these soils, as well as they currently support native ecosystem which would constitute the target final land use, stripping for re-use in rehabilitation is recommended. This soil unit can be used non-discriminately as topdressing over clayey materials, such as Soil Unit 1. Stripping for this unit should be to an approximate depth of 0.4 m, or deeper to bedrock as much as possible and as far as practical where materials are visually similar (i.e., sandy) to those in the upper profile. Some testing may be required to ensure deeper layers are suitable as topdressing.

The available stripping depths for each unit is displayed in **Figure 14**. The extent of each soil unit is displayed on **Figure 11**.

5.3 SOIL BANK AND BALANCE

The stripping depths nominated above are used as a reference to model calculations for a soil balance volume scenario, which demonstrates the availability of material for Project rehabilitation purposes.

Note the soil balance is largely conceptual. Assessments should be undertaken during stripping activities to determine if greater depths of desirable salvageable soil material (as anticipated for Soil Types 2 and 4) can be recovered as required. An accurate record of soil material volumes should be maintained for the site.

A conceptual soil bank of all recoverable soil resources to be available for rehabilitation of the Project is estimated at 5,085,457 cubic metres (m^3), as presented in **Table 9**, based on the following assumptions:

- Average soil stripping depths achieved for each Soil Unit within the Survey Area are as per depths provided in Section 5.2 and **Figure 14**.
- The 2024 rehabilitation areas contain 0.2 m of recoverable soil resource within the native ecosystem final land use domain, resulting in 288,000 m^3 obtained from approximately 144 ha of rehabilitated areas within the Approved Surface Disturbance Area as of 2024 (noting this is for the conceptual purpose of this assessment only, and these areas will be generally unaffected by the Project).
- Stockpiled soil as of 2024 is 2,591,508 m^3, as advised by Whitehaven.

In order to determine the total required soil volume for rehabilitation activities, soil respread depths for the areas subject to the proposed final land use domains is presented in **Table 10**, which shows a requirement for 4,124,000 m³ of soil. A 0.2 m respread depth for *Domain A – Native Ecosystem* is assumed and based on best practice in order to achieve the land use objective of the domain and to meet requirements of the LSC class 7, as presented in Section 4.4.

A soil balance based on recoverable soil resources and anticipated rehabilitation requirements is presented in **Table 11**, which shows a soil balance in surplus of 961,457 m³.

Table 9: Conceptual Soil Bank

Soil Resource Name	Total Area (ha)	Recommended Stripping Depth (m)	Soil Volume (m³)
Soil Unit 1: Dermosols	7	0.3	21,000
Soil Unit 2: Chromosols	68	0.4	272,000
Soil Unit 3: Sodosols	115	0.2	230,000
Soil Unit 4: Tenosols	562	0.4	2,248,000
2024 rehabilitation resource available for recovery	144	0.2	288,000
2024 stockpiled soil			2,591,508
-10% handling loss/contingency			- 565,051
		Total Volume (m³)	5,085,457

Table 10: Project Rehabilitation Soil Resource Requirement

Soil Resource Name	Total Area (ha)	Soil Volume (m^3)
Domain A: Native Ecosystem	2,062	4,124,000
Domain J – Final Void	410	0
Domain I – Infrastructure		
	Total Volume (m^3)	4,124,000

Table 11: Conceptual Soil Balance

Soil Resource Name	Soil Volume (m^3)
Recoverable soil materials	5,085,457
Required soil material for rehabilitation purposes	4,124,000
Surplus soil volume	961,457

5.4 STRIPPED SOIL MANAGEMENT

The following soil handling techniques are recommended to prevent excessive soil deterioration and dispersion. Final soil handling methods would be included in the Rehabilitation Management Plan (RMP) for the site and may include alternate methods to manage soil deterioration.

- Prior to stripping of soil, appropriate sediment controls should be installed to prevent off-site loss of soil sediments.
- Strip desirable soil material to maximum excavation depths, subject to further investigation as required.
- Stripping of saturated soils should be avoided.
- Grade or push soil into windrows with graders or dozers for later collection by open bowl scrapers or for loading into rear dump trucks by front-end loaders. These techniques are examples of preferential less aggressive soil handling systems. This minimises compression effects of the heavy equipment that is often necessary for economical transport of soil material.
- Soil transported by trucks may be placed directly onto rehabilitation areas or into storage. Soil transported by scrapers is best pushed to form stockpiles by other equipment (e.g. dozer) to avoid tracking over previously laid soil resulting in compaction of the stockpile.

Where feasible, soil is transferred directly from stripping to re-spreading operations, eliminating the need for storage. However, mine scheduling dictates that soil storage would be necessary on occasion for extended periods.

Where stockpiling is required, the following controls would be implemented in line with the MCCM Soil Management Protocol:

- Where possible, stockpiles would be located in areas away from drainage lines and/or drainage would be diverted around stockpiles to prevent erosion.
- If required, sediment controls would be installed downstream from stockpiles to prevent contamination of clean water.
- Stockpile height would be limited to the practicable minimum.
- New stockpiles would be continually created and old ones would be used in order of age.
- More erodible materials would be placed on flatter areas to minimise the potential for erosion.
- The surface of soil stockpiles shall be contour scarified in order to promote infiltration and minimise erosion until vegetation is established.
- When necessary, stockpiles would be seeded with (if storage times are to be less than five years) native grasses, tree or shrub species to protect the stockpile from raindrop splash erosion, aerate the soil to reduce anaerobic conditions, enhance organic carbon levels and suppress weeds.

5.5 SOIL RE-SPREADING AND SEEDBED PREPARATION

The following re-spreading and seedbank preparation techniques are recommended to prevent excessive soil deterioration and dispersion, in line with the MCCM Soil Management Protocol:

- Prior to the re-spreading of stockpiled soil, an assessment of weed infestation would be undertaken to determine if individual stockpiles require burial due to their unsuitability as a result of weed infestation. If unsuitable, the stockpiled material would be buried and capped as described above.
- When planning soil re-spreading, consider the information contained in the stockpile inventory (i.e. amount, age, type), climatic conditions, the location and distance of the stockpile from the area to be rehabilitated, the pre-mining vegetation communities (i.e. what communities were growing in the area prior to stripping), and the vegetation communities and final land use proposed for the rehabilitation area.
- During the removal of soils from the stockpiles, care would be taken to minimise structural degradation of the soils.
- Material would be spread in even layers at an appropriate thickness and would consider the soil depth information obtained through the pre-stripping soil sampling. During the life of the MCCM, monitoring and research studies would be undertaken to refine the soil depth used for each soil type and rehabilitation application.
- All soils would be lightly ripped prior to seeding. This would be conducted on the contour and would be managed to minimise the potential for unsuitable spoil material being ripped up to the surface.
- Where necessary, slow release fertiliser application would be conducted prior to seeding while the surface is being lightly scarified to create an optimal seed bed. The application rates and types of fertiliser used would be selected to minimise the potential for weed invasion.

Soil management measures would be included in the RMP for the site and may include alternate measures to manage soil deterioration.

5.6 MONITORING AND REPORTING

In accordance with the MCCM Soil Management Protocol, implementation of the various stages of soil stripping, stockpiling and reuse would be monitored and periodically reviewed. Where appropriate, management practices would be revised and updated based on operational experience and where improved performance/outcomes are identified.

The responsibility for overall soil management at the MCCM belongs to Whitehaven. However, all staff and contractors have a responsibility to follow the processes and procedures for managing soils, as outlined in the Soil Management Protocol. All staff and contractors must ensure that they have the necessary permits and approvals in place, including a Soil Stripping and Placement Plan, prior to undertaking works which would disturb soils.

Soil stripping and placement activities for each work area would be documented in the individual Soil Stripping and Placement Plans, which would be prepared following soil testing and updated following stripping activities to confirm the location of either stockpiled material or the direct placement of material.

Soil stockpiling and rehabilitation would be assessed and reported annually as part of the MCCM Annual Review.

5.7 WATER TRANSFER PIPELINE SOIL STRIPPING MEASURES

As described in Section 1.3, only the mine site component of the Project is expected to have a potential significant impact on soil resource and/or land capability. Notwithstanding, the following soil management measures would be implemented during the construction of the water transfer pipeline component of the Project:

- avoiding soil handling when the soils are excessively wet or dry, where practicable;
- minimising the handling of soil resources by having a dedicated area for stockpiling the soil resources;
- backfilling the trench as soon as practicable;
- backfilling subsoil in the trench prior to backfilling topsoil;
- promote vegetation establishment on respread soil as soon as practical; and
- implement suitable erosion and sediment controls where required until vegetative cover has been established.

6 SUMMARY

The Project was assessed by Minesoils to determine impacts on soil resources within the Study Area and impacts to land capability within the LSC Study Area. This included a desktop review of available soils and agricultural land use information; completion of a high intensity soil survey of previously undisturbed areas to be disturbed as a result of the Project, interpretation of field and laboratory data; and the provision of methods and findings of a soil classification and characterisation assessment, and a LSC classification assessment. The findings have been detailed in this report and are summarised below.

Four key soil units have been identified for the Study Area:

- Soil Unit 1: Dermosols – covering 7 ha;
- Soil Unit 2: Chromosols – covering 68 ha;
- Soil Unit 3: Sodosols – covering 115 ha; and
- Soil Unit 4: Tenosols – covering 562 ha.

The LSC assessment determined the LSC Study Area currently contains the following LSC classes:

- LSC class 3: High capability land – covering 16 ha;
- LSC class 4: Moderate capability land – covering 41 ha;
- LSC class 5: Moderately low capability land – covering 289 ha;
- LSC class 6: Low capability land – covering 174 ha;
- LSC class 7: Very low capability land – covering 1,512 ha; and
- LSC class 8: Extremely low capability land – covering 440 ha.

The post-disturbance LSC of the LSC Study Area is determined by assessing the post mining landform and final land uses in context of anticipated soil respread depths and available soil resources. Following the life of the Project, the LSC Study Area would be rehabilitated to the following final land use domains:

- *Domain A – Native Ecosystem*, with a soil respread depth assumption of 0.2 m;
- *Domain J – Final Void*, with no source resource allocation.

Therefore, the post mining land uses for the LSC Study Area would consist of the following LSC class areas.

- LSC class 7: Very low capability land – covering 2,062 ha; and
- LSC class 8: Extremely low capability land – covering 410 ha.

Soil disturbance mitigation measures and management recommendations have been provided as controls to temporary and long term risk of the Project on land and soil resources. The salvage of available soil material to stripping depths detailed in this report, combined with sound soil management practices during construction and operational phases of the Project, would ensure that the rehabilitation of the LSC Study Area is capable of facilitating the intended post mining land uses.

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Appendix 1
Soil Profile Descriptions

Site Description – Site B1				
Site Reference	B1	**ASC Name**	Vertic Eutrophic Brown Dermosol (CGOOV)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 226494
Surface Condition	Loose	**Permeability**	High	Y: 6617471

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A	**0.00 – 0.35**	Very dark greyish-brown (Munsell 10YR 3/2) Light Medium Clay with strong pedality. Neutral to strongly alkaline pH, non-saline and non-sodic. 10% coarse fragments 10 – 20mm. Many roots and well drained. Gradual boundary.
B	**0.35 – 0.65**	Brown (Munsell 10YR 5/3) Heavy Clay to Light Medium Clay with strong pedality. Strongly alkaline pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained.
R	**0.65 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.7	Neutral	0.9	Non sodic
0.20 – 0.30	0.4	Non-saline	8.5	Strongly Alkaline	1.7	Non sodic
0.40 – 0.50	0.9	Non-saline	8.9	Strongly Alkaline	3.4	Non sodic

Site Description – Site B2				
Site Reference	B2	**ASC Name**	Vertic Eutrophic Grey Chromosol (BGLOWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 226382
Surface Condition	Cracked	**Permeability**	High	Y: 6617832

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark greyish-brown (Munsell 10YR 3/2) Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. 10% coarse fragments 20mm. Many roots and well drained. Clear boundary.
B21	**0.10 – 0.30**	Dark grey (Munsell 7.5YR 4/1) Heavy Clay with strong pedality. Mildly alkaline pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Gradual boundary.
B22	**0.30 +**	Brown (Munsell 10YR 4/3) Light Medium Clay to Heavy Clay with strong pedality. Moderately alkaline pH, non-saline and non-sodic. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.2	Non-saline	6.2	Slightly Acidic	0.9	Non sodic
0.20 – 0.30	0.2	Non-saline	7.8	Mildly Alkaline	0.7	Non sodic
0.40 – 0.50	0.5	Non-saline	7.9	Moderately Alkaline	1.2	Non sodic
0.65 – 0.75	0.8	Non-saline	8.3	Moderately Alkaline	2.6	Non sodic

Site Description – Site B3					
Site Reference	B3	**ASC Name**	Eutrophic Mottled-Mesonatric Red Sodosol (BHLOVNR)		
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**	
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56	
Landform Element	Flat	**Drainage**	Poor	X: 226149	
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6618206	

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Black (Munsell 7.5YR 2.5/1) Sandy Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 2 - 10mm. Many roots and well drained. Abrupt boundary.
A2	**0.10 – 0.40**	Bleached light grey (Munsell 10YR 7/2) apedal Sand. Neutral pH, non-saline and non-sodic. 80% coarse fragments 2 – 10mm. Very few roots and poorly drained. Clear boundary.
B	**0.40 – 0.80**	Reddish-brown to strong brown (Munsell 5YR 5/3 to 7.5YR 4/6) Medium Clay with strong pedality. Mildly to very strongly alkaline pH, non-saline and strongly sodic. No coarse fragments. No roots and poorly drained. Gradual boundary. 40% distinct grey mottling.
R	**0.80 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	6.3	Slightly Acidic	0.9	Non sodic
0.20 – 0.30	0.5	Non-saline	6.9	Neutral	5.0	Non sodic
0.40 – 0.50	0.6	Non-saline	7.6	Mildly Alkaline	17.5	Sodic
0.65 – 0.75	1.7	Non-saline	9.0	Very Strongly Alkaline	18.9	Strongly Sodic

Site Description – Site B4					
Site Reference	B4	**ASC Name**	Eutrophic Mottled-Mesonatric Red Sodosol (BHLOVNR)		
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**	
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56	
Landform Element	Flat	**Drainage**	Poor	X: 226158	
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6618334	

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark brown (Munsell 7.5YR 2.5/2) Sandy Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 2 - 10mm. Many roots and well drained. Abrupt boundary.
A2	**0.10 – 0.40**	Bleached pinkish grey (Munsell 7.5 YR 7/2) apedal Sandy Loam. Neutral pH, non-saline and non-sodic. 80% coarse fragments 2 – 10mm. Very few roots and poorly drained. Clear boundary.
B	**0.40 – 0.80**	Reddish-brown to brown (Munsell 5YR 4/4 to 7.5YR 4/4) Light Medium Clay with strong pedality. Strongly to very strongly alkaline pH, slightly saline and strongly sodic. No coarse fragments. No roots and poorly drained. Gradual boundary. 40% distinct grey mottling.
R	**0.80 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	6.2	Slightly Acidic	1.5	Non sodic
0.20 – 0.30	0.4	Non-saline	6.9	Neutral	3.4	Non sodic
0.40 – 0.50	2.1	Slightly Saline	8.6	Strongly Alkaline	21.8	Sodic
0.65 – 0.75	3.5	Slightly Saline	9.1	Very Strongly Alkaline	28.9	Sodic

Site Description – Site B5				
Site Reference	B5	**ASC Name**	Vertic Eutrophic Brown Chromosol (BELOWNR)	
Average Slope	0%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 226171
Surface Condition	Hardset	**Permeability**	High	Y: 6618423

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Yellowish-brown (Munsell 10YR 5/4) Loam with moderate pedality. Moderately acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
B21	**0.10 – 0.35**	Brown (Munsell 7.5YR 4/3) Heavy Clay with strong pedality. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Gradual boundary.
B22	**0.35 +**	Dark yellowish-brown to brown (Munsell 10YR 4/4 to 10YR 4/3) Silty Clay to Light Medium Clay with strong pedality. Moderately to strongly alkaline pH, non- saline and non-sodic. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.2	Non-saline	5.9	Moderately Acidic	1.1	Non sodic
0.20 – 0.30	0.2	Non-saline	7.3	Neutral	1.4	Non sodic
0.40 – 0.50	0.5	Non-saline	8.0	Moderately Alkaline	1.8	Non sodic
0.65 – 0.75	1.2	Non-saline	8.7	Strongly Alkaline	1.8	Non sodic

Site Description – Site B6				
Site Reference	B6	**ASC Name**	Vertic Eutrophic Brown Dermosol (BFMMW)	
Average Slope	0%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 226413
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6618353

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark greyish brown (Munsell 10YR 3/2) Clay Loam with moderate pedality. Neutral pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
B21	**0.10 – 0.35**	Very dark grey (Munsell 10YR 3/1) Clay Loam with strong pedality. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Gradual boundary.
B22	**0.35 – 0.75**	Dark brown to dark reddish brown (Munsell 7.5YR 3/2 to 5YR 4/2) Sandy Loam to Sandy Clay Loam with moderate pedality. Slightly to moderately acidic pH, non- saline and non-sodic. No coarse fragments. Few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	6.6	Neutral	0.8	Non sodic
0.20 – 0.30	0.2	Non-saline	6.9	Neutral	0.1	Non sodic
0.40 – 0.50	0.2	Non-saline	6.4	Slightly Acidic	0.5	Non sodic
0.65 – 0.75	0.1	Non-saline	5.8	Moderately Acidic	0.9	Non sodic

Site Description – Site B7				
Site Reference	B7	**ASC Name**	Bleached-Mottled Eutrophic Brown Chromosol (BGLOWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Poor	X: 226413
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6618255

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 10YR 4/3) Sandy Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 2 - 10mm. Many roots and well drained. Abrupt boundary.
A2	**0.10 – 0.40**	Bleached very pale brown (Munsell 10YR 7/4) apedal Sandy Loam. Mildly alkaline pH, non-saline and non-sodic. 80% coarse fragments 2 – 10mm. Very few roots and poorly drained. Clear boundary.
B	**0.40 – 0.80**	Brown (Munsell 7.5YR 5/4) Light Clay with strong pedality. Strongly alkaline pH, non-saline and non-sodic. No coarse fragments. No roots and poorly drained. Gradual boundary. 40% distinct grey mottling.
R	**0.80 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.4	Slightly Acidic	0.0	Non sodic
0.20 – 0.30	0.5	Non-saline	7.4	Mildly Alkaline	0.4	Non sodic
0.40 – 0.50	1.0	Non-saline	8.5	Strongly Alkaline	0.1	Non sodic
0.65 – 0.75	0.9	Non-saline	8.5	Strongly Alkaline	0.2	Non sodic

Site Description – Site B8				
Site Reference	B8	**ASC Name**	Bleached-Mottled Eutrophic Brown Chromosol (BGLOWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Poor	X: 226402
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6618140

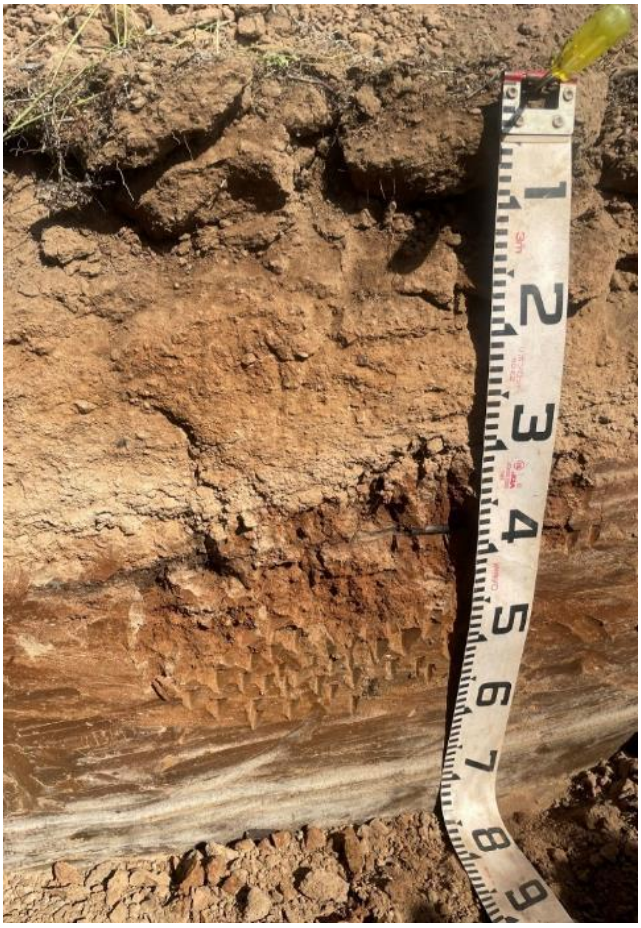

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Sandy Loam with moderate pedality. Neutral pH, non-saline and non-sodic. 20% coarse fragments 2 - 10mm. Many roots and well drained. Abrupt boundary.
A2	**0.10 – 0.40**	Bleached very pale brown (Munsell 10YR 7/4) apedal Sandy Loam. Neutral pH, non-saline and non-sodic. 80% coarse fragments 2 – 10mm. Very few roots and poorly drained. Clear boundary.
B	**0.40 – 0.80**	Strong brown to dark yellowish brown (Munsell 7.5YR 5/6 to 10YR 4/4) Medium Clay with strong pedality. Moderately alkaline pH, non-saline and non-sodic. No coarse fragments. No roots and poorly drained. Gradual boundary. 40% distinct grey mottling.
R	**0.75 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.7	Neutral	0.0	Non sodic
0.20 – 0.30	0.2	Non-saline	7.1	Neutral	1.3	Non sodic
0.40 – 0.50	0.2	Non-saline	7.8	Moderately Alkaline	0.6	Non sodic
0.65 – 0.75	0.3	Non-saline	8.3	Moderately Alkaline	1.2	Non sodic

Site Description – Site B9				
Site Reference	B9	**ASC Name**	Eutrophic Subnatric Black Sodosol (BELOWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 226637
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6618089

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A	0.00 – 0.15	Brown (Munsell 10YR 4/3) Sandy Loam with strong pedality. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
B	0.15 – 0.80+	Dark brown to brown (Munsell 7.5YR 3/2 to 10YR 4/3) Light Clay to Light Medium Clay with strong pedality. Slightly acidic to very strongly alkaline pH, moderately saline and sodic. No coarse fragments. Few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	1.1	Non-saline	6.3	Slightly Acidic	4.0	Non sodic
0.20 – 0.30	1.0	Non-saline	6.3	Slightly Acidic	13.1	Sodic
0.40 – 0.50	4.7	Moderately saline	9.0	Very Strongly Alkaline	19.4	Sodic
0.65 – 0.75	6.8	Moderately saline	9.1	Very Strongly Alkaline	22.0	Sodic

Site Description – Site B10				
Site Reference	B10	**ASC Name**	Eutrophic Subnatric Grey Sodosol (BHLOWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 226845
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6617633

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Dark greyish brown (Munsell 10YR 4/2) Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 – 20mm. Many roots and well drained. Clear boundary.
B21	**0.20 – 0.35**	Greyish-brown (Munsell 10YR 5/2) Medium Clay with strong pedality. Slightly acidic pH, non-saline and sodic. No coarse fragments. Common roots and moderately drained. Gradual boundary.
B22	**0.35 +**	Very dark grey (Munsell 7.5YR 3/1) Light Medium Clay to Light Clay with strong pedality. Strongly to very strongly alkaline pH, moderately saline and sodic. No coarse fragments. No roots and moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	6.3	Slightly Acidic	2.5	Non sodic
0.20 – 0.30	1.0	Non-saline	6.4	Slightly Acidic	13.5	Sodic
0.40 – 0.50	4.0	Moderately saline	8.9	Strongly Alkaline	16.1	Sodic
0.65 – 0.75	4.3	Moderately saline	9.1	Very Strongly Alkaline	14.6	Sodic

Site Description – Site B11				
Site Reference	B11	**ASC Name**	Basic Paralithic Leptic Tenosol (BELKWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Slight Rise	**Drainage**	Well	X: 227148
Surface Condition	Loose	**Permeability**	High	Y: 6617722

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Very dark greyish brown (Munsell 10YR 3/2) Sandy Loam with moderate pedality. Strongly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.15 – 0.30**	Dark reddish-grey (Munsell 2.5YR 4/1) apedal Sand. Slightly acidic pH, non-saline and non-sodic. 90% coarse fragments 10 – 50mm. Very few roots and well drained.
BC	**0.30 +**	Transition to parent material.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.2	Non-saline	5.5	Strongly Acidic	2.3	Non sodic
0.20 – 0.30	0.9	Non-saline	6.4	Slightly Acidic	5.8	Non sodic

Site Description – Site B12				
Site Reference	B12	**ASC Name**	Eutrophic Mottled-Mesonatric Brown Sodosol (BFKMWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Poor	X: 227025
Surface Condition	Loose	**Permeability**	Moderate	Y: 6617909

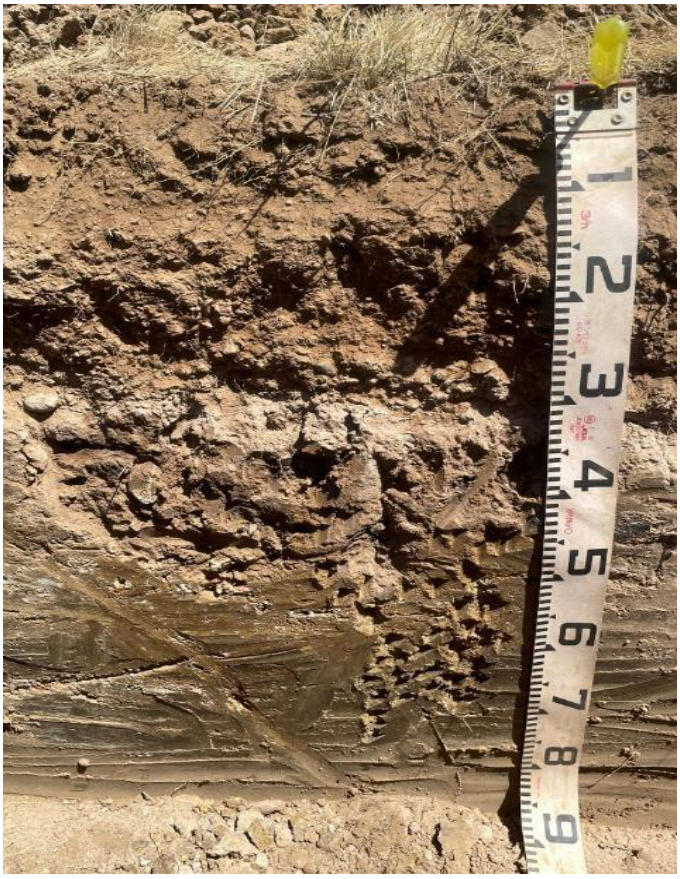

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark yellowish brown (Munsell 10YR 4/4) Loamy Sand with moderate pedality. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.30**	Bleached very pale brown (Munsell 10YR 7/3) apedal Sandy Loam. Neutral pH, non-saline and non-sodic. 80% coarse fragments 5 – 20mm. Very few roots and moderately drained. Clear boundary.
B	**0.30 +**	Brown to greyish brown (Munsell 5YR 4/6 to 7.5YR 4/4) Sandy Clay with strong pedality. Moderately alkaline pH, saline and sodic. No coarse fragments. Very few roots and poorly drained. 25% distinct grey mottling.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.3	Slightly Acidic	0.9	Non sodic
0.20 – 0.30	0.3	Non-saline	6.8	Neutral	1.6	Non sodic
0.40 – 0.50	4.5	Saline	8.1	Moderately Alkaline	19.5	Sodic
0.65 – 0.75	1.7	Non-saline	8.4	Moderately Alkaline	15.5	Sodic

Site Description – Site B13				
Site Reference	B13	**ASC Name**	Eutrophic Subnatric Brown Sodosol (BELOWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 227041
Surface Condition	Loose	**Permeability**	Moderate	Y: 6618022

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Brown (Munsell 10YR 4/3) Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	**0.20 – 0.50**	Yellowish-brown to Brown (Munsell 10YR 5/4 to 7.5YR 5/4) apedal Sandy Loam. Slightly acidic to neutral pH, non-saline and non-sodic. 60% coarse fragments <10mm. Few roots and moderately drained. Clear boundary.
B2	**0.50 +**	Strong brown (Munsell 7.5YR 5/6) Clay Loam with strong pedality. Moderately acidic pH, non- saline and sodic. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	6.5	Slightly Acidic	0.3	Non sodic
0.20 – 0.30	0.2	Non-saline	6.4	Slightly Acidic	0.8	Non sodic
0.40 – 0.50	0.2	Non-saline	7.0	Neutral	1.3	Non sodic
0.65 – 0.75	0.4	Non-saline	5.6	Moderately Acidic	6.1	Sodic

Site Description – Site B14				
Site Reference	B14	**ASC Name**	Haplic Eutrophic Brown Chromosol (BEMOUNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Lower slope	**Drainage**	Moderate	X: 227611
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6617628

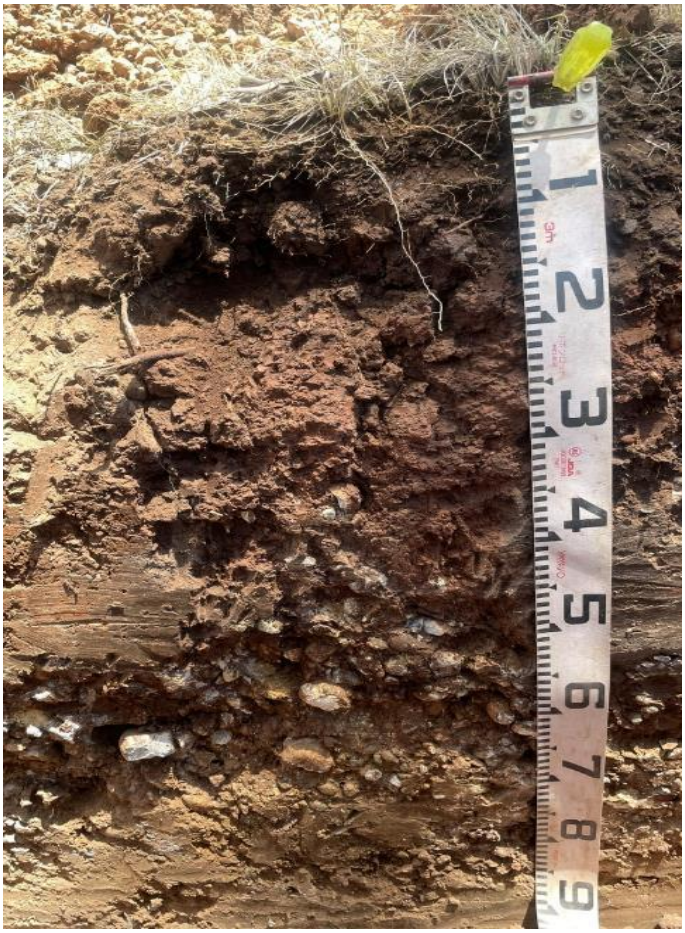

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark brown (Munsell 10YR 2/2) Clay Loam with moderate pedality. Moderately acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
B2	**0.10 – 0.45**	Brown (Munsell 7.5YR 4/4) Heavy Clay with strong pedality. Moderately acidic pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained.
R	**0.45 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	5.8	Moderately Acidic	1.0	Non sodic
0.20 – 0.30	0.5	Non-saline	6.0	Moderately Acidic	5.7	Non sodic

Site Description – Site B15				
Site Reference	B15	**ASC Name**	Sodic Eutrophic Grey Chromosol (BGLOVNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Lower slope	**Drainage**	Moderate	X: 227588
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6617771

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A	**0.00 – 0.20**	Dark brown (Munsell 7.5YR 3/2) Sandy Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. 90% coarse fragments 20 – 30mm. Many roots and well drained. Clear boundary.
B21	**0.20 – 0.40**	Brown (Munsell 7.5YR 5/2) Heavy Clay with strong pedality. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Gradual boundary.
B22	**0.40 – 0.60**	Yellowish red (Munsell 5YR 4/6) Sandy Clay with weak pedality. Moderately alkaline pH, non-saline and sodic. 95% coarse fragments 10 - 50mm. Few roots and moderately drained. Gradual boundary.
B23	**0.60 +**	Brown (Munsell 7.5YR 4/4) Heavy Clay with strong pedality. Strongly alkaline pH, saline and sodic. No coarse fragments. No roots and moderately drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.20	0.5	Non-saline	6.4	Slightly Acidic	1.5	Non sodic
0.20 – 0.40	0.4	Non-saline	7.3	Neutral	4.8	Non sodic
0.40 – 0.50	1.8	Non-saline	8.0	Moderately Alkaline	13.0	Sodic
0.65 – 0.75	5.8	Saline	8.8	Strongly Alkaline	15.3	Sodic

Site Description – Site B16				
Site Reference	B16	**ASC Name**	Eutrophic Mesonatric Brown Sodosol (BELLWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Imperfect	X: 227600
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6617920

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 10YR 3/3) Sandy Loam with weak pedality. Moderately acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Gradual boundary.
A2	**0.10 – 0.50**	Brown to light brown (Munsell 7.5YR 5/2 to 7.5YR 6/3) apedal Sandy Loam to Loamy Sand. Strongly to moderately acidic pH, non-saline and non-sodic to sodic. 80% coarse fragments 10mm. Moderately drained. Clear boundary.
B2	**0.50 +**	Brown (Munsell 7.5YR 4/3) Silty Loam with strong pedality. Mildly alkaline pH, non- saline and sodic. 60% coarse fragments 10 – 20mm. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	5.5	Moderately Acidic	1.4	Non sodic
0.20 – 0.30	0.1	Non-saline	5.2	Strongly Acidic	2.0	Non sodic
0.40 – 0.50	0.2	Non-saline	5.9	Moderately Acidic	6.5	Sodic
0.65 – 0.75	1.9	Non-saline	7.8	Mildly Alkaline	16.5	Sodic

Site Description – Site B17				
Site Reference	B17	**ASC Name**	Vertic Eutrophic Black Dermosol (BHNOU)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Moderately well	X: 228160
Surface Condition	Cracked	**Permeability**	High	Y: 6617674

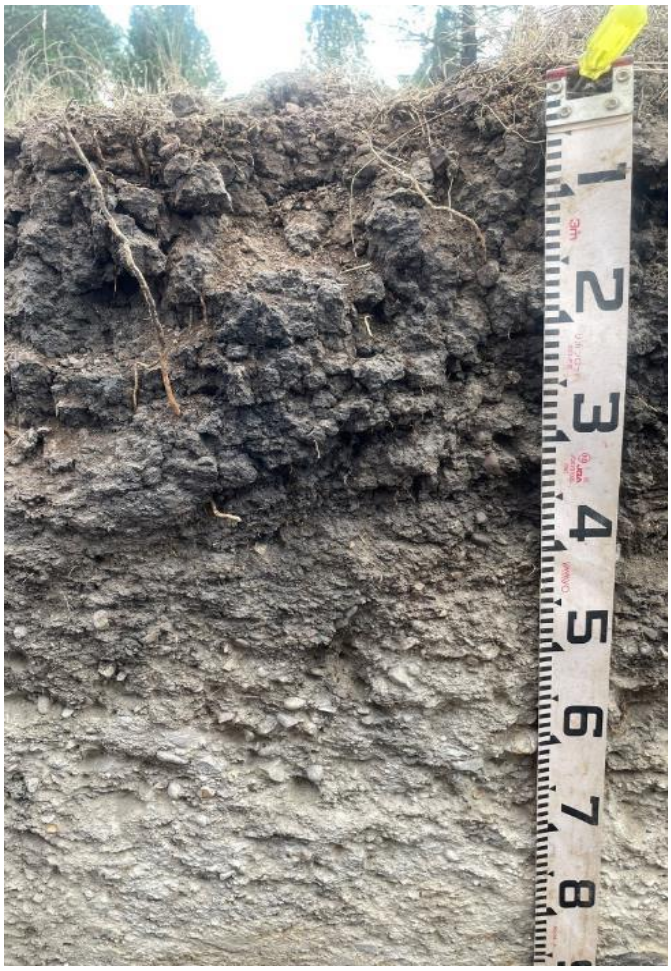

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A	**0.00 – 0.10**	Dark grayish-brown (Munsell 10YR 4/2) Sandy Clay with strong pedality. Slightly acidic pH, non-saline and non-sodic. 40% coarse fragments 10 – 20mm. Many roots and well drained. Gradual boundary.
B	**0.10 – 0.40**	Very dark gray (Munsell 10YR 3/1) Light Clay with strong pedality. Moderately alkaline pH, non-saline and sodic. No coarse fragments. Common roots and moderately well drained.
R	**0.40 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.9	Non-saline	6.2	Slightly Acidic	3.9	Non sodic
0.20 – 0.30	1.0	Non-saline	8.2	Moderately Alkaline	7.5	Sodic

Site Description – Site B18				
Site Reference	B18	**ASC Name**	Haplic Epipedal Black Vertosol (FRSU)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	High	MGA 56
Landform Element	Flat	**Drainage**	Moderately well	X: 228151
Surface Condition	Cracked	**Permeability**	High	Y: 6617749

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A	**0.00 – 0.10**	Black (Munsell 7.5YR 2.5/1) Medium Clay with strong pedality. Slightly acidic pH, non-saline and non-sodic. 40% coarse fragments 10 – 20mm. Many roots and well drained. Gradual boundary.
B	**0.10 – 0.50**	Black to dark grey (Munsell 5Y 2.5/1 to 5Y 4/1) Medium to Heavy Clay with strong pedality. Moderately alkaline pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately well drained.
R	**0.50 +**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	6.5	Slightly Acidic	1.0	Non sodic
0.20 – 0.30	0.3	Non-saline	8.1	Moderately Alkaline	2.1	Non sodic
0.40 – 0.50	0.4	Non-saline	8.3	Moderately Alkaline	2.5	Non sodic

Site Description – Site B19				
Site Reference	B19	**ASC Name**	Haplic Eutrophic Grey Chromosol (BGLOVNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Lower Slope	**Drainage**	Moderate	X: 228239
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6617631

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A	**0.00 – 0.10**	Dark greyish brown (Munsell 10YR 4/2) Sandy Loam with moderate pedality. Moderately acidic pH, non-saline and non-sodic. 10% coarse fragments 10mm. Many roots and well drained. Clear boundary.
B21	**0.10 – 0.30**	Grey (Munsell 10YR 5/1) Light Clay with weak pedality. Neutral pH, non-saline and non-sodic. 80% coarse fragments 10 – 50mm. Common roots and moderately drained. Clear boundary.
B22	**0.30 +**	Greyish brown (Munsell 10YR 5/2) Clay Loam to Sandy Clay Loam with moderate pedality. Moderately alkaline pH, non- saline and non-sodic. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	5.8	Moderately Acidic	0.9	Non sodic
0.20 – 0.30	0.2	Non-saline	7.2	Neutral	1.3	Non sodic
0.40 – 0.50	0.3	Non-saline	8.0	Moderately Alkaline	2.1	Non sodic
0.65 – 0.75	0.4	Non-saline	8.2	Moderately Alkaline	2.3	Non sodic

Site Description – Site B20				
Site Reference	B20	**ASC Name**	Eutrophic Subnatric Grey Sodosol (BELMWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Poor	X: 226253
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617495

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	0.00 – 0.12	Very dark greyish-brown (Munsell 10YR 3/2) Sandy Loam with moderate pedality. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A21	0.12 – 0.40	Bleached light grey (Munsell 10YR 7/2) apedal Loamy Sand. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Clear boundary.
A22	0.40 – 0.65	Light brownish grey (Munsell 10YR 6/2) apedal Loamy Sand. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Clear boundary.
B2	0.65+	Greyish brown (Munsell 10YR 5/2) Clay Loam with strong pedality. Neutral pH, non- saline and sodic. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	6.4	Slightly Acidic	0.4	Non sodic
0.20 – 0.30	0.5	Non-saline	6.9	Neutral	2.5	Non sodic
0.40 – 0.50	0.7	Non-saline	6.9	Neutral	4.3	Non sodic
0.65 – 0.75	0.5	Non-saline	6.6	Neutral	8.0	Sodic

Site Description – Site B21				
Site Reference	B21	**ASC Name**	Sodic Eutrophic Brown Chromosol (BEKMWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Imperfect	X: 226589
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617715

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Loamy Sand with moderate pedality. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.15**	Light brown (Munsell 7.5YR 6/3) apedal Loamy Sand. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Clear boundary.
B2	**0.15 +**	Brown (Munsell 7.5YR 5/3 to 10YR 5/3) Light Clay trending to Clay Loam at depth with strong pedality. Mildly alkaline to very strongly alkaline pH, non- saline and sodic in the lower horizon. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.7	Non-saline	6.4	Slightly Acidic	0.6	Non sodic
0.10 – 0.15	0.3	Non-saline	6.5	Neutral	0.7	Non sodic
0.20 – 0.30	0.3	Non-saline	7.3	Mildly Alkaline	2.9	Non sodic
0.40 – 0.50	0.5	Non-saline	8.6	Strongly Alkaline	4.6	Non sodic
0.65 – 0.75	0.6	Non-saline	9.0	Very Strongly Alkaline	7.4	Sodic

Site Description – Site B22				
Site Reference	B22	**ASC Name**	Bleached-Mottled Eutrophic Grey Chromosol (BEKOWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Poor	X: 226483
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617938

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Loamy Sand with weak pedality. Neutral pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.35**	Bleached white (Munsell 10YR 8/1) apedal Loamy Sand. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Clear boundary.
B2	**0.35 +**	Light yellowish brown to grey (Munsell 2.5Y 6/3 to 2.5Y 6/1) Light Medium Clay trending to Light Clay with depth, with strong pedality. Moderately alkaline to strongly alkaline pH, non- saline and non-sodic. No coarse fragments. Very few roots and moderately drained. 20% distinct orange mottling.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	1.0	Non-saline	6.8	Neutral	0.2	Non sodic
0.20 – 0.30	0.5	Non-saline	7.3	Neutral	0.0	Non sodic
0.40 – 0.50	0.4	Non-saline	8.2	Moderately Alkaline	0.5	Non sodic
0.65 – 0.75	0.5	Non-saline	8.4	Strongly Alkaline	1.2	Non sodic

Site Description – Site B23				
Site Reference	B23	**ASC Name**	Bleached-Sodic Eutrophic Grey Dermosol (BELMU)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 228503
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617552

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Black (Munsell 2.5Y 2.5/1) Loam with moderate pedality. Slightly acidic pH, non-saline and sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.20**	Bleached light grey (Munsell 10YR 7/2) Loam with moderate pedality. Neutral pH, non-saline and sodic. 20% coarse fragments 10 - 20mm. Many Common roots and moderately drained. Clear boundary.
B	**0.20 – 0.30**	Grey (Munsell 2.5Y 5/1) Clay Loam with moderate pedality. Mildly alkaline pH, non- saline and sodic. 20% coarse fragments 10 - 20mm. Many Very few roots and moderately drained.
R	**0.30**	Weathered parent material. Unable to be dug by hand.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	6.4	Slightly Acidic	10.4	Sodic
0.20 – 0.30	0.7	Non-saline	7.0	Neutral	12.5	Sodic
0.40 – 0.50	1.0	Non-saline	7.7	Mildly Alkaline	13.2	Sodic

Site Description – Site B24				
Site Reference	B24	**ASC Name**	Basic Arenic Bleached Tenosol (BEKKWNR)	
Average Slope	0%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Well drained	X: 228402
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617699

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Loamy Sand with weak pedality. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.50**	Bleached very pale brown (Munsell 10YR 7/3) Loamy Sand with weak pedality. Neutral pH, non-saline and non-sodic. No coarse fragments. Common roots and moderately drained. Clear boundary.
B2	**0.50 +**	Light grey (Munsell 10YR 7/2) Loamy Sand weak pedality. Neutral pH, non- saline and non-sodic. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.7	Non-saline	6.1	Slightly Acidic	0.5	Non sodic
0.20 – 0.30	0.4	Non-saline	6.8	Neutral	0.1	Non sodic
0.40 – 0.50	0.4	Non-saline	7.0	Neutral	0.4	Non sodic
0.65 – 0.75	0.5	Non-saline	7.2	Neutral	2.7	Non sodic

Site Description – Site B25				
Site Reference	B25	**ASC Name**	Basic Arenic Grey Tenosol (BEKKWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Lower Slope	**Drainage**	Well drained	X: 227958
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617448

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark brown (Munsell 7.5YR 2.5/2) Loamy Sand with weak pedality. Neutral pH, non-saline and non-sodic. 20% coarse fragments 10mm. Many roots and well drained. Clear boundary.
B2	**0.10 +**	Dark greyish brown to pinkish grey to greyish brown (Munsell 10YR 4/2 to 7.5YR 6/2 to 10YR 5/2) apedal Loamy Sand. Neutral pH, non- saline and non-sodic. 40% coarse fragments 10 – 50mm. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	1.2	Non-saline	7.1	Neutral	0.0	Non sodic
0.20 – 0.30	0.9	Non-saline	6.8	Neutral	0.0	Non sodic
0.40 – 0.50	0.4	Non-saline	6.7	Neutral	0.0	Non sodic
0.65 – 0.75	0.6	Non-saline	7.1	Neutral	0.2	Non sodic

Site Description – Site B26				
Site Reference	B26	**ASC Name**	Eutrophic Mesonatric Brown Sodosol (BGLMWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Lower Slope	**Drainage**	Moderate	X: 227362
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617486

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Loam with weak pedality. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 - 20mm. Many roots and well drained. Clear boundary.
A21	**0.10 – 0.20**	Brown (Munsell 10YR 4/3) apedal Loamy Sand. Moderately acidic pH, non-saline and sodic. 30% coarse fragments 10 - 20mm. Many Common roots and moderately drained. Clear boundary.
A22	**0.20 – 0.30**	Brown (Munsell 10YR 5/3) Loam with moderate pedality. Moderately acidic pH, non- saline and sodic. 20% coarse fragments 10 - 20mm. Many Very few roots and moderately drained. Clear boundary.
B2	**0.30 +**	Brown (Munsell 7.5YR 5/3) Light Clay with moderate pedality. Moderately acidic pH, non- saline trending to slightly saline at depth, and sodic. 10% coarse fragments 20mm. Many Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	6.1	Slightly Acidic	0.2	Non sodic
0.10 – 0.20	0.9	Non-saline	6.0	Moderately Acidic	12.0	Sodic
0.20 – 0.30	1.1	Non-saline	5.7	Moderately Acidic	17.6	Sodic
0.40 – 0.50	1.4	Non-saline	5.7	Moderately Acidic	20.9	Sodic
0.65 – 0.75	2.0	Slightly saline	5.6	Moderately Acidic	22.6	Sodic

Site Description – Site B27				
Site Reference	B27	**ASC Name**	Acidic Gritty Brown Tenosol (BEKKWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Lower Slope	**Drainage**	Well Drained	X: 226746
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617358

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Loamy Sand with weak pedality. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. Many roots and well drained. Clear boundary.
B2	**0.10 +**	Brown (Munsell 7.5YR 4/3) apedal Sandy Loam to Loamy Sand. Strongly to moderately acidic pH, trending to slightly acidic pH at depth, non- saline and non-sodic. No coarse fragments. Very few roots and moderately drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.8	Non-saline	6.2	Slightly Acidic	1.1	Non sodic
0.20 – 0.30	0.2	Non-saline	5.4	Strongly Acidic	1.0	Non sodic
0.40 – 0.50	0.2	Non-saline	5.9	Moderately Acidic	1.3	Non sodic
0.65 – 0.75	0.3	Non-saline	6.0	Slightly Acidic	1.5	Non sodic

Site Description – Site B28				
Site Reference	B28	**ASC Name**	Basic Lithic Grey Tenosol (BFKKVNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Hillslope	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Lower Slope	**Drainage**	Well Drained	X: 227246
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617666

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Brown (Munsell 7.5YR 3/2) Loamy Sand with weak pedality. Neutral pH, non-saline and non-sodic. 10% coarse fragments <10mm. Many roots and well drained. Gradual boundary.
B2	**0.15 -0.80**	Light brownish gray (Munsell 10YR 6/2) apedal Loamy Sand. Moderately acidic to neutral pH, non- saline and strongly-sodic. 30% coarse fragments 10-20 mm. Few roots and well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.7	Non-saline	5.5	Strongly Acidic	2.9	Non sodic
0.20 – 0.30	0.2	Non-saline	5.9	Moderately Acidic	10.4	Sodic
0.40 – 0.50	0.2	Non-saline	6.5	Slightly Acidic	18.8	Strongly sodic
0.65 – 0.75	0.5	Non-saline	6.6	Neutral	21.8	Strongly sodic

Site Description – Site B29				
Site Reference	B29	**ASC Name**	Eutrophic Subnatric Brown Sodosol (BFLOVNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Moderate	X: 226600
Surface Condition	Hardset	**Permeability**	Moderate	Y: 6617500

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/3) Loam with moderate pedality. Moderately acidic pH, non-saline and non-sodic. Nil coarse fragments. Many roots and well drained. Clear boundary.
B21	**0.10 – 0.20**	Brown (Munsell 10YR 4/3) Clay loam with strong pedality. Slightly acidic pH, non-saline, and sodic. No coarse fragments. Common roots and moderately drained. Gradual boundary.
B22	**0.20 – 0.65**	Dark yellowish brown (Munsell 10YR 4/4) Light Clay with strong pedality. Slightly acidic to strongly alkaline pH, non-saline and sodic. No coarse fragments. Few roots and moderately drained. Clear boundary.
R	**0.65 +**	Weathered parent material with 80% rock content. No roots. Layer continues.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	5.9	Moderately Acidic	3.5	Non sodic
0.10 – 0.20	0.3	Non-saline	6.2	Slightly Acidic	6.4	Sodic
0.30 – 0.40	0.4	Non-saline	6.2	Slightly Acidic	7.0	Sodic
0.55 – 0.65	0.6	Non-saline	8.8	Strongly Alkaline	10.4	Sodic

Site Description – Site B30				
Site Reference	B30	**ASC Name**	Basic Paralithic Brown-Orthic Tenosol (CGLLWNR)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Slight Rise	**Drainage**	Well	X: 227161
Surface Condition	Loose	**Permeability**	Moderate	Y: 6617779

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 10YR 3/3) Sandy Loam with weak pedality. Slightly acidic pH, non-saline and non-sodic. 60% coarse fragments 5-10mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.40**	Dark yellowish brown (Munsell 10YR 4/4) Apedal Sandy Loam. Slightly acidic pH, non-saline and non-sodic. 90% coarse fragments 10-20mm. Common roots and well drained. Gradual boundary.
B/C	**0.40 -0.90**	Dark yellowish brown (Munsell 10YR 4/4) Apedal Sand to Sandy Loam. Neutral pH, non-saline and non-sodic to sodic. 90% coarse fragments 10-20mm. Few roots and well drained. Layer continues.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	6.2	Slightly Acidic	3.1	Non sodic
0.20 – 0.30	0.3	Non-saline	6.3	Slightly Acidic	4.2	Non sodic
0.40 – 0.50	0.5	Non-saline	7.2	Neutral	5.1	Non sodic
0.65 – 0.75	0.3	Non-saline	7.2	Neutral	6.3	Sodic

Site Description – Site B31				
Site Reference	B31	**ASC Name**	Vertic Eutrophic Black Dermosol (BHNOU)	
Average Slope	1%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately High	MGA 56
Landform Element	Flat	**Drainage**	Moderately well	X: 228210
Surface Condition	loose	**Permeability**	Moderate	Y: 6617714

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A	**0.00 – 0.10**	Dark reddish grey (Munsell 2.5YR 3/1) Sandy Clay Loam with strong pedality. Slightly acidic pH, non-saline and non-sodic. Nil coarse fragments. Many roots and moderately drained. Gradual boundary.
B	**0.10 – 0.40**	Dark reddish grey (Munsell 2.5YR 3/1) Sandy Clay to Heavy Clay with strong pedality. Neutral to moderately alkaline pH, non-saline and non-sodic to sodic. 20% coarse fragments 20mm. Common roots and moderately drained. Gradual boundary to cemented conglomerate (Hardpan).
R	**0.40 +**	Weathered parent material, cemented conglomerate. Unable to be dug by hand.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	6.3	Slightly Acidic	4.6	Non sodic
0.10 – 0.20	0.2	Non-saline	7.2	Neutral	4.5	Non sodic
0.30 – 0.40	0.9	Non-saline	8.1	Moderately Alkaline	8.0	Sodic

Site Description – Site B32				
Site Reference	B32	**ASC Name**	Basic Regolithic Brown-Orthic Tenosol (BEKKWNR)	
Average Slope	0%	**Land Use**	Vacant pasture	**Coordinates**
Landform Pattern	Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Well drained	X: 228356
Surface Condition	Soft	**Permeability**	Moderate	Y: 6617719

Plate 1 – Soil Profile

Plate 2 – Surface

Plate 3 – Landscape

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Dark brown (Munsell 10YR 3/3) Sandy Loam with weak pedality. Moderately acidic pH, non-saline and non-sodic. 10% coarse fragments 10mm. Many roots and well drained. Gradual boundary.
B2	**0.15 – 0.80**	Yellowish brown (Munsell 10YR 5/4) Apedal Sandy Loam. Neutral to mildly alkaline pH, non-saline and non-sodic. 60% coarse fragments 10mm. few roots and well drained. Layer continues.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	5.9	Moderately Acidic	2.3	Non sodic
0.20 – 0.30	0.3	Non-saline	7.0	Neutral	3.2	Non sodic
0.40 – 0.50	1.0	Non-saline	7.8	Mildly Alkaline	2.8	Non sodic
0.65 – 0.75	0.3	Non-saline	7.4	Mildly Alkaline	2.7	Non sodic

Site Description – Site E1				
Site Reference	E1	**ASC Name**	Haplic Eutrophic Grey Chromosol (CFMOWNR)	
Average Slope	1%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Moderate	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 226575
Surface Condition	Soft	**Permeability**	Moderate	Y: 6616685

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Dark brown (Munsell 10YR 5/6) Clay Loam with weak pedality, rough fabric and weak consistence. Neutral pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and well drained. Gradual boundary.
A2	**0.20 – 0.60**	Dark greyish brown (Munsell 10YR 4/2) Loam trending to Clay Loam with very weak pedality, earthy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and well drained. Abrupt boundary.
B2	**0.60 +**	Dark grey (Munsell 7.5YR 4/1) Medium Clay with moderate pedality, rough fabric and moderate consistence. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 5 - 10mm. Very few roots and imperfectly drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	7.1	Neutral	0.2	Non sodic
0.20 – 0.30	0.2	Non-saline	6.3	Slightly Acidic	0.6	Non sodic
0.40 – 0.50	0.2	Non-saline	6.3	Slightly Acidic	1.8	Non sodic
0.60 – 0.70	0.2	Non-saline	6.4	Slightly Acidic	3.0	Non sodic

Site Description – Site E2				
Site Reference	E2	**ASC Name**	Eutrophic Hypernatric Grey Sodosol (CGLOWNR)	
Average Slope	6%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Moderately Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227033
Surface Condition	Loose	**Permeability**	Moderate	Y: 6616890

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Dark brown (Munsell 7.5YR 3/2) Sandy Loam with weak pedality, rough fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and well drained. Gradual boundary.
A2	**0.15 – 0.50**	Dark greyish brown (Munsell 10YR 4/2) Sandy Loam with very weak pedality, earthy fabric and weak consistence. Moderately acidic pH, non-saline and sodic. 30% coarse fragments 5 - 10mm. Few roots and well drained. Clear boundary.
B2	**0.50 +**	Brown (Munsell 7.5YR 5/2) Light Clay with moderate pedality, rough fabric and moderate consistence. Slightly acidic pH, slightly saline and sodic. 30% coarse fragments 5 - 10mm. Very few roots and imperfectly drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	6.4	Slightly Acidic	0.5	Non sodic
0.20 – 0.30	0.3	Non-saline	5.6	Moderately Acidic	6.8	Sodic
0.50 – 0.60	2.1	Slightly saline	6.4	Slightly Acidic	32.2	Sodic

Site Description – Site E3				
Site Reference	E3	**ASC Name**	Basic Lithic Grey Tenosol (BGLLWNR)	
Average Slope	5%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 226331
Surface Condition	Loose	**Permeability**	Moderate	Y: 6617030

Plate 1 – Soil Profile

Plate 2 –Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.30**	Dark brown to brown (Munsell 7.5YR 3/3 to 10YR 4/3) Sandy Loam with weak pedality, earthy fabric and weak consistence. Slightly to moderately acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 30mm. Many roots and well drained. Clear boundary.
A2	**0.30+**	Light brown (Munsell 7.5YR 6/3) apedal Sandy Loam with sandy fabric. Slightly acidic pH, non-saline and sodic. 5% coarse fragments 5 - 30mm. Few roots and well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	6.0	Slightly Acidic	2.3	Non sodic
0.20 – 0.30	0.3	Non-saline	5.6	Moderately Acidic	2.1	Non sodic
0.40 – 0.50	0.2	Non-saline	6.2	Slightly Acidic	9.2	Sodic
0.70 – 0.80	0.2	Non-saline	6.3	Slightly Acidic	10.6	Sodic

Site Description – Site E4				
Site Reference	E4	**ASC Name**	Basic Lithic Black Tenosol (BHLLUNR)	
Average Slope	7%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227780
Surface Condition	Soft	**Permeability**	Moderate	Y: 6616826

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Very dark brown (Munsell 10YR 2/2) Sandy Loam with weak pedality, earthy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and well drained. Gradual boundary.
A2	**0.20 – 0.50**	Very dark brown (Munsell 10YR 2/2) apedal Sandy Loam with sandy fabric. Slightly acidic pH, non-saline and non-sodic. 40% coarse fragments 5 - 50mm. Few roots and well drained. Clear boundary.
C	**0.50 +**	Partially decomposed parent material.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	6.2	Slightly Acidic	0.6	Non sodic
0.20 – 0.30	0.4	Non-saline	6.5	Slightly Acidic	2.2	Non sodic

Site Description – Site E5				
Site Reference	E5	**ASC Name**	Basic Lithic Black Tenosol (BHLLUNR)	
Average Slope	11%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 228055
Surface Condition	Soft	**Permeability**	Moderate	Y: 6616531

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark brown (Munsell 10YR 2/2) Sandy Loam with weak pedality, rough fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. 20% coarse fragments 5 - 100mm. Many roots and well drained. Gradual boundary.
B2	**0.10 – 0.50**	Dark reddish brown (Munsell 5YR 3/2) Loam with weak pedality, rough fabric and weak consistence. Strongly acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Very few roots and well drained. Clear boundary.
C	**0.50 +**	Partially decomposed parent material.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	5.7	Moderately Acidic	0.1	Non sodic
0.20 – 0.30	0.2	Non-saline	5.0	Strongly Acidic	0.7	Non sodic

Site Description – Site E6					
Site Reference	E6	**ASC Name**	Eutrophic Mottled-Subnatric Grey Sodosol (CGLOWNR)		
Average Slope	3%	**Land Use**	Bushland	**Coordinates**	
Landform Pattern	Lower Plain	**Soil Fertility**	Moderately Low	MGA 56	
Landform Element	Upper Slope	**Drainage**	Well	X: 227840	
Surface Condition	Loose	**Permeability**	Moderate	Y: 6616091	

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Loam with weak pedality, rough fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and well drained. Gradual boundary.
A2	**0.10 – 0.50**	Brown (Munsell 7.5YR 4/2) Loam with very weak pedality, earthy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and well drained. Abrupt boundary.
B2	**0.50 +**	Light brownish grey (Munsell 10YR 6/2) Clay Loam with moderate pedality, rough fabric and moderate consistence. Neutral pH, non-saline and sodic. 20% coarse fragments 5 - 30mm. Very few roots and imperfectly drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.3	Non-saline	6.1	Slightly Acidic	0.6	Non sodic
0.20 – 0.30	0.1	Non-saline	5.8	Moderately Acidic	1.0	Non sodic
0.50 – 0.60	0.6	Non-saline	7.0	Neutral	6.7	Sodic

Site Description – Site E7				
Site Reference	E7	**ASC Name**	Basic Lithic Brown Tenosol (AGLLUNR)	
Average Slope	5%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227334
Surface Condition	Loose	**Permeability**	Moderate	Y: 6616569

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark brown (Munsell 7.5YR 2.5/2) apedal Sandy Loam with sandy fabric. Slightly acidic pH, non-saline and non-sodic. 15% coarse fragments 5 - 50mm. Many roots and rapidly drained. Gradual boundary.
A2	**0.10 – 0.45**	Brown (Munsell 7.5YR 5/4) apedal Sandy Loam with sandy fabric. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 5 - 50mm. Common roots and well drained. Clear boundary.
AC	**0.45+**	Transition layer to parent material with 90% coarse fragments 20 – 200mm.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.7	Non-saline	6.5	Slightly Acidic	0.4	Non sodic
0.20 – 0.30	0.3	Non-saline	6.1	Slightly Acidic	1.2	Non sodic

Site Description – Site E8				
Site Reference	E8	**ASC Name**	Basic Lithic Grey Tenosol (AGKKUNR)	
Average Slope	12%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227212
Surface Condition	Loose	**Permeability**	Moderate	Y: 6615959

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Very dark brown (Munsell 7.5YR 2.5/2) Loamy Sand with weak pedality, sandy fabric and weak consistence. Neutral pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and well drained. Gradual boundary.
A2	**0.15 – 0.50**	Brown (Munsell 7.5YR 5/4) apedal Loamy Sand with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 60% coarse fragments 20 – 50mm. Few roots and well drained. Clear boundary.
R	**0.50 +**	Hard bedrock.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.9	Non-saline	6.7	Neutral	0.1	Non sodic
0.20 – 0.30	0.4	Non-saline	5.7	Moderately Acidic	1.2	Non sodic

Site Description – Site E9				
Site Reference	E9	**ASC Name**	Basic Lithic Grey Tenosol (AGLKVNR)	
Average Slope	8%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 226784
Surface Condition	Loose	**Permeability**	Moderate	Y: 6616216

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark brown (Munsell 7.5YR 3/1) Sandy Loam with weak pedality, sandy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 5% coarse fragments 10mm. Many roots and well drained. Gradual boundary.
A2	**0.10 – 0.40**	Brown (Munsell 7.5YR 5/3) apedal Loamy Sand with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 50% coarse fragments 20 - 50mm. Very few roots and well drained. Clear boundary.
A3	**0.40 – 0.60**	Brown (Munsell 7.5YR 5/2) apedal Loamy Sand with sandy fabric. Moderately acidic pH, non-saline and sodic. 10% coarse fragments 20 - 100mm. No roots and imperfectly drained.
R	**0.60+**	Hard bedrock.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.4	Slightly Acidic	0.7	Non sodic
0.20 – 0.30	1.2	Non-saline	5.9	Moderately Acidic	3.6	Non sodic
0.40 – 0.50	1.2	Non-saline	6.0	Moderately Acidic	6.3	Sodic

Site Description – Site E10				
Site Reference	E10	**ASC Name**	Basic Lithic Brown Tenosol (BHLLVNR)	
Average Slope	18%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 226895
Surface Condition	Loose	**Permeability**	Moderate	Y: 6614221

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Very dark brown (Munsell 7.5YR 2.5/2) Sandy Loam with weak pedality, sandy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 - 30mm. Many roots and well drained. Gradual boundary.
A2	**0.15 – 0.40**	Very dark brown (Munsell 7.5YR 2.5/2) apedal Loam with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 50% coarse fragments 20 - 50mm. Very few roots and well drained. Clear boundary.
A3	**0.40 +**	Brown (Munsell 7.5YR 4/3) apedal Loamy Sand with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 40% coarse fragments 20 - 100mm. No roots and imperfectly drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.2	Slightly Acidic	0.5	Non sodic
0.20 – 0.30	0.3	Non-saline	6.0	Moderately Acidic	0.7	Non sodic
0.50 – 0.60	0.4	Non-saline	5.6	Moderately Acidic	1.7	Non sodic

Site Description – Site E11				
Site Reference	E11	**ASC Name**	Acidic Lithic Brown Tenosol (BIKLVNR)	
Average Slope	19%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227371
Surface Condition	Loose	**Permeability**	Moderate	Y: 6614510

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark reddish brown (Munsell 7.5YR 4/3) Loamy Sand with weak pedality, earthy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. 10% coarse fragments 5 - 10mm. Many roots and well drained. Gradual boundary.
A2	**0.10 – 0.30**	Dark reddish brown (Munsell 10YR 3/3) apedal Loam with sandy fabric. Strongly acidic pH, non-saline and non-sodic. 20% coarse fragments 5 - 50mm. Many roots and well drained. Clear boundary.
AR	**0.30 +**	Loamy Sand transition layer to parent material with hard 90% coarse fragments 20 – 200mm. Moderately acidic pH, non-saline and non-sodic.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	1.9	Non-saline	5.6	Moderately Acidic	0.6	Non sodic
0.20 – 0.30	0.1	Non-saline	5.1	Strongly Acidic	2.5	Non sodic
0.50 – 0.60	0.3	Non-saline	5.5	Moderately Acidic	1.6	Non sodic

Site Description – Site E12				
Site Reference	E12	**ASC Name**	Basic Lithic Brown Tenosol (BHLLVNR)	
Average Slope	6%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227835
Surface Condition	Loose	**Permeability**	Moderate	Y: 6614639

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.20**	Dark reddish brown (Munsell 10YR 3/2) Sandy Loam with weak pedality, sandy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 5% coarse fragments 5 - 10mm. Many roots and rapidly drained. Gradual boundary.
A2	**0.20 – 0.55**	Dark reddish brown (Munsell 7.5YR 2.5/2) apedal Sandy Loam with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 60% coarse fragments 20 – 80mm. Few roots and well drained. Clear boundary.
AR	**0.30 +**	Sandy Loam transition layer to parent material with hard 90% coarse fragments 20 – 200mm. Moderately acidic pH, non-saline and non-sodic.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	6.2	Slightly Acidic	0.4	Non sodic
0.20 – 0.30	0.3	Non-saline	5.6	Moderately Acidic	0.3	Non sodic
0.50 – 0.60	0.3	Non-saline	5.8	Moderately Acidic	0.8	Non sodic

Site Description – Site E13				
Site Reference	E13	**ASC Name**	Basic Lithic Black Tenosol (BHLLUNR)	
Average Slope	3%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 228210
Surface Condition	Loose	**Permeability**	Moderate	Y: 6614894

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Black (Munsell 10YR 2/1) Loam with weak pedality, sandy fabric and weak consistence. Neutral pH, non-saline and non-sodic. 30% coarse fragments 10 - 50mm. Many roots and well drained. Gradual boundary.
A2	**0.10 – 0.45**	Very dark brown (Munsell 7.5YR 2.5/2) apedal Loamy Sand with sandy fabric. Neutral pH, non-saline and non-sodic. 20% coarse fragments 10 – 50mm. Few roots and well drained. Clear boundary.
R	**0.45 +**	Hard bedrock.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	6.6	Neutral	0.1	Non sodic
0.20 – 0.30	0.4	Non-saline	6.9	Neutral	1.6	Non sodic

Site Description – Site E14				
Site Reference	E14	**ASC Name**	Basic Lithic Brown Tenosol (BHLLVNR)	
Average Slope	3%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227629
Surface Condition	Loose	**Permeability**	Moderate	Y: 6614118

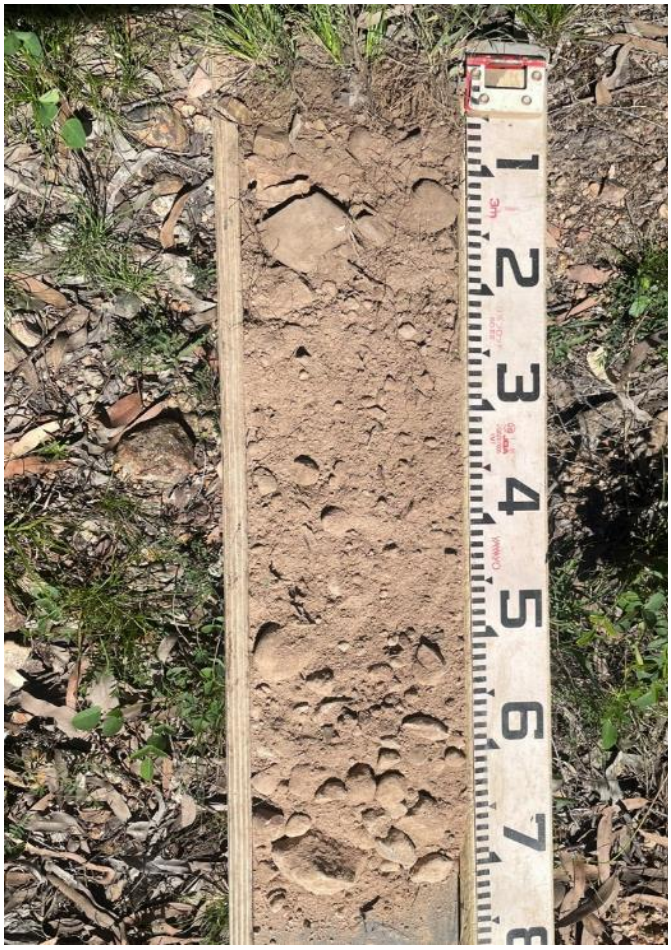

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Very dark brown (Munsell 7.5YR 2.5/2) Loam with very weak pedality, sandy fabric and weak consistence. Neutral pH, non-saline and non-sodic. 40% coarse fragments 10 - 100mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0. 50**	Brown (Munsell 7.5YR 4/3) apedal Loamy Sand with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 30% coarse fragments 10 – 50mm. Few roots and well drained. Clear boundary.
AR	**0.45 +**	Transition layer to parent material with hard 90% coarse fragments 20 – 200mm.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.5	Non-saline	6.5	Neutral	0.0	Non sodic
0.20 – 0.30	0.4	Non-saline	5.8	Moderately Acidic	0.5	Non sodic
0.40 – 0.50	0.2	Non-saline	6.0	Moderately Acidic	0.5	Non sodic

Site Description – Site E15				
Site Reference	E15	**ASC Name**	Basic Lithic Brown Tenosol (BHLLVNR)	
Average Slope	2%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Ridge flat	**Drainage**	Well	X: 227611
Surface Condition	Soft	**Permeability**	Moderate	Y: 6613844

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 7.5YR 4/3) Sandy Loam with weak pedality, sandy fabric and weak consistence. 40% coarse fragments 10 - 100mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.70**	Light brownish grey (Munsell 10YR 6/2)) apedal Loamy Sand with sandy fabric. 60% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
R	**0.70 +**	Hard parent material.

Site Description – Site E16				
Site Reference	E16	**ASC Name**	Acidic Lithic Brown Tenosol (BHLLVNR)	
Average Slope	5%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Lower Slope	**Drainage**	Well	X: 226906
Surface Condition	Loose	**Permeability**	Moderate	Y: 6613654

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 10YR 3/2) Sandy Loam with weak pedality, sandy fabric and weak consistence. Slightly acidic pH, slightly saline and non-sodic. 20% coarse fragments 10 - 50mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.70**	Brown (Munsell 7.5YR 4/3) apedal Sandy Loam trending to Loamy Sand with sandy fabric. Strongly acidic pH, non-saline and non-sodic. 40% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
AR	**0.70 +**	Transition layer to parent material with hard 90% coarse fragments 20 – 200mm. Strongly acidic pH, non-saline and non-sodic.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	2.0	Slightly saline	6.1	Slightly Acidic	0.3	Non sodic
0.20 – 0.30	0.4	Non-saline	5.2	Strongly Acidic	0.8	Non sodic
0.50 – 0.60	0.4	Non-saline	5.4	Strongly Acidic	0.8	Non sodic

Site Description – Site E17				
Site Reference	E17	**ASC Name**	Eutrophic Subnatric Grey Sodosol (BHLOWNR)	
Average Slope	8%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227314
Surface Condition	Soft	**Permeability**	Moderate	Y: 6613911

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Dark brown (Munsell 7.5YR 3/2) Sandy Loam with very weak pedality, sandy fabric and weak consistence. Neutral pH, non-saline and non-sodic. 30% coarse fragments 10 - 100mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.30**	Brown (Munsell 7.5YR 5/2) apedal Loam with sandy fabric. Neutral pH, non-saline and non-sodic. 50% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
B2	**0.30 – 0.65**	Light brownish grey (Munsell 10YR 6/2) apedal Silty Clay with sandy fabric. Moderately acidic pH, non-saline and sodic. 50% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
BR	**0.65 +**	Transition layer to parent material with hard 90% coarse fragments 20 – 200mm.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	1.0	Non-saline	6.6	Neutral	0.0	Non sodic
0.20 – 0.30	0.3	Non-saline	6.6	Neutral	1.7	Non sodic
0.50 – 0.60	1.8	Non-saline	5.5	Moderately Acidic	9.5	Sodic

Site Description – Site E18				
Site Reference	E18	**ASC Name**	Basic Lithic Brown Tenosol (BHLLVNR)	
Average Slope	22%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227808
Surface Condition	Soft	**Permeability**	Moderate	Y: 6613667

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Brown (Munsell 7.5YR 4/2) Sandy Loam with very weak pedality, sandy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. 50% coarse fragments 10 - 100mm. Many roots and well drained. Clear boundary.
A2	**0.15 – 0.50**	Dark reddish brown to dark brown (Munsell 5YR 3/2 to 7.5YR 3/4) apedal Sandy Loam with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 20% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
R	**0.50 +**	Hard parent material.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	5.9	Moderately Acidic	0.8	Non sodic
0.20 – 0.30	0.2	Non-saline	5.8	Moderately Acidic	0.8	Non sodic
0.40 – 0.50	0.2	Non-saline	5.9	Moderately Acidic	1.1	Non sodic

Site Description – Site E19				
Site Reference	E19	**ASC Name**	Acidic Lithic Brown Tenosol (BHLLWNR)	
Average Slope	11%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 228169
Surface Condition	Loose	**Permeability**	Moderate	Y: 6614011

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 10YR 4/3) Sandy Loam with very weak pedality, sandy fabric and weak consistence. Moderately acidic pH, non-saline and non-sodic. 50% coarse fragments 10 - 100mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.80**	Brown (Munsell 7.5YR 5/4) apedal Sandy Loam with sandy fabric. Strongly to moderately acidic pH, non-saline and non-sodic. 20% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
R	**0.80 +**	Hard parent material.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.2	Non-saline	5.7	Moderately Acidic	0.6	Non sodic
0.20 – 0.30	0.2	Non-saline	5.1	Strongly Acidic	1.8	Non sodic
0.50 – 0.60	0.1	Non-saline	5.6	Moderately Acidic	1.2	Non sodic

Site Description – Site E20 (Observation)				
Site Reference	E20	**ASC Name**	Tenosol	
Average Slope	3%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 228031
Surface Condition	Soft	**Permeability**	Moderate	Y: 6613836

Plate 1 – Surface

Observation	Description
Surface Rock	80% surface coarse fragments, 5 – 100mm.

Site Description – Site E21				
Site Reference	21	**ASC Name**	Basic Lithic Brown Tenosol (BHLLUNR)	
Average Slope	5%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Midslope	**Drainage**	Well	X: 228016
Surface Condition	Loose	**Permeability**	Moderate	Y: 6614420

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 7.5YR 4/3) Sandy Loam with very weak pedality, sandy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 - 50mm. Many roots and rapidly drained. Clear boundary.
A2	**0.10 – 0.30**	Brown (Munsell 7.5YR 4/3) apedal Sandy Loam with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 20% coarse fragments 10 – 100mm. Very roots and well drained. Clear boundary.
AR	**0.30 +**	Transition layer to parent material with hard 90% coarse fragments 20 – 200mm.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.8	Non-saline	6.4	Slightly Acidic	0.4	Non sodic
0.20 – 0.30	0.5	Non-saline	5.6	Moderately Acidic	1.4	Non sodic

Site Description – Site E22				
Site Reference	E22	**ASC Name**	Acidic Lithic Brown Tenosol (BHLLUNR)	
Average Slope	23%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227296
Surface Condition	Soft	**Permeability**	Moderate	Y: 6614973

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 7.5YR 4/3) Sandy Loam with very weak pedality, sandy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 - 30mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.30**	Brown (Munsell 7.5YR 4/3) apedal Sandy Loam with sandy fabric. Strongly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
AR	**0.30 +**	Transition layer to parent material with hard 90% coarse fragments 20 – 200mm.

Sample Depth	ECe		$pH_{(1\text{-}5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.0	Slightly Acidic	0.1	Non sodic
0.20 – 0.30	0.4	Non-saline	5.1	Strongly Acidic	0.4	Non sodic

Site Description – Site E23				
Site Reference	E23	**ASC Name**	Basic Lithic Brown Tenosol (BHLLUNR)	
Average Slope	7%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227767
Surface Condition	Loose	**Permeability**	Moderate	Y: 6615219

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 7.5YR 4/3) Sandy Loam with very weak pedality, sandy fabric and weak consistence. Neutral pH, non-saline and non-sodic. 20% coarse fragments 10 - 30mm. Many roots and well drained. Clear boundary.
A2	**0.10 – 0.30**	Brown (Munsell 7.5YR 4/3) apedal Sandy Loam with sandy fabric. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 – 100mm. Few roots and well drained. Clear boundary.
AR	**0.30 +**	Transition layer to parent material with hard 80% coarse fragments 20 – 200mm.

Sample Depth	ECe		pH(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.9	Non-saline	6.9	Neutral	0.1	Non sodic
0.20 – 0.30	0.5	Non-saline	6.5	Slightly Acidic	0.1	Non sodic

Site Description – Site E24				
Site Reference	E24	**ASC Name**	Basic Lithic Brown Tenosol (BHLLUNR)	
Average Slope	10%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227640
Surface Condition	Soft	**Permeability**	Moderate	Y: 6614933

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 7.5YR 4/3) Sandy Loam with very weak pedality, sandy fabric and weak consistence. 20% coarse fragments 10 - 30mm. Many roots and well drained. Clear boundary.
AR	**0.10 +**	Transition layer to parent material with hard 90% coarse fragments 20 – 200mm.

Site Description – Site E25				
Site Reference	E25	**ASC Name**	Basic Lithic Brown Tenosol (BHLLUNR)	
Average Slope	5%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227555
Surface Condition	Soft	**Permeability**	Moderate	Y: 6615601

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.10**	Brown (Munsell 10YR 5/3) Sandy Loam with very weak pedality, sandy fabric and weak consistence. 20% coarse fragments 10 - 30mm. Many roots and well drained. Clear boundary.
AR	**0.15 – 0.80**	Transition layer to parent material with hard 80% coarse fragments 20 – 200mm with apedal sand.
R	**0.80 +**	Hard parent material.

Site Description – Site E26				
Site Reference	E26	**ASC Name**	Basic Lithic Brown Tenosol (BHLLVNR)	
Average Slope	4%	**Land Use**	Bushland	**Coordinates**
Landform Pattern	Lower Plain	**Soil Fertility**	Low	MGA 56
Landform Element	Flat	**Drainage**	Well	X: 227916
Surface Condition	Soft	**Permeability**	Moderate	Y: 6615653

Plate 1 – Soil Profile

Plate 2 – Landscape

Plate 3 – Surface

Horizon	Depth (m)	Description
A1	**0.00 – 0.15**	Brown (Munsell 7.5YR 4/3) Sandy Loam with very weak pedality, sandy fabric and weak consistence. Slightly acidic pH, non-saline and non-sodic. 20% coarse fragments 10 - 30mm. Many roots and well drained. Clear boundary.
A2	**0.15 – 0.30**	Brown (Munsell 10YR 5/3) apedal Sandy Loam with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 20% coarse fragments 10 – 50mm. Few roots and well drained. Clear boundary.
A3	**0.30 +**	Brown (Munsell 7.5YR 5/3) apedal Sandy Loam with sandy fabric. Moderately acidic pH, non-saline and non-sodic. 70% coarse fragments 10 – 100mm. No roots and well drained.

Sample Depth	ECe		$pH_{(1-5water)}$		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.9	Non-saline	6.3	Slightly Acidic	0.3	Non sodic
0.20 – 0.30	0.4	Non-saline	5.6	Moderately Acidic	0.8	Non sodic
0.40 – 0.50	0.5	Non-saline	5.9	Moderately Acidic	1.3	Non sodic

Appendix 2
Laboratory Certificates of Analysis

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ANALYSIS REPORT SOIL

PROJECT NO: EW231624		**Date of Issue:**	**06/09/2023**
Customer:	Minesoils Pty Ltd	Report No:	1
Address:	135 Whitehouse Lane TAMWORTH NSW 2340	Date Received:	31/08/2023
		Matrix:	Soil
Attention:	Clayton Richards	Location:	Boggabri
Phone:	0408 474 248	Sampler ID:	Client
Fax:		Date of Sampling:	31/08/2023
Email:	clayton@minesoils.com.au	Sample Condition:	Acceptable

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

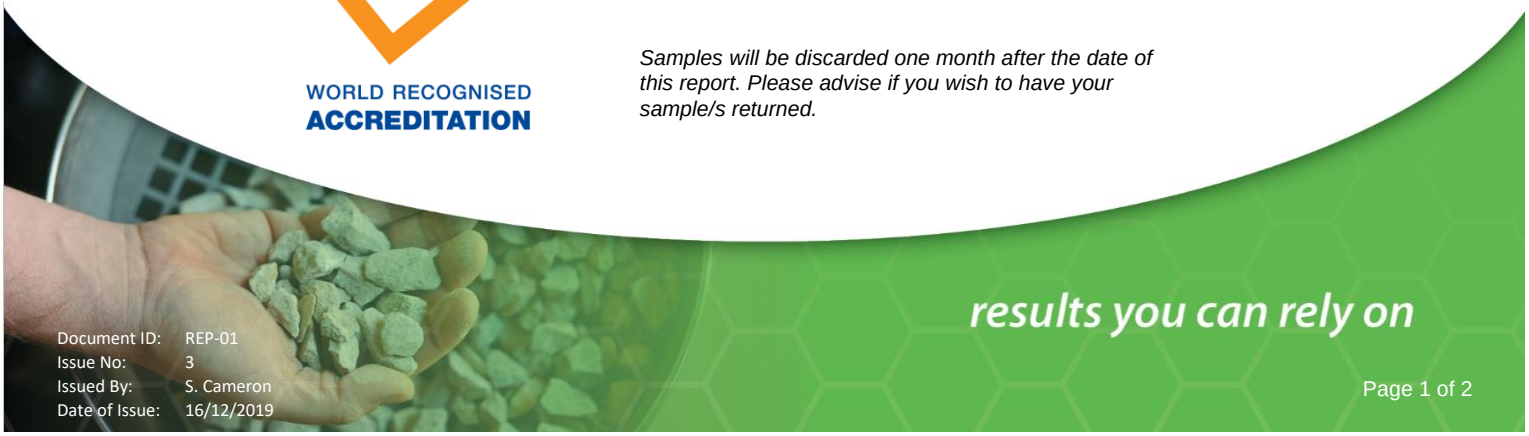
Signed:

Stephanie Cameron
Laboratory Operations Manager

NATA Accredited Laboratory 15708
Accredited for compliance with ISO/IEC 17025 - Testing

This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.



ANALYSIS REPORT

PROJECT NO: EW231624 **Location: Boggabri**

				CLIENT SAMPLE ID	28	28	28	28
				DEPTH	0-10	20-30	40-50	65-75
Test Parameter	**Method Description**	**Method Reference**	**Units**	**LOR**	**231624-1**	**231624-2**	**231624-3**	**231624-4**
pH (1:5 in H20)	Electrode	R&L 4A1	pH units	na	5.45	5.85	6.45	6.60
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.01	0.01	0.02
Exchangeable Potassium	NH4Cl/ICP	R&L 15A1	mg/kg	10	109	123	109	110
Exchangeable Calcium	NH4Cl/ICP	R&L 15A1	mg/kg	20	527	52.7	27.8	52.2
Exchangeable Magnesium	NH4Cl/ICP	R&L 15A1	mg/kg	10	116	131	179	230
Exchangeable Sodium	NH4Cl/ICP	R&L 15A1	mg/kg	10	27.2	45.1	103	159
Exchangeable Aluminium	KCl/ICP	R&L 15G1	mg/kg	2	<2.00	<2.00	<2.00	<2.00
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.28	0.32	0.28	0.28
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.64	0.26	0.14	0.26
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.97	1.09	1.49	1.92
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.12	0.20	0.45	0.69
Exchangeable Aluminium	Calculation	R&L 15J1	cmol/kg	na	0.02	0.02	0.02	0.02
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.02	1.89	2.38	3.17
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	2.73	0.24	0.09	0.14
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.29	0.29	0.19	0.15
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	6.95	16.7	11.7	8.89
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	65.5	14.0	5.84	8.23
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	24.0	57.8	62.7	60.4
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	2.94	10.4	18.8	21.8
Exchangeable Aluminium %	Calculation	PMS-15A1	%	na	0.55	1.18	0.93	0.70

Soils are air dried at 40^{o}C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

33 soil samples supplied by Minesoils Pty. Ltd. on 13th March, 2023 - Lab Job No. N8540
Analysis requested by Clayton Richards. Job Ref: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in 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 (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)
1 0-10	N8540/1	3.0%	5.3%	2.5%	2.8%	17.2%	33.6%	4.5%	39.5%
1 20-30	N8540/2	13.5%	1.7%	0.0%	1.7%	12.5%	26.1%	5.4%	54.4%
1 40-50	N8540/3	11.6%	1.5%	0.0%	1.5%	17.5%	30.5%	6.5%	44.1%
2 0-10	N8540/4	2.7%	26.0%	9.3%	16.6%	23.7%	31.1%	8.3%	11.0%
2 20-30	N8540/5	11.6%	10.8%	5.7%	5.1%	12.0%	24.6%	7.1%	45.4%
2 40-50	N8540/6	10.7%	2.6%	0.0%	2.6%	15.6%	33.7%	3.1%	45.0%
2 65-75	N8540/7	9.9%	6.1%	3.7%	2.4%	16.6%	35.9%	5.5%	35.8%
3 0-10	N8540/8	3.1%	8.9%	1.6%	7.3%	26.3%	29.9%	15.9%	19.0%
3 20-30	N8540/9	12.8%	2.3%	0.0%	2.3%	12.4%	17.3%	14.4%	53.5%
3 40-50	N8540/10	13.9%	0.0%	0.0%	0.0%	5.7%	20.5%	27.5%	46.2%
3 65-75	N8540/11	13.0%	4.5%	2.3%	2.2%	5.8%	33.5%	14.1%	42.0%
4 0-10	N8540/12	2.1%	5.8%	1.2%	4.6%	18.1%	54.6%	7.9%	13.5%
4 20-30	N8540/13	9.8%	0.4%	0.0%	0.4%	15.7%	37.1%	9.3%	37.5%
4 40-50	N8540/14	11.4%	4.9%	1.6%	3.3%	13.1%	29.1%	13.2%	39.7%
4 65-75	N8540/15	11.1%	1.8%	0.0%	1.8%	17.9%	38.0%	5.4%	37.0%
5 0-10	N8540/16	2.5%	17.2%	7.2%	10.0%	28.9%	28.5%	12.4%	13.0%
5 20-30	N8540/17	9.7%	20.2%	14.0%	6.2%	17.9%	18.8%	5.7%	37.5%
5 40-50	N8540/18	12.5%	1.5%	0.0%	1.5%	14.2%	28.1%	14.3%	41.9%
5 65-75	N8540/19	10.4%	4.8%	2.9%	1.9%	15.6%	31.7%	11.8%	36.0%
6 0-10	N8540/20	2.3%	5.2%	1.0%	4.2%	39.9%	35.2%	8.6%	11.0%
6 20-30	N8540/21	3.6%	11.0%	3.1%	7.9%	41.3%	37.6%	2.9%	7.2%
7 0-10	N8540/22	2.4%	7.1%	0.6%	6.5%	37.6%	31.5%	11.4%	12.4%
7 20-30	N8540/23	3.0%	18.5%	11.8%	6.6%	34.4%	31.4%	6.5%	9.3%
7 40-50	N8540/24	4.3%	10.5%	1.7%	8.8%	41.5%	30.2%	8.9%	8.9%
7 65-75	N8540/25	10.3%	4.0%	0.0%	4.0%	26.8%	31.3%	10.8%	27.1%
8 0-10	N8540/26	5.5%	11.2%	5.6%	5.6%	23.0%	31.5%	13.0%	21.3%
8 20-30	N8540/27	13.2%	3.4%	1.7%	1.6%	12.9%	18.4%	4.7%	60.7%
9 0-10	N8540/28	3.1%	13.8%	4.6%	9.2%	31.4%	37.6%	6.7%	10.5%
9 20-30	N8540/29	3.4%	24.0%	11.6%	12.5%	32.8%	30.9%	5.0%	7.2%
9 40-50	N8540/30	3.8%	46.8%	28.8%	17.9%	23.9%	15.3%	10.2%	3.8%
9 65-75	N8540/31	8.7%	10.3%	5.4%	4.9%	22.9%	21.4%	32.3%	13.1%
10 0-10	N8540/32	5.2%	15.2%	11.6%	3.6%	22.6%	35.6%	2.4%	24.2%
10 20-30	N8540/33	16.2%	5.6%	2.1%	3.5%	11.5%	38.3%	9.3%	35.3%

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. This report is not to be reproduced except in full. Results only relate to the item tested.

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

6. This report was issued on 03/04/2023.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

33 soil samples supplied by Minesoils Pty. Ltd. on 22nd June, 2023 - Lab Job No. P2164
Analysis requested by Clayton Richards. Job Ref: MS-093 Maules Creek BSAL2
PO BOX 11034 TAMWORTH NSW 2340

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in 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 (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)
11, 0-10	P2164/1	13.1%	30.4%	18.1%	12.3%	19.5%	32.7%	7.4%	9.9%
11, 20-30	P2164/2	4.6%	21.8%	12.6%	9.2%	28.2%	34.4%	13.2%	2.3%
11, 40-50	P2164/3	5.7%	49.8%	38.2%	11.6%	18.0%	23.2%	4.7%	4.4%
11, 65-75	P2164/4	10.5%	30.0%	17.5%	12.5%	16.8%	16.0%	13.1%	24.2%
12, 0-10	P2164/5	12.5%	13.9%	5.3%	8.6%	31.1%	39.2%	9.8%	6.0%
12, 10-15	P2164/6	5.9%	25.3%	14.5%	10.8%	29.0%	29.1%	13.2%	3.4%
12, 20-30	P2164/7	10.2%	3.4%	0.0%	3.4%	24.5%	32.8%	7.2%	32.0%
12, 40-50	P2164/8	12.2%	1.2%	0.0%	1.2%	34.1%	30.7%	5.0%	28.9%
12, 65-75	P2164/9	10.2%	14.3%	8.2%	6.2%	20.1%	38.5%	8.5%	18.5%
13, 0-10	P2164/10	12.7%	17.1%	6.5%	10.7%	26.5%	34.6%	15.2%	6.6%
13, 20-30	P2164/11	4.8%	16.9%	6.1%	10.8%	30.3%	39.8%	8.2%	4.9%
13, 40-50	P2164/12	14.2%	2.3%	1.4%	1.0%	15.4%	35.7%	6.2%	40.4%
13, 65-75	P2164/13	12.6%	7.8%	2.7%	5.1%	34.0%	15.8%	10.5%	31.9%
14, 0-10	P2164/14	14.8%	3.4%	1.1%	2.3%	13.3%	49.6%	19.8%	14.0%
14, 20-30	P2164/15	7.5%	13.0%	4.0%	9.0%	28.4%	32.8%	14.6%	11.2%
14, 40-50	P2164/16	11.3%	22.0%	9.8%	12.2%	25.3%	24.8%	8.6%	19.4%
15, 0-10	P2164/17	13.2%	20.3%	5.7%	14.6%	32.8%	33.3%	8.4%	5.2%
15, 20-30	P2164/18	7.1%	16.9%	9.6%	7.3%	35.1%	34.6%	8.5%	4.9%
15, 40-50	P2164/19	8.2%	23.4%	13.8%	9.6%	30.4%	36.0%	4.1%	6.0%
15, 65-75	P2164/20	9.6%	23.0%	15.7%	7.3%	27.5%	32.2%	9.6%	7.6%
16, 0-10	P2164/21	12.5%	14.8%	5.6%	9.3%	39.8%	34.4%	6.8%	4.1%
16, 20-30	P2164/22	6.0%	26.6%	15.1%	11.5%	36.9%	27.9%	3.4%	5.1%
16, 40-50	P2164/23	5.0%	37.3%	24.5%	12.7%	30.4%	24.9%	3.0%	4.4%
16, 65-75	P2164/24	5.5%	21.8%	12.7%	9.1%	38.9%	28.8%	5.5%	5.0%
17, 0-10	P2164/25	15.7%	6.0%	2.3%	3.7%	35.8%	30.9%	12.5%	14.8%
17, 10-20	P2164/26	7.0%	9.2%	1.9%	7.3%	36.6%	30.9%	15.6%	7.7%
17, 20-30	P2164/27	10.1%	9.3%	3.9%	5.3%	32.5%	28.1%	10.9%	19.3%
17, 40-50	P2164/28	10.4%	3.9%	0.0%	3.9%	29.2%	31.2%	5.7%	30.0%
17, 65-75	P2164/29	12.2%	10.1%	5.1%	5.0%	23.4%	25.2%	6.1%	35.2%
18, 0-10	P2164/30	12.3%	46.1%	33.5%	12.6%	14.3%	25.9%	8.5%	5.1%
18, 20-30	P2164/31	6.3%	29.1%	11.6%	17.5%	22.7%	28.2%	8.9%	11.1%
18, 40-50	P2164/32	6.7%	23.8%	11.6%	12.2%	25.6%	33.2%	7.8%	9.6%
18, 65-75	P2164/33	4.9%	35.0%	22.8%	12.3%	22.2%	27.6%	10.2%	5.0%

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. This report is not to be reproduced except in full. Results only relate to the item tested.

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

6. This report was issued on 13/07/2023.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

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AGRICULTURAL SOIL ANALYSIS REPORT

33 samples supplied by Minesoils Pty. Ltd. on 13/03/2023. Lab Job No.N8540
Analysis requested by Clayton Richards. Your Job: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
		Sample ID:	1 0-10	1 20-30	1 40-50	2 0-10	2 20-30
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
	Parameter	Method reference	N8540/1	N8540/2	N8540/3	N8540/4	N8540/5
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.68	8.54	8.86	6.22	7.80
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.066	0.070	0.108	0.023	0.034
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	7.8	15	13	4.2	13
	Exchangeable Calcium (kg/ha)		3,505	6,894	5,798	1,888	5,711
	Exchangeable Calcium (mg/kg)		1,565	3,078	2,588	843	2,550
	Exchangeable Magnesium (cmol+/kg)		3.4	6.4	6.4	1.3	4.9
	Exchangeable Magnesium (kg/ha)		918	1,733	1,746	355	1,324
	Exchangeable Magnesium (mg/kg)		410	774	780	159	591
	Exchangeable Potassium (cmol+/kg)		1.5	1.0	0.82	0.77	0.75
	Exchangeable Potassium (kg/ha)		1,345	907	714	674	654
	Exchangeable Potassium (mg/kg)		601	405	319	301	292
	Exchangeable Sodium (cmol+/kg)		0.12	0.40	0.72	<0.065	0.14
	Exchangeable Sodium (kg/ha)		63	206	369	<33	70
	Exchangeable Sodium (mg/kg)		28	92	165	<15	31
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.03	<0.01
	Exchangeable Aluminium (kg/ha)		2.3	2.4	2.6	6.0	1.9
	Exchangeable Aluminium (mg/kg)		1.0	1.1	1.2	2.7	<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)	13	23	21	6.4	18
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	61	66	62	66	69
	Magnesium (%)		26	27	31	20	26
	Potassium (%)		12	4.5	3.9	12	4.0
	Sodium - ESP (%)		0.95	1.7	3.4	0.92	0.74
	Aluminium (%)		0.09	0.05	0.06	0.46	0.05
	Hydrogen (%)		0.12	0.04	0.06	0.00	0.02
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	2.3	2.4	2.0	3.2	2.6
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 3/2 Very Dark Greyish Brown	10 YR 3/2 Very Dark Greyish Brown	10 YR 5/3 Brown	10 YR 3/2 Very Dark Greyish Brown	7.5 YR 4/1 Dark Grey
	Mottles Munsell Colour		..	..	10 YR 4/1 Dark Grey	..	..
	Degree of Mottling (%)		..	..	40	..	..

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/t&cs).
17. This report was issued on 28/03/2023.

Quality Checked: Kris Saville
Agricultural Co-Ordinator

Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

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AGRICULTURAL SOIL ANALYSIS REPORT

33 samples supplied by Minesoils Pty. Ltd. on 13/03/2023. Lab Job No.N8540
Analysis requested by Clayton Richards. Your Job: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

Parameter		Method reference	Sample 6	Sample 7	Sample 8	Sample 9	Sample 10
Sample ID:			2 40-50	2 65-75	3 0-10	3 20-30	3 40-50
Crop:			N/G	N/G	N/G	N/G	N/G
Client:			WHC	WHC	WHC	WHC	WHC
			N8540/6	N8540/7	N8540/8	N8540/9	N8540/10
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.85	8.34	5.85	7.26	7.97
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.065	0.096	0.025	0.033	0.057
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	11	12	3.5	11	14
	(kg/ha)		5,031	5,430	1,590	5,029	6,352
	(mg/kg)		2,246	2,424	710	2,245	2,836
Exchangeable Magnesium	(cmol$_+$/kg)		4.7	4.7	1.2	5.0	6.8
	(kg/ha)		1,290	1,290	324	1,365	1,850
	(mg/kg)		576	576	145	609	826
Exchangeable Potassium	(cmol$_+$/kg)		0.59	0.83	0.73	0.95	1.1
	(kg/ha)		521	729	641	835	923
	(mg/kg)		233	326	286	373	412
Exchangeable Sodium	(cmol$_+$/kg)		0.20	0.47	<0.065	0.24	0.41
	(kg/ha)		104	240	<33	122	209
	(mg/kg)		47	107	<15	54	93
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	0.02	0.05	0.02	0.04
	(kg/ha)		2.9	3.9	11	4.7	7.4
	(mg/kg)		1.3	1.7	4.9	2.1	3.3
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.07	<0.01	<0.01
	(kg/ha)		<1	<1	1.6	<1	<1
	(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)	17	18	5.7	17	22
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	67	67	63	64	63
Magnesium (%)			28	26	21	29	30
Potassium (%)			3.6	4.6	13	5.5	4.7
Sodium - ESP (%)			1.2	2.6	1.1	1.4	1.8
Aluminium (%)			0.08	0.11	0.96	0.13	0.16
Hydrogen (%)			0.00	0.01	1.2	0.05	0.00
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.4	2.6	3.0	2.2	2.1
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 4/3 Brown	10 YR 4/3 Brown	10 YR 5/4 Yellowish Brown	7.5 YR 4/3 Brown	10 YR 4/4 Dark Yellowish Brown
Mottles Munsell Colour			7.5 YR 2.5/1 Black	7.5 YR 3/1 Very Dark Grey	..	7.5 YR 2.5/1 Black	..
Degree of Mottling (%)			30	30	..	20	..

Notes:

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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).
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AGRICULTURAL SOIL ANALYSIS REPORT

33 samples supplied by Minesoils Pty. Ltd. on 13/03/2023. Lab Job No.N8540
Analysis requested by Clayton Richards. Your Job: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
		Sample ID:	3 65-75	4 0-10	4 20-30	4 40-50	4 65-75
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
	Parameter	Method reference	N8540/11	N8540/12	N8540/13	N8540/14	N8540/15
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.69	6.29	6.28	9.01	9.13
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.141	0.078	0.113	0.541	0.794
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	22	5.1	7.3	12	13
	Exchangeable Calcium (kg/ha)		10,061	2,300	3,277	5,573	5,989
	Exchangeable Calcium (mg/kg)		4,491	1,027	1,463	2,488	2,674
	Exchangeable Magnesium (cmol+/kg)		7.0	2.1	4.1	7.1	6.9
	Exchangeable Magnesium (kg/ha)		1,917	579	1,114	1,931	1,871
	Exchangeable Magnesium (mg/kg)		856	259	497	862	835
	Exchangeable Potassium (cmol+/kg)		0.97	0.56	0.23	0.35	0.44
	Exchangeable Potassium (kg/ha)		846	488	197	302	386
	Exchangeable Potassium (mg/kg)		378	218	88	135	172
	Exchangeable Sodium (cmol+/kg)		0.57	0.32	1.8	4.8	5.8
	Exchangeable Sodium (kg/ha)		293	166	907	2,467	3,006
	Exchangeable Sodium (mg/kg)		131	74	405	1,101	1,342
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.03	0.02	0.03	0.02	0.02
	Exchangeable Aluminium (kg/ha)		5.2	3.6	5.5	3.3	3.9
	Exchangeable Aluminium (mg/kg)		2.3	1.6	2.5	1.5	1.8
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.03	<0.01	0.07	0.04	0.03
	Exchangeable Hydrogen (kg/ha)		<1	<1	1.6	<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)	31	8.2	13	25	27
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	72	63	54	50	50
	Magnesium (%)		23	26	30	29	26
	Potassium (%)		3.1	6.8	1.7	1.4	1.7
	Sodium - ESP (%)		1.8	4.0	13	19	22
	Aluminium (%)		0.08	0.22	0.20	0.07	0.07
	Hydrogen (%)		0.09	0.00	0.54	0.16	0.10
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.2	2.4	1.8	1.8	1.9
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 4/3 Brown	10 YR 4/3 Brown	7.5 YR 3/2 Dark Brown	10 YR 4/3 Brown	10 YR 4/3 Brown
	Mottles Munsell Colour		..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
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Analysis requested by Clayton Richards. Your Job: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 16	Sample 17	Sample 18	Sample 19	Sample 20
		Sample ID:	5 0-10	5 20-30	5 40-50	5 65-75	6 0-10
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
Parameter		Method reference	N8540/16	N8540/17	N8540/18	N8540/19	N8540/20
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.28	6.35	8.90	9.14	5.45
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.029	0.133	0.466	0.500	0.016
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	4.3	6.9	12	14	2.0
	(kg/ha)		1,929	3,086	5,370	6,304	879
	(mg/kg)		861	1,378	2,397	2,814	392
Exchangeable Magnesium	(cmol$_+$/kg)		1.5	6.7	10	8.2	0.67
	(kg/ha)		405	1,837	2,763	2,242	183
	(mg/kg)		181	820	1,233	1,001	82
Exchangeable Potassium	(cmol$_+$/kg)		0.58	0.43	0.89	0.76	0.40
	(kg/ha)		504	375	777	669	349
	(mg/kg)		225	167	347	299	156
Exchangeable Sodium	(cmol$_+$/kg)		0.17	2.2	4.4	4.0	0.09
	(kg/ha)		85	1,145	2,282	2,037	47
	(mg/kg)		38	511	1,019	910	21
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.03	0.02	0.02	0.63
	(kg/ha)		3.1	6.7	3.9	3.4	126
	(mg/kg)		1.4	3.0	1.7	1.5	56
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.02	0.12	0.05	0.04	0.23
	(kg/ha)		<1	2.8	1.0	<1	5.1
	(mg/kg)		<1	1.2	<1	<1	2.3
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	6.6	16	27	27	4.0
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	65	42	44	52	49
Magnesium (%)			23	41	37	30	17
Potassium (%)			8.8	2.6	3.2	2.8	10
Sodium - ESP (%)			2.5	14	16	15	2.3
Aluminium (%)			0.24	0.20	0.07	0.06	16
Hydrogen (%)			0.35	0.75	0.17	0.15	5.7
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.9	1.0	1.2	1.7	2.9
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 4/2 Dark Greyish Brown	10 YR 5/2 Greyish Brown	7.5 YR 3/1 Very Dark Grey	7.5 YR 3/1 Very Dark Grey	10 YR 3/2 Very Dark Greyish Brown
Mottles Munsell Colour			..	..	..	..	..
			..	..	..	..	..
Degree of Mottling (%)			..	..	..	..	..

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).
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Analysis requested by Clayton Richards. Your Job: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 21	Sample 22	Sample 23	Sample 24	Sample 25
		Sample ID:	6 20-30	7 0-10	7 20-30	7 40-50	7 65-75
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
Parameter		Method reference	N8540/21	N8540/22	N8540/23	N8540/24	N8540/25
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.42	6.50	6.42	6.97	5.61
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.041	0.047	0.015	0.015	0.042
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.6	4.1	2.7	2.3	5.0
	(kg/ha)		1,148	1,849	1,220	1,043	2,225
	(mg/kg)		512	825	545	466	993
Exchangeable Magnesium	(cmol$_+$/kg)		1.6	1.2	0.60	0.63	4.2
	(kg/ha)		427	316	163	172	1,139
	(mg/kg)		190	141	73	77	508
Exchangeable Potassium	(cmol$_+$/kg)		0.25	1.2	0.37	0.17	0.34
	(kg/ha)		219	1,066	328	153	295
	(mg/kg)		98	476	146	68	132
Exchangeable Sodium	(cmol$_+$/kg)		0.28	<0.065	<0.065	<0.065	0.66
	(kg/ha)		142	<33	<33	<33	341
	(mg/kg)		63	<15	<15	<15	152
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.03	0.02	0.02	0.60
	(kg/ha)		6.7	5.1	4.9	3.6	121
	(mg/kg)		3.0	2.3	2.2	1.6	54
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.04	<0.01	<0.01	<0.01	0.13
	(kg/ha)		<1	<1	<1	<1	2.8
	(mg/kg)		<1	<1	<1	<1	1.3
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	4.7	6.5	3.7	3.2	11
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	54	63	73	73	46
Magnesium (%)			33	18	16	20	39
Potassium (%)			5.3	19	10.0	5.5	3.1
Sodium - ESP (%)			5.8	0.29	0.76	1.3	6.1
Aluminium (%)			0.70	0.39	0.65	0.56	5.5
Hydrogen (%)			0.85	0.03	0.00	0.00	1.2
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.6	3.5	4.6	3.7	1.2
Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	2.5 YR 4/1 Dark Reddish Grey	10 YR 4/3 Brown	10 YR 5/4 Yellowish Brown	7.5 YR 5/4 Brown	7.5 YR 5/6 Strong Brown
Mottles Munsell Colour			..	..	..	..	10 YR 5/3
Degree of Mottling (%)			..	..	..	..	Black 20

Notes:

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			Sample 26	Sample 27	Sample 28	Sample 29	Sample 30
		Sample ID:	8 0-10	8 20-30	9 0-10	9 20-30	9 40-50
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
	Parameter	Method reference	N8540/26	N8540/27	N8540/28	N8540/29	N8540/30
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.79	5.95	5.54	5.17	5.92
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.032	0.094	0.024	0.009	0.008
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.1	7.1	1.5	0.06	0.33
	Exchangeable Calcium (kg/ha)		2,750	3,168	678	26	148
	Exchangeable Calcium (mg/kg)		1,228	1,414	303	12	66
	Exchangeable Magnesium (cmol+/kg)		3.3	9.0	1.00	0.64	1.1
	Exchangeable Magnesium (kg/ha)		907	2,456	271	175	289
	Exchangeable Magnesium (mg/kg)		405	1,096	121	78	129
	Exchangeable Potassium (cmol+/kg)		0.71	0.69	0.47	0.19	0.15
	Exchangeable Potassium (kg/ha)		623	604	412	164	132
	Exchangeable Potassium (mg/kg)		278	269	184	73	59
	Exchangeable Sodium (cmol+/kg)		0.11	1.0	<0.065	<0.065	0.14
	Exchangeable Sodium (kg/ha)		55	526	<33	<33	70
	Exchangeable Sodium (mg/kg)		24	235	<15	<15	31
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.07	0.12	0.56	1.2	0.28
	Exchangeable Aluminium (kg/ha)		14	25	113	239	56
	Exchangeable Aluminium (mg/kg)		6.2	11	50	107	25
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.07	0.09	0.16	0.21	0.15
	Exchangeable Hydrogen (kg/ha)		1.5	2.0	3.5	4.6	3.5
	Exchangeable Hydrogen (mg/kg)		<1	<1	1.6	2.1	1.5
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	10	18	3.7	2.3	2.1
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	59	39	40	2.5	16
	Magnesium (%)		32	50	27	28	50
	Potassium (%)		6.8	3.8	13	8.1	7.2
	Sodium - ESP (%)		1.0	5.7	1.4	2.0	6.5
	Aluminium (%)		0.66	0.68	15	51	13
	Hydrogen (%)		0.65	0.50	4.2	8.8	7.3
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.8	0.78	1.5	0.09	0.31
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 2/2 Very Dark Brown	7.5 YR 4/4 Brown	10 YR 3/3 Dark Brown	7.5 YR 5/2 Brown	7.5 YR 6/3 Light Brown
	Mottles Munsell Colour		..	..	..	..	..
			..	..	..	..	..
	Degree of Mottling (%)		..	..	..	..	..

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AGRICULTURAL SOIL ANALYSIS REPORT

33 samples supplied by Minesoils Pty. Ltd. on 13/03/2023. Lab Job No.N8540
Analysis requested by Clayton Richards. Your Job: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

			Sample 31	Sample 32	Sample 33
		Sample ID:	9 65-75	10 0-10	10 20-30
		Crop:	N/G	N/G	N/G
		Client:	WHC	WHC	WHC
	Parameter	Method reference	N8540/31	N8540/32	N8540/33
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.79	6.20	8.20
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.205	0.077	0.117
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.0	9.3	15
	Exchangeable Calcium (kg/ha)		2,229	4,182	6,797
	Exchangeable Calcium (mg/kg)		995	1,867	3,034
	Exchangeable Magnesium (cmol+/kg)		4.5	4.7	8.0
	Exchangeable Magnesium (kg/ha)		1,230	1,281	2,189
	Exchangeable Magnesium (mg/kg)		549	572	977
	Exchangeable Potassium (cmol+/kg)		0.40	1.4	1.4
	Exchangeable Potassium (kg/ha)		352	1,243	1,237
	Exchangeable Potassium (mg/kg)		157	555	552
	Exchangeable Sodium (cmol+/kg)		2.0	0.62	2.0
	Exchangeable Sodium (kg/ha)		1,013	321	1,023
	Exchangeable Sodium (mg/kg)		452	143	457
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.02
	Exchangeable Aluminium (kg/ha)		4.6	5.0	3.9
	Exchangeable Aluminium (mg/kg)		2.0	2.2	1.8
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.06	0.07	0.03
	Exchangeable Hydrogen (kg/ha)		1.3	1.5	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	12	16	27
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	42	58	57
	Magnesium (%)		38	29	30
	Potassium (%)		3.4	8.8	5.3
	Sodium - ESP (%)		16	3.9	7.5
	Aluminium (%)		0.19	0.15	0.07
	Hydrogen (%)		0.49	0.42	0.13
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	1.1	2.0	1.9
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 4/3 Brown	10 YR 4/2 Dark Greyish Brown	10 YR 3/1 Very Dark Grey
	Mottles Munsell Colour		..	..	..
	Degree of Mottling (%)		..	..	..

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.
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17. This report was issued on 28/03/2023.

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Agricultural Co-Ordinator

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Analysis requested by Clayton Richards. Your Job: MS-093 Maules Creek BSAL
PO BOX 11034 TAMWORTH NSW 2340

				Heavy Soil	Medium Soil	Light Soil	Sandy Soil
			Sample ID:				
			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 (%)			..			

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.
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AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Clayton Richards. Your Job: MS-093A Maules Creek Alluvial
PO BOX 11034 TAMWORTH NSW 2340

			Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
		Sample ID:	1A 0-10	1A 20-30	1A 40-50	1A 65-75	2A 0-10
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
	Parameter	Method reference	N8539/1	N8539/2	N8539/3	N8539/4	N8539/5
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.26	6.94	7.58	9.02	6.15
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.038	0.021	0.086	0.192	0.032
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.5	1.9	4.7	4.7	3.3
	Exchangeable Calcium (kg/ha)		1,133	839	2,112	2,102	1,483
	Exchangeable Calcium (mg/kg)		506	375	943	938	662
	Exchangeable Magnesium (cmol+/kg)		0.72	0.47	6.0	5.5	1.1
	Exchangeable Magnesium (kg/ha)		196	128	1,643	1,500	297
	Exchangeable Magnesium (mg/kg)		88	57	733	669	133
	Exchangeable Potassium (cmol+/kg)		0.75	0.29	0.37	0.46	1.0
	Exchangeable Potassium (kg/ha)		660	258	324	401	891
	Exchangeable Potassium (mg/kg)		295	115	145	179	398
	Exchangeable Sodium (cmol+/kg)		<0.065	0.14	2.4	2.5	0.09
	Exchangeable Sodium (kg/ha)		<33	72	1,222	1,281	44
	Exchangeable Sodium (mg/kg)		<15	32	545	572	20
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.08	0.02	0.02	0.03	0.02
	Exchangeable Aluminium (kg/ha)		15	4.3	4.3	5.5	4.3
	Exchangeable Aluminium (mg/kg)		6.9	1.9	1.9	2.5	1.9
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.08	<0.01	0.03	<0.01	0.07
	Exchangeable Hydrogen (kg/ha)		1.7	<1	<1	<1	1.6
	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)	4.2	2.8	14	13	5.6
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	60	67	35	36	59
	Magnesium (%)		17	17	45	42	20
	Potassium (%)		18	10	2.7	3.5	18
	Sodium - ESP (%)		0.9	5.0	18	19	1.5
	Aluminium (%)		1.8	0.8	0.2	0.2	0.4
	Hydrogen (%)		1.8	0.3	0.2	0.0	1.3
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.5	4.0	0.78	0.85	3.0
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 2.5/1 Very Dark Brown	7.5 YR 5/4 Brown	5 YR 5/3 Yellowissh Red	7.5 YR 4/6 Strong Brown	7.5 YR 2.5/2 Very Dark Brown
	Mottles Munsell Colour		.. ..	.. ..	2.5 YR 5/3 Reddish Brown	.. ..	.. ..
	Degree of Mottling (%)		..	..	15.00	..	..

Notes:

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17. This report was issued on 3/04/2023.

Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

CRICOS Provider: 01241G

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Analysis requested by Clayton Richards. Your Job: MS-093A Maules Creek Alluvial
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Sample 6 2A 20-30 N/G WHC N8539/6	Sample 7 2A 40-50 N/G WHC N8539/7	Sample 8 2A 65-75 N/G WHC N8539/8	Sample 9 3A 0-10 N/G WHC N8539/9	Sample 10 3A 20-30 N/G WHC N8539/10
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.93	8.56	9.09	6.59	6.91
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.025	0.244	0.365	0.037	0.021
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	2.8	5.8	3.7	7.8	10
		(kg/ha)		1,269	2,583	1,677	3,522	4,693
		(mg/kg)		566	1,153	749	1,572	2,095
	Exchangeable Magnesium	**(cmol$_+$/kg)**		0.59	7.2	6.4	2.2	2.0
		(kg/ha)		159	1,958	1,742	588	540
		(mg/kg)		71	874	778	263	241
	Exchangeable Potassium	**(cmol$_+$/kg)**		0.34	0.73	0.81	1.2	0.46
		(kg/ha)		301	642	710	1,016	407
		(mg/kg)		134	286	317	454	182
	Exchangeable Sodium	**(cmol$_+$/kg)**		0.13	3.8	4.5	0.09	<0.065
		(kg/ha)		69	1,968	2,295	47	<33
		(mg/kg)		31	879	1,025	21	<15
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	0.02	0.02	<0.01	0.01	3.6
		(kg/ha)		3.7	4.1	2.0	2.1	736
		(mg/kg)		1.6	1.8	<1	<1	328
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.02	<0.01	0.02	<0.01
		(kg/ha)		<1	<1	<1	<1	<1
		(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)	3.9	18	15	11	17
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	72	33	24	69	63
	Magnesium (%)			15	41	42	19	12
	Potassium (%)			8.8	4.2	5.3	10	2.8
	Sodium - ESP (%)			3.4	22	29	0.8	0.1
	Aluminium (%)			0.5	0.1	0.1	0.1	22
	Hydrogen (%)			0.0	0.1	0.0	0.2	0.0
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	4.8	0.80	0.58	3.6	5.3
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 5/3 Brown	5 YR 4/4 Reddish Brown	7.5 YR 4/4 Brown	10 YR 3/2 Very Dark Greyish Brown	10 YR 3/1 Very Dark Grey
	Mottles Munsell Colour			..	..	..	..	..
				..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Notes:

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	Parameter		Method reference	Sample 11	Sample 12	Sample 13	Sample 14	Sample 15
	Sample ID:			3A 40-50	3A 65-75	4A 0-10	4A 20-30	4A 40-50
	Crop:			N/G	N/G	N/G	N/G	N/G
	Client:			WHC	WHC	WHC	WHC	WHC
				N8539/11	N8539/12	N8539/13	N8539/14	N8539/15
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.43	5.80	6.39	7.35	8.49
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.013	0.009	0.040	0.035	0.111
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.5	5.5	5.0	6.0	25
		(kg/ha)		2,462	2,477	2,233	2,702	11,011
		(mg/kg)		1,099	1,106	997	1,206	4,916
	Exchangeable Magnesium	(cmol$_+$/kg)		1.8	3.0	1.2	0.85	2.1
		(kg/ha)		499	816	325	233	568
		(mg/kg)		223	364	145	104	253
	Exchangeable Potassium	(cmol$_+$/kg)		0.23	0.28	1.2	0.38	0.62
		(kg/ha)		203	244	1,009	335	543
		(mg/kg)		91	109	450	150	242
	Exchangeable Sodium	(cmol$_+$/kg)		<0.065	0.08	<0.065	<0.065	<0.065
		(kg/ha)		<33	44	<33	<33	<33
		(mg/kg)		<15	19	<15	<15	<15
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.03	0.02	0.02	0.02	0.01
		(kg/ha)		5.1	4.5	3.2	3.5	2.9
		(mg/kg)		2.3	2.0	1.4	1.5	1.3
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.57	0.06	<0.01	0.05
		(kg/ha)		<1	13	1.4	<1	1.2
		(mg/kg)		<1	5.7	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	7.6	9.5	7.4	7.3	27
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	72	58	67	82	90
	Magnesium (%)			24	32	16	12	7.6
	Potassium (%)			3.0	2.9	16	5.2	2.3
	Sodium - ESP (%)			0.5	0.9	0.0	0.4	0.1
	Aluminium (%)			0.3	0.2	0.2	0.2	0.1
	Hydrogen (%)			0.0	6.0	0.8	0.0	0.2
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.0	1.8	4.2	7.0	12
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 3/2 Dark Brown	5 YR 4/2 Dark Reddish Brown	10 YR 4/3 Brown	10 YR 4/3 Brown	7.5 YR 5/4 Brown
	Mottles Munsell Colour			..	..	..	..	10 YR 5/4
	Degree of Mottling (%)			..	..	..	..	Yellowish Brown 10.00

Notes:

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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
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AGRICULTURAL SOIL ANALYSIS REPORT

35 samples supplied by Minesoils Pty. Ltd. on 13/03/2023. Lab Job No.N8539
Analysis requested by Clayton Richards. Your Job: MS-093A Maules Creek Alluvial
PO BOX 11034 TAMWORTH NSW 2340

			Sample 16	Sample 17	Sample 18	Sample 19	Sample 20
		Sample ID:	4A 65-75	5A 0-10	5A 20-30	5A 40-50	5A 65-75
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
	Parameter	Method reference	N8539/16	N8539/17	N8539/18	N8539/19	N8539/20
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.52	6.67	7.09	7.84	8.27
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.109	0.044	0.015	0.029	0.035
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	24	3.9	3.3	11	9.1
	Exchangeable Calcium (kg/ha)		10,663	1,765	1,489	4,961	4,107
	Exchangeable Calcium (mg/kg)		4,760	788	665	2,215	1,834
	Exchangeable Magnesium (cmol$_+$/kg)		2.0	1.1	0.66	5.9	6.0
	Exchangeable Magnesium (kg/ha)		554	304	180	1,614	1,626
	Exchangeable Magnesium (mg/kg)		247	136	80	720	726
	Exchangeable Potassium (cmol$_+$/kg)		0.62	1.1	0.38	0.67	0.86
	Exchangeable Potassium (kg/ha)		542	938	332	586	750
	Exchangeable Potassium (mg/kg)		242	419	148	262	335
	Exchangeable Sodium (cmol$_+$/kg)		<0.065	<0.065	<0.065	0.11	0.20
	Exchangeable Sodium (kg/ha)		<33	<33	<33	58	102
	Exchangeable Sodium (mg/kg)		<15	<15	<15	26	45
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	0.02	0.02	0.01	0.02
	Exchangeable Aluminium (kg/ha)		2.5	4.1	3.6	2.7	3.5
	Exchangeable Aluminium (mg/kg)		1.1	1.8	1.6	1.2	1.6
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.04	<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	6.1	4.4	18	16
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	90	64	75	62	57
	Magnesium (%)		7.7	18	15	33	37
	Potassium (%)		2.3	17	8.5	3.8	5.3
	Sodium - ESP (%)		0.2	0.0	1.3	0.6	1.2
	Aluminium (%)		0.0	0.3	0.4	0.1	0.1
	Hydrogen (%)		0.2	0.0	0.0	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	12	3.5	5.0	1.9	1.5
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 4/2 Brown	7.5 YR 3/2 Dark Brown	7.5 YR 5/4 Brown	7.5 YR 5/6 Strong Brown	10 YR 4/4 Dark Yellowish Brown
	Mottles Munsell Colour		7.5 YR 4/6 Strong Brown	..	..	..	..
	Degree of Mottling (%)		15.00	..	..	..	..

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.
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PO BOX 11034 TAMWORTH NSW 2340

			Sample 21	Sample 22	Sample 23	Sample 24	Sample 25
		Sample ID:	6A 0-10	6A 20-30	6A 40-50	6A 65-75	7A 0-10
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
	Parameter	Method reference	N8539/21	N8539/22	N8539/23	N8539/24	N8539/25
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.29	6.76	8.05	8.37	6.40
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.024	0.018	0.526	0.180	0.036
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.1	2.2	6.2	5.5	4.2
	Exchangeable Calcium (kg/ha)		1,408	1,004	2,774	2,464	1,867
	Exchangeable Calcium (mg/kg)		629	448	1,238	1,100	834
	Exchangeable Magnesium (cmol$_+$/kg)		0.92	0.99	6.8	5.6	1.5
	Exchangeable Magnesium (kg/ha)		251	270	1,852	1,518	415
	Exchangeable Magnesium (mg/kg)		112	121	827	678	185
	Exchangeable Potassium (cmol$_+$/kg)		0.87	0.52	0.70	0.60	0.78
	Exchangeable Potassium (kg/ha)		761	455	613	522	680
	Exchangeable Potassium (mg/kg)		340	203	274	233	304
	Exchangeable Sodium (cmol$_+$/kg)		<0.065	<0.065	3.3	2.1	0.10
	Exchangeable Sodium (kg/ha)		<33	<33	1,716	1,104	49
	Exchangeable Sodium (mg/kg)		<15	<15	766	493	22
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.02	0.03	0.02	0.02
	Exchangeable Aluminium (kg/ha)		4.3	4.1	6.1	3.5	3.1
	Exchangeable Aluminium (mg/kg)		1.9	1.8	2.7	1.6	1.4
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.06	<0.01	0.05	<0.01	0.01
	Exchangeable Hydrogen (kg/ha)		1.2	<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)	5.0	3.8	17	14	6.6
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	62	58	36	40	63
	Magnesium (%)		18	26	40	40	23
	Potassium (%)		17	14	4.1	4.3	12
	Sodium - ESP (%)		0.9	1.6	19	16	1.5
	Aluminium (%)		0.4	0.5	0.2	0.1	0.2
	Hydrogen (%)		1.1	0.0	0.3	0.0	0.2
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.4	2.3	0.91	0.98	2.7
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	10 YR 4/4 Dark Yellowish Brown	7.5 YR 5/3 Brown	10 YR 5/3 Brown	10 YR 5/2 Greyish Brown	7.5 YR 3/2 Dark Brown
	Mottles Munsell Colour		..	..	10 YR 5/6 Yellowish Brown	7.5 YR 5/6 Strong Brown	7.5 YR 5/8 Strong Brown
	Degree of Mottling (%)		..	..	20.00	10.00	40.00

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.
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Analysis requested by Clayton Richards. Your Job: MS-093A Maules Creek Alluvial
PO BOX 11034 TAMWORTH NSW 2340

	Parameter		Method reference	Sample 26	Sample 27	Sample 28	Sample 29	Sample 30
	Sample ID:			7A 20-30	7A 40-50	7A 65-75	8A 0-10	8A 20-30
	Crop:			N/G	N/G	N/G	N/G	N/G
	Client:			WHC	WHC	WHC	WHC	WHC
				N8539/26	N8539/27	N8539/28	N8539/29	N8539/30
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.27	7.95	8.79	6.49	8.06
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.064	0.205	0.491	0.061	0.054
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	9.7	6.8	10	13	17
		(kg/ha)		4,344	3,064	4,564	6,026	7,818
		(mg/kg)		1,939	1,368	2,038	2,690	3,490
	Exchangeable Magnesium	(cmol$_+$/kg)		6.6	6.9	10.0	4.1	6.7
		(kg/ha)		1,786	1,890	2,722	1,115	1,817
		(mg/kg)		797	844	1,215	498	811
	Exchangeable Potassium	(cmol$_+$/kg)		0.54	0.46	0.55	1.7	1.4
		(kg/ha)		477	400	479	1,479	1,186
		(mg/kg)		213	179	214	660	529
	Exchangeable Sodium	(cmol$_+$/kg)		0.85	2.1	3.7	0.19	0.53
		(kg/ha)		435	1,092	1,925	95	275
		(mg/kg)		194	487	859	43	123
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	0.01	0.01	0.01	0.02
		(kg/ha)		2.7	2.6	2.5	2.2	3.1
		(mg/kg)		1.2	1.2	1.1	<1	1.4
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.01	<0.01	0.02	0.02	0.02
		(kg/ha)		<1	<1	<1	<1	<1
		(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)	18	16	24	19	26
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	55	42	42	69	67
	Magnesium (%)			37	42	41	21	26
	Potassium (%)			3.1	2.8	2.2	8.7	5.2
	Sodium - ESP (%)			4.8	13	15	1.0	2.1
	Aluminium (%)			0.1	0.1	0.1	0.1	0.1
	Hydrogen (%)			0.1	0.0	0.1	0.1	0.1
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.5	0.98	1.0	3.3	2.6
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 5/2	5 YR 4/6	7.5 YR 4/4	7.5 YR 2.5/1	5 Y 2.5/1
				Brown	Yellowish Red	Brown	Black	Black
	Mottles Munsell Colour			..	10 YR 5/2	10 YR 5/3	..	..
				..	Greyish Brown	Brown	..	..
	Degree of Mottling (%)			..	15.00	20.00	..	..

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).
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5. Guidelines for phosphorus have been reduced for Australian soils.
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PO BOX 11034 TAMWORTH NSW 2340

			Sample 31	Sample 32	Sample 33	Sample 34	Sample 35
		Sample ID:	8A 40-50	9A 0-10	9A 20-30	9A 40-50	9A 65-75
		Crop:	N/G	N/G	N/G	N/G	N/G
		Client:	WHC	WHC	WHC	WHC	WHC
	Parameter	Method reference	N8539/31	N8539/32	N8539/33	N8539/34	N8539/35
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.30	5.84	7.24	8.00	8.24
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.053	0.021	0.029	0.032	0.037
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	13	3.6	7.9	6.5	6.5
	Exchangeable Calcium (kg/ha)		6,038	1,604	3,541	2,910	2,931
	Exchangeable Calcium (mg/kg)		2,695	716	1,581	1,299	1,309
	Exchangeable Magnesium (cmol$_+$/kg)		6.1	1.2	4.6	4.3	4.7
	Exchangeable Magnesium (kg/ha)		1,664	315	1,242	1,176	1,278
	Exchangeable Magnesium (mg/kg)		743	141	554	525	571
	Exchangeable Potassium (cmol$_+$/kg)		0.98	0.58	1.1	1.0	1.0
	Exchangeable Potassium (kg/ha)		858	505	920	891	906
	Exchangeable Potassium (mg/kg)		383	225	411	398	404
	Exchangeable Sodium (cmol$_+$/kg)		0.53	<0.065	0.17	0.25	0.29
	Exchangeable Sodium (kg/ha)		272	<33	89	129	152
	Exchangeable Sodium (mg/kg)		122	<15	40	58	68
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	0.04	0.02	0.02	<0.01
	Exchangeable Aluminium (kg/ha)		2.4	7.2	3.5	4.6	2.0
	Exchangeable Aluminium (mg/kg)		1.1	3.2	1.5	2.0	<1
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.02	0.05	0.02	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		<1	1.2	<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)	21	5.4	14	12	13
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	64	66	58	54	52
	Magnesium (%)		29	21	33	36	37
	Potassium (%)		4.6	11	7.7	8.4	8.2
	Sodium - ESP (%)		2.5	0.9	1.3	2.1	2.3
	Aluminium (%)		0.1	0.7	0.1	0.2	0.1
	Hydrogen (%)		0.1	1.0	0.2	0.0	0.0
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.2	3.1	1.7	1.5	1.4
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5 Y 4/1 Dark Grey	10 YR 4/2 Dark Greyish Brown	10 YR 5/1 Grey	10 YR 5/2 Greyish Brown	10 YR 5/2 Greyish Brown
	Mottles Munsell Colour		..	..	..	10 YR 4/1 Dark Grey	10 YR 5/8 Yellowish Brown
	Degree of Mottling (%)		..	..	..	30.00	25.00

Notes:

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				Heavy Soil	Medium Soil	Light Soil	Sandy Soil
			Sample ID:				
			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 (%)			..			

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
17. This report was issued on 3/04/2023.

Quality Checked: Kris Saville
Agricultural Co-Ordinator KS

APPENDIX B: LAND MANAGER INTERVIEWS

Zone 1

Table B1 Land manager questionnaire with responses for Oakleigh in Zone 1

Question	Response
How long have you lived on or managed the property?	44 years
Describe the property history (e.g. ownership, land use, product)	Primary sheep and cattle Secondary various cropping including wheat, granola, chickpeas, sorghum, etc
Where do you get your water from?	Dams, bore connected to troughs near the house
What do you consider to be the main limitations of your property?	Weather
How many people do you employ?	2 full time employees not including land manager, harvesting contractors for land leased from Whitehaven
Describe the key agricultural infrastructure on your property	1 lot of cattle and sheep yards – both steel and wood 3 large machinery sheds 1 workshop
Describe the key agricultural infrastructure on your property? Typical yield/production – what commodities does the property typically produce (and production rate) • Average dry sheep equivalent (DSE); • Average type and number/quantity of stock and/or product sold annually; and • Last 10 years annual average revenue. What could it produce opportunistically in ideal weather conditions? How much stock can you run per ha? How much area do you crop?	In a good year: • 100-150 calves • 100 lambs • 1,500 tonnes (t) of grain
What/who are your main markets? Which saleyards do you sell at? Who is your stock and station agent?	Dorpers, Angus cows and wagyu bulls, calves sold to a feedlot Lambs sold in Tamworth Grains sold to Narrabri and Boggabri Grain Cooperations No stock and station agent

Zone 2

Table B2 Land manager questionnaire with responses for Greenhills in Zone 2

Question	Response
How long have you lived on or managed the property?	4 – 5 years
Describe the property history (e.g. ownership, land use, product)	Not cultivated for the last 15 years, only grazed
Where do you get your water from?	Dams and permanent on ground water bore (on Greenhills) feeds both properties (goes to a large tank and is sent to troughs on the properties), supplies the house (leased separately to a Whitehaven employee)
What do you consider to be the main limitations of your property?	Soil type and rainfall – rocky, light alluvial soils
How many people do you employ?	3 people not including land manager, shared across multiple properties including Greenhills
Describe the key agricultural infrastructure on your property	Some small unused sheds near the house (tin sheds) 1 large shed adjoining steel cattle yards
Describe the key agricultural infrastructure on your property? Typical yield/production – what commodities does the property typically produce (and production rate) • Average DSE; • Average type and number/quantity of stock and/or product sold annually; and • Last 10 years annual average revenue. What could it produce opportunistically in ideal weather conditions? How much stock can you run per ha? How much area do you crop?	50 cows, 3 bulls (12 bulls owned total but distributed across an additional 5 leased properties by land manager) Average yield of 47 calves per year
What/who are your main markets? Which saleyards do you sell at? Who is your stock and station agent?	Angus/wagyu cross sold at Gunnedah saleyards Stock and Station agent – Noll Carpenter Agency (agent Steven Carpenter)

Table B3 Land manager questionnaire with responses for Bollo Creek Station in Zone 2

Question	Response
How long have you lived on or managed the property?	4 – 5 years
Describe the property history (e.g. ownership, land use, product)	Not cultivated for the last 15 years, only grazed
Where do you get your water from?	Dams and permanent on ground water bore (on Greenhills) feeds both properties (goes to a large tank and is sent to troughs on the properties), supplies the house (leased separately to a Whitehaven employee)
What do you consider to be the main limitations of your property?	Soil type – 50% rocky, runoff degraded soils from the adjoining mountain with dark, heavier alluvial soils.
How many people do you employ?	3 people not including land manager, shared across multiple properties including Bollo Creek Station
Describe the key agricultural infrastructure on your property	Large machinery shed 1 large shed and adjoining steel cattle yards 6 km of new internal fencing
Describe the key agricultural infrastructure on your property? Typical yield/production – what commodities does the property typically produce (and production rate) • Average DSE; • Average type and number/quantity of stock and/or product sold annually; and • Last 10 years annual average revenue. What could it produce opportunistically in ideal weather conditions? How much stock can you run per ha? How much area do you crop?	No cows, just approximately 120 weaners per year run
What/who are your main markets? Which saleyards do you sell at? Who is your stock and station agent?	Angus/wagyu cross sold at Gunnedah saleyards Stock and Station agent – Noll Carpenter Agency (agent Steven Carpenter)

Zone 3

Table B4 Land manager questionnaire with responses for Kyalla in Zone 3

Question	Response
How long have you lived on or managed the property?	12 months
Describe the property history (e.g. ownership, land use, product)	Property was previously a Bull Stud of 600 ha Sold to Whitehaven 12 years ago (2010)
Where do you get your water from?	Bore hole in house yard One bore hole attached to nonfunctional windmill; not enough water extracted 2 surface dams
What do you consider to be the main limitations of your property?	Liability (little experience)
How many people do you employ?	Short term fencing contractors
Describe the key agricultural infrastructure on your property	House yard has grain sheds, machinery shed, 3x silos, numerous troughs
Describe the key agricultural infrastructure on your property? Typical yield/production – what commodities does the property typically produce (and production rate) • Average DSE; • Average type and number/quantity of stock and/or product sold annually; and • Last 10 years annual average revenue. What could it produce opportunistically in ideal weather conditions? How much stock can you run per ha? How much area do you crop?	First lot of weaners to be sold in 2025. Expecting first calves March 2025 Stock and station agents and real estate proposed a total 300 head (calves and weaners) can be run on the property
What/who are your main markets? Which saleyards do you sell at? Who is your stock and station agent?	Black Angus cows bred with Brahman bull Gunnedah saleyards Stock and station agent is James Bradford Rural Occasional contract fodder cropping

Table B5 Land manager questionnaire with responses for Pine Grove, Flixton and Wean properties in Zone 3

Question	Response
How long have you lived on or managed the property?	Since 1988, 37 years
Describe the property history (e.g. ownership, land use, product)	Used mainly for cropping various grains – winter and summer crops, dependent of fallows and don't graze these areas Landscape grows liver seed, provides good feed for livestock. Run 450 cows across all three properties. Used to run sheep and have an existing shearing shed (constructed prior to Whitehaven management and on one of the other properties not in the Zone 3).
Where do you get your water from?	8 dams and 2 bores (pump 600 – 1,000 gallons/hour) situated within the proposed boundaries of Zone 3.
What do you consider to be the main limitations of your property?	Feral animals particularly pigs are breeding and increasing in large numbers, despite management endeavours. Within zoned existing revegetation offset areas the fencing is not stock proof. Water availability on the property, particularly if Landscape Revegetation Zones go forward. Post revegetation limitations include water availability as the main property dams and bores lie within Zone 3, and flow of moving cattle to stockyards on the properties will be hindered by offset fencing.
How many people do you employ?	Family (2-3), employ 2 full time, 2-3 seasonal harvesters
Describe the key agricultural infrastructure on your property	Within the Zone boundaries are bores and dam and new fencing.
Typical yield/production – what commodities does the property typically produce (and production rate) • Average DSE; • Average type and number/quantity of stock and/or product sold annually; and • Last 10 years annual average revenue What could it produce opportunistically in ideal weather conditions? How much stock can you run per ha? How much area do you crop?	2.5 dry sheep equivalent per hectare (DSE/ha) 590 ha total - 290 ha is farming (1,200 t grain) and rest is (300 ha) grazing (75 cows and calves) annual Can't run sheep anymore because of offset fencing gaps.
What/who are your main markets? Which saleyards do you sell at? Who is your stock and station agent?	Cattle sale to Gunnedah Sale Yards Grain delivered to Boggabri or Gunnedah Grain Corp James Bradford Rural

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